FOOD SECURITY AND NUTRITIONAL STATUS IN FISHING COMMUNITIES IN BOLIVIA'S NORTHERN AMAZON: RESULTS OF A HOUSEHOLD SURVEY

by

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ABSTRACT

Background: Bolivia faces both under and over nutrition. Fishing communities are thought to be at particularly high risk of malnutrition; however, their household food security and nutrition status is unknown.

Objective: To examine the prevalence and correlates of household food insecurity, childhood stunting and maternal overweight in fisher populations in Bolivia's Northern Amazon Basin.

Methods: A cross-sectional survey was conducted among 304 urban and 327 rural households with a head female of child bearing age (15-49 years) during the low water (October-November) and 186 urban and 297 rural households during the high water (February-March) seasons. Household food insecurity was measured with the Household Food Insecurity Access Scale, Household Hunger Scale and the Household Dietary Diversity Score. Demographic, socio-economic and other relevant data were collected. Weight and height were measured for children (<60 months) and their mothers.

Results: 45% of urban and 69% of rural households were food insecure. Only 9% of urban and 13% of rural households reported hunger. The average dietary diversity score was nine and seven out of 12 among the urban and rural groups respectively. For both groups, significantly fewer households were food insecure during the high versus low water season (urban P=0.01 and rural P=0.03). Over 34% of urban and 42% of rural children were stunted and 57% of urban and 46% of rural women were overweight/obese. No significant associations were found between food insecurity and childhood stunting or maternal obesity or between childhood stunting and maternal obesity. Independent correlates of household food insecurity included unemployment and consuming wild meat for both populations as well as receiving food assistance and having inadequate floor materials for the urban population and being Indigenous and having more household members for the rural population. The household survey identified inappropriate dietary intake, unhealthy environments and high rates of diarrhea in both populations, which may contribute stunting. Maternal overweight/obesity was associated with older age and some socio-economic variables.

Conclusion: Household food insecurity, childhood stunting and maternal overweight are highly prevalent, but not significantly associated. It is questionable whether improving household food insecurity alone would eliminate childhood stunting or maternal obesity.

PREFACE

This thesis is my original work conducted under the supervision of Dr. Timothy Green and Dr. Judy McLean and committee member Dr. Andrew Riseman. The thesis is part of a larger research project titled “Food Security, Fisheries and Aquaculture in the Bolivian Amazon” (Fish for Life) designed and carried out by Bolivian and Canadian teams led by Dr. Paul Van Damme and Dr. Joachim Carolsfeld respectively. The main partner organizations involved in the project were World Fisheries Trust, a Canadian non-governmental organization that works on improving fishing value chains in small communities in Latin America; Faunagua, a Bolivian non-governmental organization that works with Bolivian fisheries; and Agua Sustantable, a Bolivian non-governmental organization that works on water rights and health.

Tamara Perez, a biologist with Faunagua, and I were the leads in designing the household survey tool and coordinated input and contributions from a team of over ten Canadian and Bolivian researchers. Perez was responsible for the original translation of the survey with revision by me. I collaborated with Delaram Farshad, another Canadian graduate student, to design the interviewer training guide and household survey question guide. The training was carried out by Tamara Perez and the Bolivian team. The Bolivian research team, including a statistician, designed the sampling methods and I assisted in estimating the sample size. Perez oversaw the training of the survey team and the field implementation of the survey with my support from afar. A database was designed by the Bolivian statistician, Bolivian research assistants entered the data, and the database was originally cleaned by the Bolivian statistician and later by me. I independently conducted the data analysis presented in this thesis and wrote this thesis with supervision from Dr. Timothy Green and Dr. Judy McLean.

Publications and Presentations

To date, I have submitted no publications based on the work presented in this thesis. I helped prepare a presentation for the Third International Conference on Health, Wellness, and Society in March 2013 in Sao Paulo, Brazil titled "The relationship between household food security and the nutritional status of women and children in the Bolivian Amazon Basin." I included some preliminary results of the household survey. Other authors including Tamara Perez, Dr. Timothy Green, Dr. Judy McLean and Dr. Joachim Carolsfeld contributed to intellectual and content revisions of the presentation. I also prepared a presentation titled "Food Security and Nutrition Status of Fishing Communities in the Bolivian Amazon Basin" and presented it at the International Congress on Nutrition in Granada, Spain in September 2013. This presentation included the final results from the household survey.

Ethics Approval

The leaders of each of the Bolivian communities where the survey was conducted provided approval for the study. Additionally, several important community organizations provided consent. The following is a list of these groups.

- La Confederacion de Pueblos Indigenas de Bolivia (CIDOB)
  English: The Confederation of Indigenous Communities of Bolivia (CIDOB)
- El Comite Impulsor para el Fortalecimiento del Sector Pesquero en Riberalta
  English: The Committee to Strengthen the Fisheries Sector in Riberalta
- La Asociación de Pescadores Amazonicos de Riberalta (ASOPESAR) y la Asociación de Pescadores y Comerciantes Riberalta (ASOPRYC)
  English: The Association of Amazonian Fishermen of Riberalta and the Riberalta Association of Fishermen and Merchants
- La Federación de Pescadores y Comercializadores del Norte Amazonico de Bolivia.
  English: The Federation of Fishermen and Merchants of the Northern Bolivian Amazon.

The Behavioral Research Ethics Board of the University of British Columbia approved the procedures for the household survey- ethics certificate number (H11-00883). Additionally, the Bolivian research team submitted an application for ethical approval to Bolivia's bioethics committee for the full project titled "Food Security, Fisheries and Aquaculture in the Bolivian Amazon." The Bolivian project partners have secured written approval for the survey from community leaders. Free and informed verbal consent was obtained from all study participants.

Project Funding

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TABLE OF CONTENTS

Abstract ii
Preface iii
Table of Contents vi
List of Tables vii
List of Figures x
List of Abbreviations xi
Acknowledgements xii
Chapter 1. Introduction 1
1.1 Background 1
1.2 Literature Review: Food Insecurity in the Bolivian Amazon 6
1.3 Food Security: Definitions and Measurements 7
1.4 Malnutrition: Outcomes and Correlates 12
1.5 Summary of the Gaps in Knowledge 18
1.6 Research Objectives 19
Chapter 2. Methods 20
2.1 Study Design 20
2.2 Sampling Methodology 20
2.3 Survey Implementation Methods 23
2.4 The Household Questionnaire 24
2.5 Data Analysis Methods 34
Chapter 3. Results 37
3.1 Low Water Season Survey Results 37
3.2 Associations between Household Food Security and Dietary Diversity (Low Water Season) 77
3.3 Correlates of HFIAS (Low Water Season) 78
3.4 Correlates of Childhood Stunting (Low Water Season) 84
3.5 Correlates of Maternal BMI (Low Water Season) 92
3.6 Associations between Childhood Stunting and Maternal BMI 100
3.7 High Water Season Survey Results 101
3.8 Seasonal Comparison of Food Security Status 105
Chapter 4. Discussion of Results 107
4.1 Study Strengths and Limitations 122
4.2 Implications for Practice and Recommendations 123
Chapter 5. Conclusion and Future Research 125
Work Cited 128
Appendix I- Sample Size Calculations 137
Appendix II- Original Survey- Season One Questionnaire 140

LIST OF TABLES

Table 1.1 Household Dietary Diversity Categories with Examples 11
Table 2.1 Urban Sample Strata 20
Table 2.2 Household Dietary Diversity Score 28
Table 2.3 Child Individual Dietary Diversity Score 29
Table 2.4 WHO Stunting Classification for Children <Five Years of Age 32
Table 2.5 Adult Individual Dietary Diversity Score 33
Table 2.6. Adult Body Mass Index Classifications 34
Table 3.1 Urban Household Distribution by Strata 38
Table 3.2 Urban Household Demographics 38
Table 3.3 Urban Respondent Literacy, Education, Employment and Income Characteristics 40
Table 3.4 Urban Housing Characteristics 41
Table 3.5 Urban Ownership of Household Items 42
Table 3.6 Urban Household Water Source and Treatment 43
Table 3.7 Urban Household Toilet Facilities 44
Table 3.8 Urban Household Food Insecurity, Hunger and Dietary Diversity in the Low Water Season 46
Table 3.9 Urban Household Food Production, Hunting and Gathering Practices and Food Assistance 48
Table 3.10 Urban Household Fish Consumption, Procurement and Preservation Practices, and Health Beliefs 50
Table 3.11 Breastfeeding and Complementary Feeding Practices for Urban Children ≥Six Months 52
Table 3.12 Food Groups Consumed in the 24 Hours Previous to the Survey by Urban Children Six to <24 Months as Assessed by the Individual Dietary Diversity Score 53
Table 3.13 The Diet of Urban Children Six to <24 Months as Assessed by key WHO Indicators . 54
Table 3.14 Occurrence and Treatment of Diarrhea in Urban Children <24 Months in the 2 Weeks Prior to the Survey 55
Table 3.15 Anthropometric Status as Assessed by the WHO Standards for Urban Children <60 Months 56
Table 3.16 Food Groups Consumed by Urban Women of Child Bearing Age in the 24 Hours Prior to the Survey as Assessed by the Individual Dietary Diversity Score in the Low Water Season .. 57
Table 3.17 Urban Women's Body Mass Index 57
Table 3.18 Rural Household Distribution by Community in the Low Water Season 58
Table 3.19 Rural Household Demographics 59
Table 3.20 Rural Respondent Literacy, Education, Employment and Income Characteristics 61
Table 3.21 Rural Housing Characteristics 62

Table 3.22 Rural Ownership of Household Items 63
Table 3.23 Household Water Supply (Rural) 64
Table 3.24 Rural Household Toilet Facilities 64
Table 3.25 Rural Household Food Insecurity, Hunger and Dietary Diversity in the Low Water Season 66
Table 3.26 Rural Household Food Production, Hunting and Gathering Practices and Food Assistance 68
Table 3.27 Rural Household Fish Consumption, Procurement and Preservation Practices, and Health Beliefs 70
Table 3.28 Breastfeeding and Complementary Feeding Practices for Rural Children ≥Six Months 71
Table 3.29 Food Groups Consumed in the 24 Hours Previous to the Survey by Rural Children Six to <24 Months as Assessed by the Individual Dietary Diversity Score 73
Table 3.30 The Diet of Rural Children Six to <24 Months as Assessed by key WHO Indicators 73
Table 3.31 Occurrence and Treatment of Diarrhea in Rural Children <24 Months in the Two Weeks Prior to the Survey 74
Table 3.32 Anthropometric Status as Assessed by the WHO Standards for Rural Children <60 Months 75
Table 3.33 Food Groups Consumed by Rural Women in the 24 Hours Prior to the Survey as Assessed by the Individual Dietary Diversity Score in the Low Water Season 76
Table 3.34 Rural Women's Body Mass Index 76
Table 3.35 T-Test for HDDS and HFIAS (Urban and Rural) 77
Table 3.36 Urban Logistic Regression Models Examining Associations between Household Food Insecurity and Variables in its Causal Pathway 79
Table 3.37 Rural Logistic Regression Models Examining Associations between Household Food Insecurity and Variables in its Causal Pathway 82
Table 3.38 Association between HFIAS and Stunting (Children zero to <60 months) 84
Table 3.39 Association between HDDS and Stunting (Children zero to <60 months) 85
Table 3.40 Urban Logistic Regression Models Examining Associations between Childhood Stunting (Children <60 Months) and Variables in its Causal Pathway 86
Table 3.41 Rural Logistic Regression Models Examining Associations between Childhood Stunting (Children <60 Months) and Variables in its Causal Pathway 90
Table 3.42 Association between HFIAS and Maternal Overweight/Obesity 92
Table 3.43 Association between HDDS and Maternal Overweight/Obesity 93
Table 3.44 Urban Logistic Regression Models Examining Associations between Maternal Overweight/Obesity and Variables in its Causal Pathway 95
Table 3.45 Rural Logistic Regression Models Examining Associations between Maternal Overweight/Obesity and Variables in its Causal Pathway 98

Table 3.46 Association between Maternal Overweight/Obesity and Childhood Stunting (Children <60 Months) 100
Table 3.47 Urban Household Food Insecurity and Hunger in the High Water Season 102
Table 3.48 Rural Household Distribution by Community in the High Water Season 103
Table 3.49 Rural Household Food Insecurity and Hunger in the High Water Season 104
Table 3.50 Urban Paired Seasonal Comparisons of Food Security Indicators 105
Table 3.51 Rural Paired Seasonal Comparisons for Food Security Indicators 106

LIST OF FIGURES

Figure 1.1 Map of Bolivian Departments 2
Figure 1.2 UNICEF Conceptual Framework for Malnutrition 15
Figure 1.3 Malnutrition and Infection Cycle 16
Figure 2.1 Map of Urban and Rural Sample Areas 21
Figure 3.1 Analytical Sample 37

LIST OF ABBREVIATIONS

BMI- Body Mass Index

CIA- Central Intelligence Agency of the United States of America

DHS- Demographic Health Survey

FANTA- Food and Nutrition Technical Assistance Project

FAO- Food and Agriculture Organization of the United Nations

HDDS- Household Dietary Diversity Score

HFIAS- Household Food Insecurity Access Scale

HHS- Household Hunger Scale

INE- Instituto National de Estadisticas de Bolivia (Bolivian National Institute of Statistics)

IQR- Interquartile range

MGRS- Multicenter Growth Reference Study

SD- Standard deviation

UNICEF- United Nations Children's Fund

USAID- United States Agency for International Development

WFP- World Food Program

WHO- World Health Organization

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CHAPTER 1. INTRODUCTION

The survey on which my thesis work is based was conducted as part of a baseline assessment for a larger study "Food Security, Fisheries and Aquaculture in the Bolivian Amazon" (Fish for Life). The main objective of the "Fish for Life" project was to determine effective methods of increasing food security in the fishing communities located along the Amazon River tributaries in the Departments of Beni and Pando in Bolivia's Northern Amazon Basin. In this thesis, I focus on identifying and exploring the correlates of household food insecurity and its relationship to over and under nutrition in urban and rural populations surrounding the urban center of Riberalta, Beni. I present the supporting background, rationale, methods, results and analysis for this assessment in this thesis. The following introductory chapter provides background information about Bolivia and discusses food security and malnutrition as they relate to the research presented in the subsequent chapters. Additionally, in this chapter, I identify gaps in the literature around food insecurity in the Bolivian Amazon and present the research rationale and objectives for this thesis.

1.1 Background

Bolivia is a landlocked country located in central South America and is bordered by Peru, Brazil, Paraguay, Argentina, and Chile. Bolivia has three geographical regions which differ in culture and economic activity: the "Alteplano," the western mountainous Andean region comprising 28% of the country; the "Valle," the central valley accounting for 13% of the country; and the "Llano," the Amazon rainforest basin located in the North East of the country comprising 59% of the country (1). Similar to provinces or states, Bolivia has nine political departments (Figure 1.1 (2)). The Amazonian Llano departments include Santa Cruz, Beni and Pando (1). The current study was conducted in the most northern part of the country in the department of Beni (with a few households located in Pando) among households located along two Amazon River tributaries: the Rio Beni and Rio Madre de Dios.

Figure 1.1 Map of Bolivian Departments

Source: Fonadier07 (original map), MacedonianBoy (derivative). Map of the departments of Bolivia in English [Internet]. 2012; Available at: http://en.wikipedia.org/w/index.php?title=File:Bolivia_departments_en.svg&page=1;. Accessed Jan 1, 2013.

Bolivia's official name is the Plurinational State of Bolivia. Plurinational means that Bolivia recognizes the legal rights of Indigenous communities within the country. As such, Bolivia has a varied and complex socio-political landscape. The Bolivian constitution recognizes almost 40 languages with Spanish, Quechua and Aymara being the most widely spoken (3). According to the 2001 Bolivian Census, 55% of the population was Indigenous (30% Quechua and 25% Aymara), 30% mestizo (mixed European and Amerindian ancestry), and 15% European ancestry (3). However, there are many other ethnic groups recognized in the country. In Bolivia, the cultural diversity and tension between social interest groups is reflected in the impermanence of laws and regulatory frameworks and the high number of conflicts, marches and demonstration in the country's capital and at the site of disputes, often over natural resources.

Bolivia is one of the poorest countries in South America. In 2009, the World Bank estimated that 61% of Bolivia's 10 million people were living in poverty (4). In 2007, the Bolivian National Institute of Statistics (INE) estimated that around 40% of the total population was living in extreme poverty, defined as living on one dollar or less per day (5). The rural areas of Bolivia are disproportionately poor with 77% living in poverty and 64% living in extreme poverty (5).

Bolivia is a lower middle income country. In 2011, the World Bank estimated the Gross Domestic Product (GDP) of Bolivia to be $24.4 billion dollars, which has been steadily increasing over the last five years (6). The United Nations Development Program estimated the 2011 Human Development Index (HDI) of Bolivia to be 0.64 giving Bolivia a rank of 108 out of 187 countries and categorized as having "medium human development"(7). The HDI is an indicator of development that is estimated using life expectancy, average years of education and average income (7). The 2001 Bolivian census reported that 87% of the population over 15 years of age could read and write (3). The Bolivian National Institute of Statistics (INE) reported that in 2007 the Bolivian population had an average of 8.6 years of education (5) with 48% of the population not completing secondary school (5). The rural population had a much lower education level with 88% of women and 82% of men not completing secondary school (1). In Beni 68% of women and 66% of men respectively did not complete secondary school in 2008 (1) showing an overall lower education level in Beni compared to the national average. Therefore, many Bolivians have low levels of education, low income and low life expectancy. Additionally, there are differences in education level among men and women and urban and rural populations and between departments.

In 2007, the INE estimated 34% of employed Bolivians worked in agriculture/fishing, 16% worked in industry and 15% worked in services (5). All other areas of work accounted for less than 7% of the workforce (5). The 2010 Bolivian Demographic Health Survey (DHS) reported that about 12% of men and between 30% and 36% of women in Beni and Pando departments, respectively, were unemployed (1). The same report showed that of the men who worked, the highest portion were professionals followed by a similar portion working in agriculture and manual labor (1). Of the women who worked, most were involved in sales and service, followed

by domestic work and professional or technical occupations (1). From these reports, it is unknown how many people engage in fishing for commercial purposes or for home consumption although fishing is known to be an important economic and subsistence activity among communities along the Amazon River tributaries (8).

Lack of roadway infrastructure in Bolivia decreases access to foods and markets, especially in rural areas. The Food and Agriculture Organization of the United Nations (FAO) estimated in 2009 that only 7.9% of Bolivia's roads were paved and the road density was 7.3 roads per 100 square kilometers, compared to 27.3 for other lower-middle income countries (9). This is known to be an issue in the Bolivian Amazon where access to market and infrastructure is an ongoing barrier to development of fish supply chains. Seasonal flooding in the Amazonian areas of Bolivia can be a barrier to accessing food sources, further impacting food security of rural Amazonian communities (8).

In 2009, the FAO estimated Bolivia's land area to be 108 million hectares (10). Of this, almost 37 million hectares were under agricultural production (10). In the period between 2009 and 2011, Bolivia had an average dietary energy supply adequacy of 100%, which it maintained in the 2010-2012 period (9). This means the country's Dietary Energy Supply (DES) was sufficient to meet the Average Dietary Energy Requirements (ADER). However, the FAO also estimated that 24% of the population was undernourished having insufficient kcal/capita/day (9). In 2011, the Bolivian food deficit for those lacking sufficient energy was an average of 161 kcals per person per day (9). This shows that distribution of food is not equal within the country.

The FAO reported that in 2011, 53% of the country's energy supply was from cereals, roots and tubers (9), which on average is an adequate amount. The FAO also reported that in 2011 there were 60 grams of protein available per capita per day in Bolivia (9). Of this, 26 grams were high quality protein from animal sources (9). This amount of protein would be adequate for an average 60 kg adult; however, the amount does not take into account for waste or unequal distribution. In Beni and Pando the Bolivian DHS reported that in 2008 over 90% of women ate meat, fish or eggs the previous day (1). However, the report did not include quantities of these

foods consumed and thus cannot speak to nutritional sufficiency of dietary protein. No information on dietary fat was discussed in these reports.

In 2008 in Bolivia, 5% of children were underweight, 1% of children were wasted and 2% of women were underweight. Although few women and children were underweight or acutely malnourished, many suffered from chronic malnutrition and micronutrient deficiencies. For example 61% of children between six and 59 months of age and 38% of women of childbearing age were anemic in 2008 (1). In the same year, the FAO estimated 27% of Bolivian children less than five years of age were stunted, an indicator of chronic malnutrition (9). This number was down from 33% in 2004 (9). According to the World Health Organization this classifies Bolivia as having a moderate severity of stunting prevalence (11).

Bolivia sits at the global average of 27% of children being stunted, which is almost double the Latin American average of 14% (12). The 2008 Bolivian DHS surveyed 19,564 households and found that stunting rates tended to be higher among rural children, children with a mother who had a lower level of education and in certain departments (1). The department of Beni had an 18% stunting rate, which was lower than the national average (1). However, in a study conducted with the Tsimane Indigenous peoples of Beni, stunting was nearly 50% among children 0-9 years of age (13). Poor diet quality combined with high infection rates were cited as the main causes (13). Another study looked at 108 children under three years of age in Beni and found a 41% prevalence of stunting and pointed to growth faltering during weaning as the primary cause (14). This shows that there is substantial variability in rates of stunting among populations in the Bolivian Amazon. I did not identify any data on the nutritional status of children, including stunting, in the fishing communities involved in this study.

Across Bolivia only 2% of women were found to be underweight (BMI <18.5), while 50% were overweight (BMI 25-30) or obese (BMI >30) (1), indicating the presence of overnutrition. Body Mass Index (BMI) is used to describe the relationship between a person's height and weight and has been shown to correlate to increased risk of chronic disease in populations (15). Of interest, the DHS identifies a country wide tendency for women with high BMIs to be in rural areas, to have lower education levels and to parallel areas with high rates of childhood stunting

(1). However, the rates of overweight and obesity, their correlates, and how they relate to household food insecurity or childhood stunting in the fishing communities of the Bolivian Amazon are unknown.

Together the high prevalence of childhood stunting and maternal obesity point to a double burden of malnutrition, where both under and overnutrition exist together. With the emergence of a double burden of malnutrition, a country is faced with the burden of malnutrition and associated morbidity and mortality along with the chronic diseases that follow high rates of obesity. This has implications for the health and productivity of the population as well as for the economic status of the country as a whole. As such, it is important to explore and understand these relationships.

1.2 Literature Review: Food Insecurity in the Bolivian Amazon

Together, the high rates of poverty, an unequal distribution of the food supply and climate make Bolivia a country vulnerable to food insecurity with large differences existing between urban and rural populations (1,16,17). This is my rationale for examining approaches to improve food insecurity in the Bolivian Amazon across urban and rural groups. However, there is little formal research on food insecurity in the area. In the following review I discuss current studies on food insecurity in the Bolivian Amazon and I outline the gaps in the evidence base.

There are very few peer-reviewed publications on the food security status of Bolivian households or women and children. The most frequently cited study conducted by Melgar-Quinonez et al. examined the associations between household food security and food expenditure in Bolivia, Burkina Faso and the Philippines in 2006 (18). The authors used a nine question food security scale (a version of the Household Food Insecurity Access Scale) to determine food insecurity and the Daily Per Capita Consumption to measure expenditure. Unfortunately, the Bolivian sample was a convenience sample taken in the Andean region of the country and therefore was not representative of the country or the Amazonian region. In

the Bolivian portion of the sample (N=327), 70% of households experienced moderate or severe food insecurity and food insecurity was negatively associated with household expenditure (18).

In the grey literature there were two studies conducted by the World Food Program (WFP) in 2006 and 2009, which assessed household food security status. The 2006 survey (N= 4,536) included 480 households in the department of Beni and 480 households randomly selected in the department of Pando. To assess vulnerability to food insecurity, the authors created an index with quintiles of risk based on three variables: adequate energy consumption, dietary diversity and per capita food expenditure. The study found that the most food insecure groups were families with children under five years, pregnant and breastfeeding women, the elderly and Indigenous households (16). The 2009 survey was a response to flooding in several departments including Beni and Pando. To measure food insecurity they factored in consumption and access to food, but they did not specify their methods. They reported that 33% of households in Beni (N=320) and 45% in Pando (N=139) were food insecure and identified Indigenous households and households dependent on fishing as among the most food insecure (8).

From these reports it can be seen that there are high levels of food insecurity in the Bolivian Amazon. However, these studies have important methodological weaknesses, none looked at the fishing communities in and around Riberalta specifically, and none of them linked food insecurity to malnutrition. Therefore, there is a need to assess the household food security status of these populations.

1.3 Food Security: Definitions and Measurements

Food security has multiple definitions and there are multiple methods for its measurement. The WHO suggests that food security is not only linked to malnutrition but it is connected to the health of the environment and to national and global economies and trade (17). As such food security is at the crossroads of cause and consequence for physical, social and psychological health. It is food security's central position in these complex relationships that makes it a

powerful and compelling concept to capture. The purpose of this section is to discuss the definition of food security, the constructs of food security and the literature supporting the methods used for measuring food insecurity.

The definition of food security has evolved over the last half century (19). Today, one of the most highly cited definitions of food security comes from the "Rome Declaration on World Food Security" resulting from the 1996 World Food Summit. According to this definition food security "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (17,20). This definition has been adopted by the WHO among other international humanitarian organizations. Food security is widely recognized as having three main constructs: food availability, food access and food use (17). Referring back to the evolution of the definition of food security, early measures of food security measured a nation's ability to produce or purchase sufficient food energy for its population. Over time, measures of food security began to focus on household and even individual level food security because it better captures the relationship between nutritional adequacy and food security. Measurements of food security at the household level are the primary focus of the study at hand.

Traditional methods of measuring household food security relied on proxy indicators for food insecurity such as household income, presumed to be a primary cause of food insecurity, or nutrition status, presumed to be a direct outcome of food insecurity. Both of these measures are considered objective, in that they can be measured absolutely, and indirect, because they are proxy measures for food security. While both of these concepts are of primary importance when considering food security, neither is a specific or direct indicator of food security. Income is not a direct measure of food security because food security status is influenced by many other factors including but not limited to availability of food at the community or national level, the percentage of household income spent on food, the cost of food staples in a community, the distribution of income among family members, and the distribution of food among family members. In the case of income, not only is the measure non-specific, it is also very difficult to accurately measure. In many cultures and for many families, income is a very sensitive issue

that may not be openly or reliably shared (21,22). Even when income data can be obtained, similar income levels mean very different standards of living as well as quantity and quality of food that can be purchased within the community under consideration. Similarly, nutrition status is influenced by many more factors other than food security such as disease state, infection load, infant and young child feeding practices, and cultural food practices. The objective and indirect metrics of income and nutrition status over simplify the concept of food security and they omit the complex dimensionality that makes food security a compelling metric in the first place.

A team of researchers from the Food and Nutrition Technical Assistance Project (FANTA) developed a series of food security measurement tools that aim to capture individual and household food security by directly asking the individual or a representative of the household about their experiences around food security. In this way, the tools directly measure the food security in a subjective way (23). The tools are the Household Food Insecurity Access Scale (HFIAS), the Household Hunger Scale (HHS) and the Household Dietary Diversity Scale (HDDS). These tools are discussed in brief.

The "Household Food Insecurity Access Scale" (HFIAS)

Coates et al. report that food security can be measured as an experience (24). One of the first tools to do this was the U.S. Household Food Security Survey Measure (23) which was later adjusted by FANTA to fit the global context resulting in the HFIAS (25). The HFIAS consists of occurrence and frequency options measuring the perception or experience of food insecurity with a focus on quantity of food accessed (26). The nine questions are divided into three domains used to describe the experience of food insecurity: anxiety, changes to food quality and changes to the quantity of food consumed. The scale can yield a continuous score or four categories of food insecurity. The tool and food security categories are provided in the methods section of this paper.

Culturally adapted versions of the HFIAS have been the subject of extensive study (23,25,27). One such trial took place in Peru, which has geographical and cultural similarities to Bolivia, and

found the questions had good internal validity yielding a Cronbach's alpha value of 0.86 (28). Similar studies were conducted in Venezuela (Cronbach's alpha of 0.92), in Brazil (Cronbach's alpha of 0.91) (27) and in Mexico (29) indicating good internal validity for these questions in a variety of Latin American contexts. I was not able to identify any studies using the HFIAS in Bolivia. The previously discussed Bolivian food security study conducted by Melgar-Quinonez et al. used the HFIAS questions but created three food security categories based on a nine point continuous scale (18), which is not standard.

Household Hunger Scale (HHS)

A large multi-cultural validation trial found that the HFIAS has considerably variable results in different cultural contexts and therefore may not be useful to compare food security status across cultures (30). From this study, one construct, hunger, showed excellent internal and external validity across cultures (31). Therefore, the Household Hunger Scale (HHS) was developed from the HFIAS.

The HHS includes the final three yes/no questions and the accompanying frequency question from the HFIAS that address the experience of hunger. The HHS is quite limited in its ability to describe food security as it only considers hunger. Therefore, the HHS should be used with other measures of food security to increase sensitivity within a particular cultural context (31). I did not identify any studies using the HHS conducted in Bolivia.

The "Household Diet Diversity Score" (HDDS)

The HDDS was also developed by FANTA as a proxy measure for dietary quality and socio-economic status (32). Change in household dietary diversity has been shown to significantly correlate with food security status as measured by the energy available and consumed at the household level (33). One study compared the HDDS score to other measures of food security such as the number of meals per day, household food expenditure, and per capita food expenditure in Loas (N=3913), Uganda (N=1956) and Bakina Faso (N=3640) with good correlation for all comparisons (34). A study comparing dietary diversity to childhood stunting in 11 countries, including Columbia and Peru, found that there was a significant relationship

(35). The components of the HDDS are recorded in the DHS, but no studies were identified that specifically reported on HDDS in the population of interest.

The 12 HDDS food groups are listed in Table 1.1 with examples of common Bolivian foods that would fall into each. The United Nations Children's Fund (UNICEF) and other UN organizations have also adopted this 12 category system to identify consumed food groups. The same information can yield an Individual Dietary Diversity Score (IDDS). The IDDS combines some food categories to give a proxy measure of dietary quality for the individual (32,36).

Table 1.1 Household Dietary Diversity Categories with Examples

Categories	Examples
Cereals	Wheat, rice, corn
White Tubers	Potatoes, cassava/yucca
Vegetables	Carrots, tomatoes, onions
Fruits	Mango, papaya, watermelon
Meat or poultry	Chicken, beef, alligator, turtle
Fish	Canned, Amazonian varieties
Eggs	Chicken, duck, turtle
Legumes or nuts	Kidney beans, Brazil nuts
Dairy products	Milk, yogurt, cheese
Fat/oil	Cooking oil, butter, lard
Sugar/honey	Added sweeteners
Other foods	Any other foods such as coffee, tea

Note: I provided examples of foods commonly eaten in Bolivia for the Household Dietary Diversity Score categories described by: Swindale A, Bilinsky P. Household Dietary Diversity Score (HDDS) for measurement of household food access: indicator guide (v.2) [Internet]. FANTA (USAID and FHI 360). 2006; Available at: http://www.fantaproject.org/monitoring-and-evaluation/household-dietary-diversity-score. Accessed Nov 1, 2013.

There are many potential correlates of food security. Two particularly common factors are seasonal variability (26,31,32) and urban versus rural dwelling (1,16,17). In the Bolivian Amazon Basin there are two main seasons, low water season (May-October) and high water season (November-April), referring to the level of water in the river, which also correspond to the seasonal rains. The seasonal Castana nut (Brazil nut) harvest takes place during the rainy

season. The Castana nut harvest is an important income source for many households in the area (37). Therefore, it is essential to measure household food security during the two seasons. Likewise in this region Riberalta is the urban center and differs in population density and access to services among others factors compared to the more remote villages in the surrounding rural areas. As such, it is important to measure food security status in both populations.

1.4 Malnutrition: Outcomes and Correlates

One of the main reasons for studying food insecurity is its potential relationship to malnutrition, especially undernutrition. There are many factors that determine the prevalence and degree of malnutrition. In this section, I present the information explaining aspects of malnutrition discussed elsewhere in this thesis. Specifically, I will cover some of the basic background information on malnutrition, with a special focus on childhood stunting and maternal overweight/obesity. Other forms of malnutrition, such as wasting and underweight, are measured and reported in this thesis, but are not the main focus of the study at hand. I have defined these elsewhere in the thesis.

Malnutrition is an umbrella term that includes undernutrition, overnutrition and micronutrient deficiencies. Anthropometric measures, especially weight and height, are used to measure over and undernutrition because they are inexpensive, accurate and reproducible (38). The definitions of malnutrition discussed here are population level definitions of malnutrition used to indicate the portion of the population at increased risk for the associated adverse health outcomes.

1.4.1 Childhood Stunting

A child who is abnormally short for his/her age is considered stunted. Stunting is an indicator of chronic malnutrition, as children who are chronically malnourished are less likely to reach their full height potential. Stunting is an important indicator of health for children less than five years of age because the stunting process can be slowed or even reversed in young children (11). For older children and adults, stunting indicates that chronic malnutrition occurred during the prime growth years, but does not necessarily reflect current nutritional deficit (11).

The outcomes of stunting have been studied around the world and most typically in low-middle income countries. Most studies looking at the effects of stunting are observational and thus there are limitations to identifying the outcomes of stunting independent of other factors. However, important associations have been made. In the short term, childhood stunting has been shown to be related to increased risk of premature death as well as increased risk of death from infection (39). Victora et al. conducted an extensive literature review and analysis of large cohorts in Brazil, Guatemala, India, the Philippines and South Africa and found that stunting is associated with lower levels of education and reduced income generation in adulthood. They also conclude that people who do not reach their full height potential as children tend to become stunted adults (40). Stunted women are more likely to have obstructed labor resulting in increased rates of maternal and child morbidity and mortality (39) and to have lower birth weight babies (40). As such, stunting can impact entire communities for multiple generations.

The first two years of life are a developmentally rich period for children. Not only is a child rapidly growing and changing physically, but there are many cognitive development processes underway as well. If a child is nutritionally deprived during this important period, it follows that these functions could be negatively affected. In this way, stunting is not only a measure of stature and sub-optimal physical function, but is a marker of the processes that lead to poor health related outcomes, including cognitive development (41). Before two years of age, catch-up weight gain can be beneficial for babies born small for gestational age (42), but after the first two years of life stunted children who gain weight rapidly may be at higher risk for nutrition related chronic diseases (39). A review of five cohort studies concluded that children with early growth failure and later childhood weight increases are at increased risk for cardiovascular disease risk factors (43). Catch-up growth later in life is often not making up for the losses early in life which can affect the physical ability and wellbeing of an individual throughout their lifetime.

The time period between conception and about the second year of life has been deemed the “first thousand days,” which is the “window of opportunity” to improve stunting outcomes (44).

In a 2001 analysis of world infant growth data from 39 countries, Shrimpton et al. used the now outdated NCHS reference growth curves and found that growth faltering peaks between three and 12 months of age and continues through about 19 months of age, after which children may experience catch-up growth (45). In a follow up study, some of these researchers used growth data from 52 lower to middle income countries collected between 1994 and 2007 and found that children in low-middle income countries tended to be born with low height-for-age. They reported that the average height-for-age of these children compared to healthy children continued to decline until about 24 months of age where it plateaued (44). Despite using different growth curves and data sets, these studies both showed that childhood stunting starts before birth and continues to about two years of age. During this "first thousand days" interventions have the opportunity to disrupt the stunting processes and the potential for improving outcomes. After this period of early growth and development the potential for improving stunting and health outcomes associated with early chronic malnutrition are much reduced.

To be effective in alleviating stunting, interventions must target the causes of stunting in a population. As such, the specific causes of stunting should be assessed. UNICEF developed the "Conceptual Framework for Malnutrition" to describe the many potential contributing factors to under-nutrition (Figure 1.2 (46)). The framework divides the causes of malnutrition into the immediate, underlying and basic causes. Within the "UNICEF Conceptual Framework for Malnutrition," food security is a concept related to adequate dietary intake and thereby nutrition status. In the model, the concept of food security at the household level would encompass "inadequate dietary intake" and "inadequate access to food" and at the community or national level would encompass "inadequate access to food" and "resources and control." However, the framework also illustrates how nutrition status or malnutrition is impacted by many other factors such as disease burden, education, dietary practices, knowledge and attitudes (46).

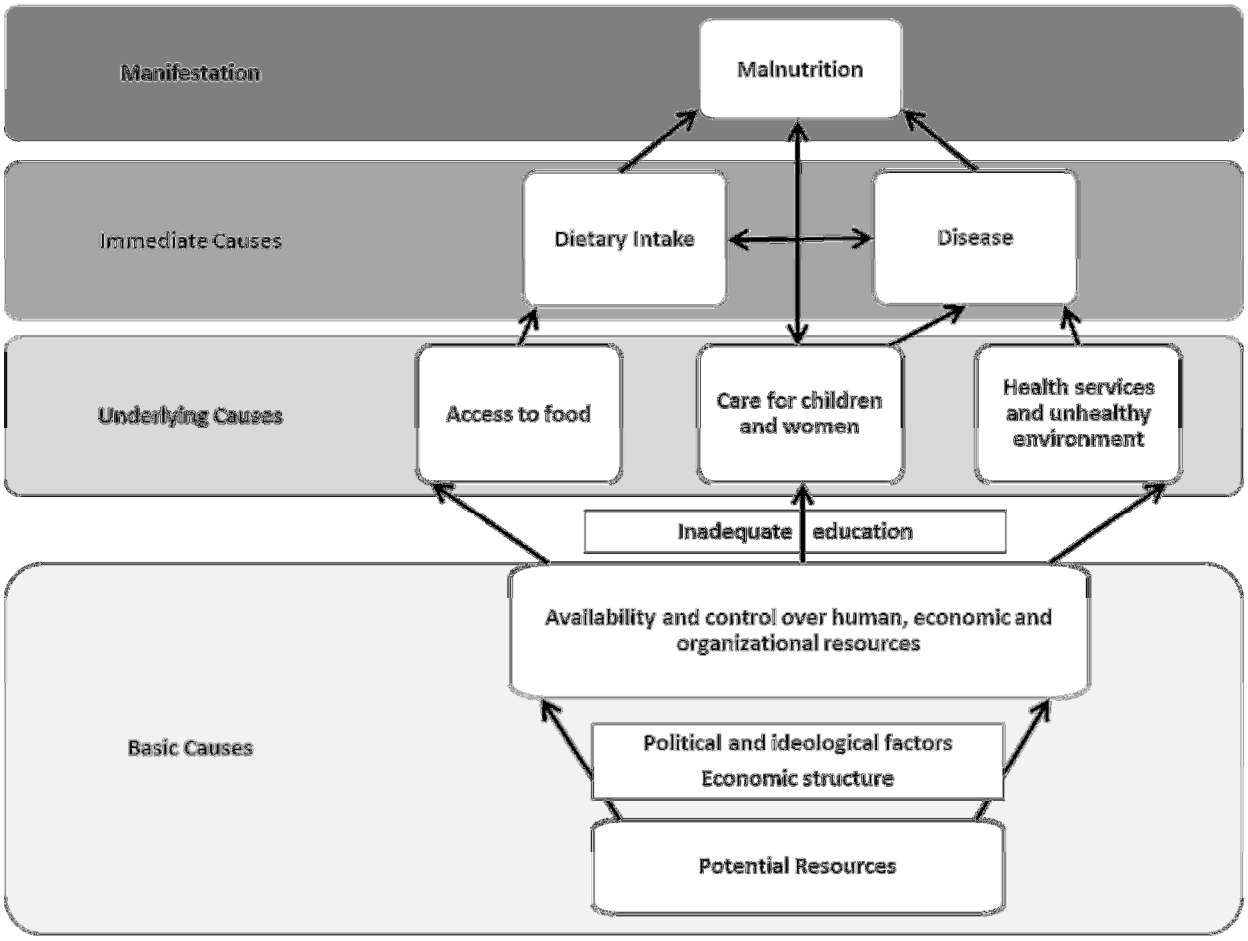

Figure 1.2 UNICEF Conceptual Framework for Malnutrition

Source: Recreated from Bellamy C. The state of the world's children 1998 [Internet]. UNICEF. 1998; Available at: http://www.unicef.org/sowc98/. Accessed Nov 1, 2013.

Stunting is typically attributed to intrauterine growth retardation due to poor maternal health, insufficient nutrition during childhood and/or high disease burden causing increased energy expenditure during childhood or a combination of these over an extended period of time (11). This means maternal nutrition (47, 48), breast feeding (49), infant and young child feeding practices (49) and hygiene and sanitation (50) are all implicated in the process of stunting. Women's nutrition status, both before and during pregnancy, will impact the health of the mother and child during pregnancy and beyond. During pregnancy, women have increased need for energy, protein, essential fatty acids and most micronutrients (47) and inadequate

intake of these can result in poor nutrition outcomes for the woman and her fetus. Therefore, it is important to consider women's diets and health in the evaluation of the causes of stunting. Additionally, the WHO's "Guiding Principles for Complementary Feeding of the Breast Fed Child" recommend a child be exclusively breast fed for first six months of life and that breastfeeding be continued through 24 months as breast milk imparts immune benefits and provides a clean source of water and nutrients for the child (49). If these practices are not followed, a child may be at risk of inadequate nutrition and infection, which can cause stunting. The 2008 DHS reported that only 57% of rural and 34% of urban Bolivian children were exclusively breast fed between four and six months (1). Although this information was not specific to the study population in the Bolivian Amazon, it suggests there is reason to explore the breastfeeding and early child feeding practices in the study population. Finally, malnutrition and infection are closely related. When a person is not adequately nourished, they can have depressed immune system function which can make them more vulnerable to infection such as intestinal infections, malaria, measles and respiratory infections. In turn, infections can impact dietary intake in many ways. The malnutrition-infection cycle is depicted in Figure 1.3 (50).

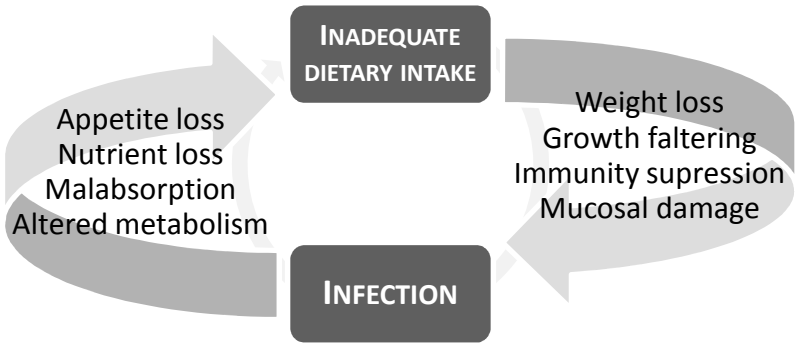

Figure 1.3 Malnutrition and Infection Cycle

Source: Recreated from Tomkins A, Watson F. Malnutrition and infection- a review- nutrition policy discussion paper no. 5 [Internet]. United Nations Administrative Committee on Coordination/Subcommittee on Nutrition. 1989; Available at: http://www.unscn.org/layout/modules/resources/files/Policy_paper_No_5.pdf. Accessed Nov 1, 2013.

In Bolivia there is high risk for food and waterborne diseases such as bacterial diarrhea, hepatitis A, and typhoid fever (3). Similarly, vector borne diseases such as dengue fever, malaria, and yellow fever are common (3). The FAO estimated that in 2010, 88% of Bolivians had access to improved drinking water sources and only 27% of the population had access to improved sanitation facilities (9) leaving a large portion of the population vulnerable to disease burden associated with contaminated water and soils. For example, the DHS reported that 26% of Bolivian children less than five years of age had diarrhea in the two weeks previous to the survey (1) indicating intestinal infections are common. Another study conducted among 632 Amerindian children in the Beni River area found that 75% of the children had at least one helminth (14) indicating that parasitic infections could be highly prevalent in this population. Therefore, it is possible that infection would be contributing to stunting rates in the Amazon Basin.

1.4.2 Maternal Overweight and Obesity

Overweight and obesity are terms used to describe individuals with a high percentage of body fat. A high percentage of body fat is a risk factor for many chronic diseases and is associated with poor health outcomes (51). BMI is a widely accepted proxy indicator for body fat. BMI categories were defined based on increased risk for poor health outcomes such as cardiovascular disease, diabetes and cancer (51) and can be found in the methods section of this report. On the individual level, obesity and overweight are caused by positive energy balance which occurs when an individual consumes more calories than she/he expends. This results in an accumulation of stored energy or fat. Beyond this simplistic view of the causes of overweight and obesity, the factors contributing to the high prevalence of overweight in Bolivia likely have complex origins in the social determinants of health. Researchers are now looking to understand how a wide variety of factors can influence the weight of individuals and populations around the world. A few factors in question include the food environment, which encompasses geographical access and availability of foods; the composition of the food supply and the nutritional and caloric density of available foods; socioeconomic factors such as

education level, financial access to healthy foods and cultural views of weight and food choice; and physiological factors such as genetics and early life processes such as stunting.

Cuevas et al. reviewed the causes of increased obesity in Latin America. According to these researchers, obesity and overweight have increased in both adults and children throughout Latin America due to increased availability of inexpensive processed high fat foods and increased urbanization leading to a more sedentary lifestyle. However, they note that genetics and early malnutrition may also play a role (52). In the Bolivian context there are few studies looking at the correlates of obesity. The DHS found the largest increases in obesity rates in Bolivia were among rural women, women with lower levels of education and in the lowest wealth quintile (1). Benefice et al. looked at correlates of overweight in 195 Amerindian mothers in the Beni River region. They found that the risk of overweight was associated with health status and dietary diversity, but not ethnic group or economic status (53). Although there are no studies on the correlates of weight in the Riberalta area, the identified studies indicate socio-economic factors may be important.

1.5 Summary of the Gaps in Knowledge

At present, basic country and department level information on food availability and access is available, however I identified no studies that assess Bolivian food insecurity at the household level. The information that is available suggests that the Bolivian Amazon is a particularly vulnerable area as it is predominantly rural (with many of the urban centers still being quite remote), there is a large Indigenous population and many households are dependent on fishing. Food security is of primary importance because of its role in the health and wellbeing of the population, particularly nutritional status. Current data on the consequences of food insecurity, such as stunting, are inconsistent in this population. Furthermore, while it is known that Bolivia is faced with a double burden of malnutrition, specifically childhood stunting and maternal obesity, it is not known to what extent these issues exist across the urban and rural populations in the Northern Amazon and how household food insecurity interacts with these. It is important to explore the prevalence of food insecurity and its relationship to nutrition status to help identify how these public health challenges can be addressed.

1.6 Research Objectives

Primary Objective:

To assess the household food security and nutritional status of women and children in urban and rural fishing communities in the Northern Bolivian Amazon in two seasons and to identify correlates of food insecurity and malnutrition.

Specific Objectives:

1. To describe the food security status of households as measured by the Household Food Insecurity Access Scale (HFIAS), Household Hunger Scale (HHS) and Household Diet Diversity Score (HDDS);
2. To describe the nutritional status of children less than 60 months as measured by underweight (weight for age), wasting (weight for height and mid upper arm circumference) and stunting (height-for-age);
3. To describe the nutritional status of women of child bearing age as measured by body mass index (BMI);
4. To identify the correlates of food insecurity as measured by HFIAS;
5. To assess if HFIAS is a correlate of stunting in children less than 60 months and to identify other correlates; and
6. To assess if HFIAS is a correlate of overweight/obesity in women of child bearing age and to identify other correlates.

CHAPTER 2. METHODS

In this chapter I outline the methods used to achieve the research objectives presented in the previous chapter. I also describe the study design, sampling framework, survey implementation and the approach to data analysis.

2.1 Study Design

This study was a descriptive, non-experimental, cross-sectional survey using a quantitative questionnaire. The Bolivian research team conducted the survey in urban and rural populations between October 31 and November 12, 2011 at the end of the low water season (May-October) and February 27- March 10, 2012 during the high water season (November- April) to capture potential seasonal variation in food security status and related variables.

2.2 Sampling Methodology

The urban sample was randomly selected by a Bolivian Statistician from the urban/peri-urban municipality of Riberalta, the economic center in the region. The urban population was divided into four geographically defined groups based on fishing occupation, poverty and migration data derived from the 2001 Bolivian National Census. There was a sample size target of 100 households for each stratum yielding a total urban sample target of 400 households (Table 2.1).

Table 2.1 Urban Sample Strata

Stratum 1	< 40% poverty and 0% migration
Stratum 2	> 40% poverty and <25% migration
Stratum 3	>40% poverty and >25% migration
Stratum 4	population assumed to be involved with fishing

Note: Poverty and migration are defined using Bolivian census definitions (5).

The rural population could not be sampled randomly because there was a lack of current census information to draw from. Because of this limitation, the groups were sampled separately. A total of 15 rural/Indigenous villages nestled along the tributary rivers running towards Riberalta were purposefully selected to capture the wide diversity of the rural fisher communities that send fish to market in Riberalta. A census survey was conducted in each of

these villages with a target of 400 households. These communities were predominantly located in the department of Beni and only a few were located in the department of Pando. In Figure 2.1, the urban sample was located in Riberalta (circled in black), while the rural sample was taken from 15 villages along the tributaries leading to Riberalta. Figure 2.1 was prepared by the Faunagua research team (54).

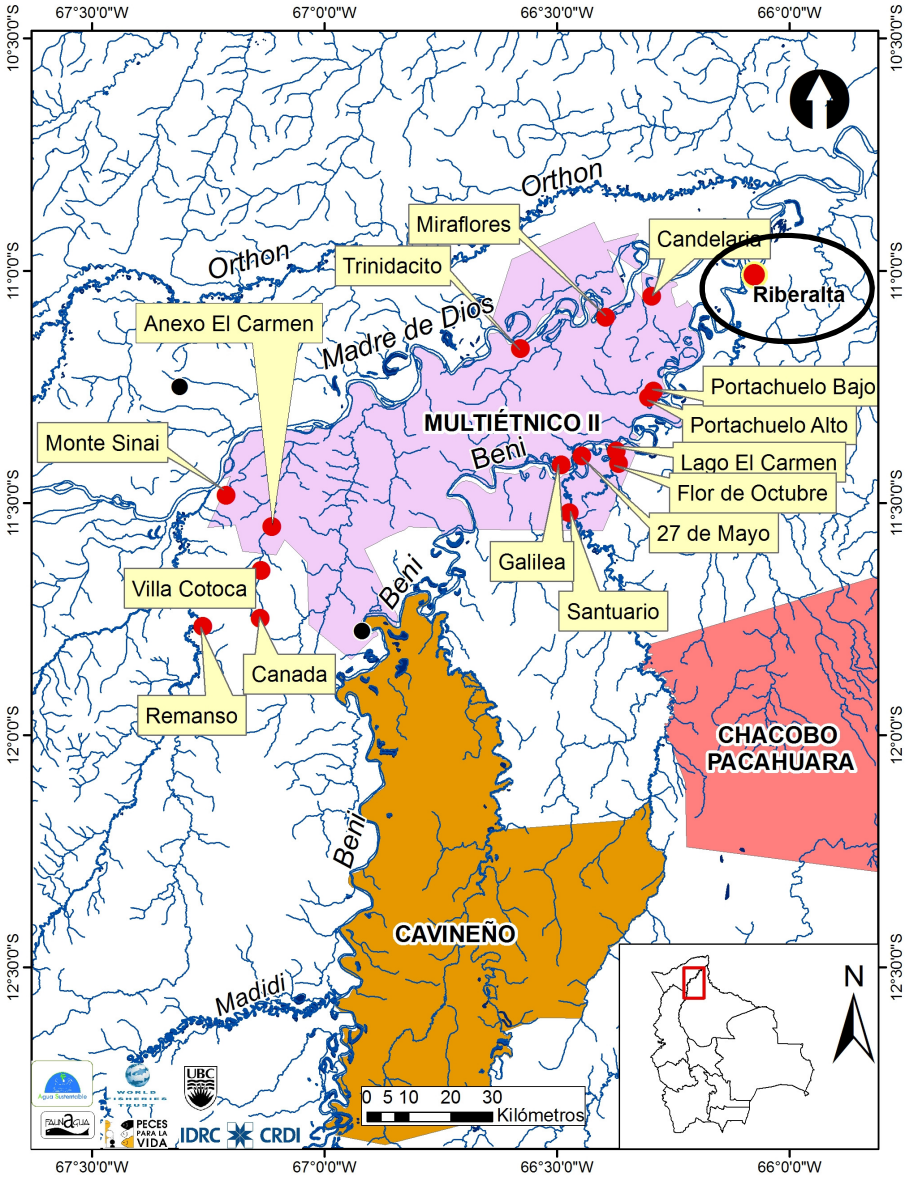

Figure 2.1 Map of Urban and Rural Sample Areas

Source: by permission, Associacion Faunagua. Urban and rural sample areas for the Fish for Life household survey. 2011.

2.2.1 Household Survey Participation Criteria

The primary caregiver in selected households was included in the survey if she was:

1. Female; and
2. The person who prepares the family meals.

The primary caregiver of the selected household was excluded if she was:

1. Unwilling to consent to participation in the survey;
2. Unavailable or not at home for either of two attempts;
3. Not competent to answer the survey; or
4. Could not or did not wish to communicate in Spanish, Esse Ejja or Cavineña.

2.2.2 Sample Size

Estimating a required sample size is difficult for complex surveys with multiple variables and components. For this survey, I carried out sample size calculations using the World Food Program estimates of household food insecurity and the 2008 Bolivian DHS prevalence of stunting in children less than five years of age as well as "safe estimates" for each, which produced the largest sample size potentially needed. Full calculations and an explanation of the methods can be found in Appendix I.

I found that a sample size of 384 households was needed to detect a 50% prevalence of food insecurity with a precision of 5%. To detect a difference of 15% in the proportion of households experiencing food insecurity (between seasons or between baseline and endline assessments), a sample size of 262 was needed. Therefore, the participant recruitment goal was to have at least 400 households in each of the urban and rural populations. Additional households were selected in case of non-participation. For childhood stunting detection, I estimated that 288 children would need to be measured for a precision of 5% or 72 children for a precision of 10% assuming a 25% prevalence of stunting.

2.3 Survey Implementation Methods

2.3.1 Participant Recruitment

The week prior to the study, study announcements were transmitted by radio-car in the study communities. Initial contact with the selected participant candidates was made by an interviewer. The interviewer introduced him/herself and, with permission from the potential participant, read a standardized letter of introduction. The information informed the potential participant of the purpose of the survey, the survey procedures, methods for measuring anthropometrics, the amount of time the survey would take, the potential risks and benefits of participating, and the method for disseminating the findings back to the community. The potential respondent was then asked if she was willing to participate. For those respondents who agreed to participate, a standardized verbal consent form was read and the participant was asked to clearly state her/his willingness to participate. Once consent was obtained, the respondent was considered a survey participant.

2.3.2 Interviewer Training

The interview team consisted of 15 students from the University of the Bolivian Amazon (Universidad Amazónica de Bolivia) who were familiar with the culture of the communities included in this study. In preparation for conducting the survey, the student team underwent an intensive interviewer training including cultural and gender sensitivity training, training on maintaining a neutral demeanour when reading survey questions, and standardized questionnaire administration procedures. In an effort to standardize the survey process, a question by question guide was prepared to explain the significance of each question in the questionnaire and how each question should be asked. This guide was provided to the interviewers and reviewed in the training. Interviewer were given the opportunity to practice their interview skills by interviewing urban community members who were not study participants.

2.3.3 The Survey Process

The survey was an interviewer administered oral questionnaire which took approximately 60-90 minutes. The interviewer recorded answers on a paper copy of the questionnaire. At the end of the oral survey, the interviewer took anthropometric measurements of the women (height and weight) and children under five years of age (length/height, weight and mid-upper arm circumference). These measurements were also recorded on the paper copy of the questionnaire. After the data collection was complete, a poster of local fish species was provided to the participant in recognition of her time. All interviewers spoke Spanish as their first language; however some respondents spoke Indigenous languages as their primary language. In the two rural communities where Esse Ejja and Cavineña (Indigenous languages) were primarily spoken, translators were hired to facilitate participation of community members who could not or did not want to communicate in Spanish.

2.4 The Household Questionnaire

The questionnaire was developed by a researcher team from University of British Columbia, including myself, and Faunagua. The questionnaire used in the first season included 167 questions. The second questionnaire included questions measuring season dependent variables and included 97 questions. We prepared the questionnaire in English and it was later translated to Spanish and back translated to English to help identify translation errors and assure complete accuracy of the question wording. The field version of the questionnaire was in Spanish. The questionnaire was field tested with 16 respondents. Observations during the interviews were recorded and the respondents' feedback was solicited. Based on the field testing, unclear or unacceptable survey questions were adjusted.

The questionnaire included nine modules (listed below). Each module contained questions relating to the module theme. The modules were as follows:

- Module 1: Household Characteristics
- Module 2: Homestead
- Module 3: Hygiene and Sanitation
- Module 4: Economic Activities

- Module 5: Diet and Fish Consumption
- Module 6: Household Food Security
- Module 7: Maternal Knowledge and Attitudes
- Module 8: Open Ended Questions (not reported or analyzed in this thesis)
- Module 9: Anthropometrics

The full questionnaire can be found in Appendix II.

2.4.1 The Questionnaire Variables

Within the survey modules there were questions covering key constructs associated with the correlates of food security and/or nutrition status. These included:

- **Household demographics**: number of household members, number of children less than 60 months of age, marital status (partner/husband), ethnicity (Indigenous vs. mestizo/European ancestry);
- **Socioeconomic variables**: wealth related variables (type of housing, access to electricity, durable items owned, alternative sources of income), education variables (maternal and paternal education level and literacy), and occupation variables (maternal and paternal employment status and occupation);
- **Potable water, hygiene and sanitation**: water sources and treatment, hand washing practice and toilet facilities;
- **Household food security**: HFIAS, HHS, HDDS, hunting and gathering practices, food assistance;
- **Household diet and fish consumption**: some of these variables overlap with other categories and include protein source, HDDS and hunting and gathering practices;
- **Child variables**: age, sex, child's IDDS, meal frequency, breastfeeding information, complementary feeding information, maternal knowledge of recommended child feeding practices; and
- **Women's characteristics**: Mother's IDDS.

We drew the majority of the survey questions pertaining to household demographics, livelihood, hygiene and sanitation, infant and young child feeding practices and maternal knowledge and attitudes from the Bolivian Demographic Health Survey (1) and the Rapid Knowledge, Practices and Coverage Survey (55). The HFIAS, HHS and HDDS questions were developed by FANTA (26,31,32). In the categories of household demographics, livelihood, food security, dietary diversity, and maternal knowledge and attitudes, we also devised questions important to the region. I describe a selection of the primary and/or more complicated variables in the questionnaire in more detail below.

The Household Food Insecurity Access Scale (HFIAS)

The HFIAS questions were asked of the mother with respect to her experience of food security for the previous 30 days. There are nine occurrence and frequency question pairs measuring the perception or experience of food insecurity with a focus on quantity of food accessed (26). The nine questions are divided into three domains and are as follows:

Domain 1: Anxiety and uncertainty about the household food supply:

1. Did you worry that your household would not have enough food?

Domain 2: Insufficient quality of food (includes variety and preferences of the type of food):

2. Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?
3. Did you or any household member have to eat a limited variety of foods due to a lack of resources?
4. 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?

Domain 3: Insufficient food intake and its physical consequences:

1. Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?
2. Did you or any household member have to eat fewer meals in a day because there was not enough food?

3. Was there ever no food to eat of any kind in your household because of a lack of resources to get food?
4. Did you or any household member go to sleep at night hungry because there was not enough food?
5. Did you or any household member go a whole day and night without eating anything because there was not enough food? (26).

The responses to the nine occurrence and frequencies questions yields a score between zero and 27 on an ordinal scale. The responses can also be used to categorize the household as 1) food secure, 2) mildly food insecure, 3) moderately food insecure, and 4) severely food insecure (26). The calculation for this is as follows, where 'a' refers to the frequency question associated with each of the nine HFIAS questions:

- HFIA category = 1 if [(Q1a=0 or Q1a=1) and Q2=0 and Q3=0 and Q4=0 and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0]
- HFIA category = 2 if [(Q1a=2 or Q1a=3 or Q2a=1 or Q2a=2 or Q2a=3 or Q3a=1 or Q4a=1) and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0]
- HFIA category = 3 if [(Q3a=2 or Q3a=3 or Q4a=2 or Q4a=3 or Q5a=1 or Q5a=2 or Q6a=1 or Q6a=2) and Q7=0 and Q8=0 and Q9=0]
- HFIA category = 4 if [Q5a=3 or Q6a=3 or Q7a=1 or Q7a=2 or Q7a=3 or Q8a=1 or Q8a=2 or Q8a=3 or Q9a=1 or Q9a=2 or Q9a=3] (26).

For the purpose of regression analysis in this thesis I further grouped the categories into dichotomous groups: food secure (category 1) and food insecure (categories 2, 3 and 4).

The Household Hunger Scale (HHS)

The HHS includes the final three yes/no questions and the accompanying frequency question from the HFIAS. The HHS is derived from the HFIAS and yields a score between zero and six on an ordinal scale. The score can also be described categorically as 0-1 'little or no hunger in the household," 2-3 "moderate hunger in the household," 4-6 "severe hunger in the household" (31).

The Household Diet Diversity Score (HDDS)

The HDDS consists of a list of 12 food categories that a household might eat in a typical 24 hour period (Table 2.2). The respondent was asked to respond for herself, which is considered to be an accurate response that can be used as a proxy for the household. The tool yields a score between zero and 12, with 12 indicating the greatest dietary diversity. This measure is related to household food security (32).

Table 2.2 Household Dietary Diversity Score (HDDS)

Category	Score
Cereals	1
White tubers	1
Vegetables	1
Fruit	1
Meat or poultry	1
Fish	1
Eggs	1
Legumes or nuts	1
Dairy products	1
Fat/oil	1
Sugar/honey	1
Other foods	1
TOTAL possible score	**12**

Note: I based this figure on the HDDS food categories and scoring presented by: Swindale A, Bilinsky P. Household Dietary Diversity Score (HDDS) for measurement of household food access: indicator guide (v.2) [Internet]. FANTA (USAID and FHI 360). 2006; Available at: http://www.fantaproject.org/monitoring-and-evaluation/household-dietary-diversity-score. Accessed Nov 1, 2013.

Child Variables

According to the WHO's *Indicators for Assessing Infant and Young Child Feeding Practices*, the child's IDDS is similar to the adult IDDS, but has only seven categories of food (Table 2.3)(36). Scores range from zero to seven and children can be categorized based on the number of meals consumed: three or fewer food groups indicating insufficient dietary diversity and four or more groups indicating sufficient diversity for children (36). The Minimum Meal Frequency is another WHO indicator defined as two meals for breastfed children six to 8.9 months and three meals for breastfed children nine to 23.9 months and four meals for non-breastfed children six to 23.9 months (36). The Minimum Acceptable Diet, another WHO indicator, can be calculated based on the frequency and diversity of the diet for each age group (36). I calculated these variables from information provided by the mother on the number of meals her child consumed and the child's dietary diversity the day prior to the survey.

Table 2.3 Child Individual Dietary Diversity Score (IDDS)

Category	Score
Cereals, tubers or roots	1
Vitamin A rich fruits or vegetables	1
Other fruits or vegetables	1
Meat, poultry or fish	1
Eggs	1
Legumes or nuts	1
Dairy products	1
TOTAL possible score	**7**

Note: I based this figure on the IDDS food categories and scoring presented by: World Health Organization. Indicators for assessing infant and young child feeding practices: part 2 measurement [Internet]. WHO. 2010; Available at: http://www.who.int/nutrition/publications/infantfeeding/9789241599290/en/. Accessed Nov 1, 2013.

Children's Anthropometrics

The definitions of childhood malnutrition outlined here are based on international reference data gathered between 1997 and 2003 in a study titled "The WHO Multicenter Growth Reference Study" (MGRS) (56). The data includes growth information from 8,500 healthy infants from Brazil, Ghana, India, Norway, Oman and the USA (56). The WHO reports that while there are some differences in growth trends among young children in different global populations, the differences are smaller than the differences in growth between well-nourished and malnourished children (56). Thus the use of global infant growth data is valid among most populations.

In this study, the height of children two to five years of age was measured with a stadiometer and the length of children under two years of age was measured using a length board according to methods outlines elsewhere (38). Children's weight was taken using a digital scale accurate to 0.02 kg. All anthropometric measures were taken twice to assure correct readings. If the reading was not within 0.02 kg for weight and 0.1 cm for height/length the measure was repeated.

Childhood Stunting

Stunting is defined as a low height-for-age and is an indicator of chronic malnutrition. In order to determine if a child is stunted, the height of the child must be measured and the child's age in months must be known. According to the WHO, children with a height that is smaller than two standard deviations below the mean on the standard WHO height-for-age growth curve (MGRS reference data) are defined as stunted (the lowest 2.1% on the chart), while those falling below three standard deviations below the mean are severely stunted (the lowest 0.1%) (11). For the purpose of regression analysis, stunted children were categorized as stunted (Z-score below the healthy range) or not stunted (Z-score within the healthy range). I outline the WHO classification for stunting in Table 2.4.

Stunting is a useful population level measurement because it can indicate if a larger than normal percentage of the population has a low height-for-age. For example, on a standard curve it is expected that 2.1% of the population will fall outside of two standard deviations below the mean. Therefore, if more than 2.1% of children in a population fall outside of two standard deviations below the mean then the population has a higher than expected prevalence of stunting.

Childhood Wasting

Wasting is defined as low weight-for-height and most commonly indicates a recent and substantial reduction in weight or acute malnutrition (11). Wasting is determined by plotting a child's weight for height on the WHO standard growth curve. Children whose weight-for-height falls below the second standard deviation below the mean are said to be wasted. Children falling below the third standard deviation below the mean are considered severely wasted (11). I outline the WHO classification for wasting in Table 2.4. Additionally, children's middle upper arm circumference (MUAC) can be used to identify wasted children on an individual level. Children who have a MUAC < 115 mm are considered wasted (57).

Childhood Underweight and Overweight

Underweight is defined as low weight-for-age and is affected by both the weight and height of a person (11). This means that underweight is a less specific indicator for malnutrition and can indicate that a child is either wasted or stunted. Underweight is determined by plotting the child's weight-for-age on the WHO standard growth curve. Children falling below the second standard deviation below the mean are said to be underweight. Children falling below the third standard deviation below the mean are considered severely underweight (11, 56). Childhood overweight is defined as a high weight-for-age (11) and is determined by plotting the child's weight-for-age on the WHO standard growth curve. Children falling above the second standard deviation above the mean are said to be overweight (11). I outline the WHO classification for under and overweight in Table 2.4.

Table 2.4 WHO Stunting Classification for Children <Five Years of Age

Stunting classification	**Z-Score**
Healthy range	≥-2
Stunted	-3 to <-2
Severely stunted	< -3
Wasting classification	**Z-Score**
Healthy range	≥-2
Wasted	-3 to <-2
Severely wasted	< -3
Weight classification	**Z-Score**
Overweight	>+2
Healthy range	-2 to +2
Underweight	-3 to <-2
Severely underweight	< -3

Note: WHO means World Health Organization. I based this figure on the WHO standards described in: World Health Organization. Global database on child growth and malnutrition: description [Internet]. WHO. 1997; Available at: http://www.who.int/nutgrowthdb/about/introduction/en/index5.html. Accessed Nov 1, 2012.

Women's Variables

The Adult Individual Diet Diversity Score (IDDS)

The IDDS consists of the same list of food categories as the HDDS, but certain categories are combined to yield a list of eight categories of foods corresponding to specific essential nutrients (Table 2.5). The respondent is asked to report the foods eaten in the last 24 hours. The tool yields a score between zero and eight, with eight indicating the greatest dietary diversity. This gives a better estimate of dietary quality compared to the HDDS which is meant to measure food security (32).

Table 2.5 Adult Individual Dietary Diversity Score

Category	Score
Cereals, tubers or roots	1
Vitamin A rich fruits or vegetables	1
Other fruits or vegetables	1
Meat, poultry or fish	1
Eggs	1
Legumes or nuts	1
Dairy products	1
Fat/oil	1
TOTAL possible score	**8**

Note: I based this figure on the IDDS food categories and scoring presented by: Swindale A, Bilinsky P. Household Dietary Diversity Score (HDDS) for measurement of household food access: indicator guide (v.2) [Internet]. FANTA (USAID and FHI 360). 2006; Available at: http://www.fantaproject.org/monitoring-and-evaluation/household-dietary-diversity-score. Accessed Nov 1, 2013.

Maternal Overweight and Obesity

Women's height was measured using a stadiometer and weight was taken using a digital scale accurate to 0.02 kg according to methods outlined elsewhere (38). BMI is equal to a person's weight in kilograms divided by his/her height in meters squared (kg/m^2). All anthropometric measures were taken twice to assure correct readings. If the reading was not within 0.02 kg for weight and 0.1 cm for height/length the measure was repeated. It is widely accepted that overweight and obesity are defined by the WHO's BMI categories (Table 2.6) (58). I calculated the women's BMI and classified them according to BMI category. For the purpose of regression analysis, I dichotomized women by BMI, grouping underweight and healthy females and overweight and obese females to yield two categories.

Table 2.6. Adult Body Mass Index Classifications

Underweight	< 18.5
Healthy	18.5 - 24.9
Overweight	25 - 29.9
Obese	≥ 30

Note: Body Mass Index (BMI) is calculated as kg/m^2. I based this table on the standards outlined by: World Health Organization. BMI classification [Internet]. WHO. 2006; Available at: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html. Accessed Mar 1, 2013.

2.5 Data Analysis Methods

I used IBM's SPSS Statistics 20 data analysis software for all aspects of data analysis. For the purpose of this thesis, I included households with a female respondent of child bearing age, ≤49 years, in the survey analysis. For analysis of any variables relating to children, I chose the youngest child in the home as the representative child if the household had more than one child less than 60 months of age. I used the survey results to describe the survey population and explored the potential correlates of the outcome variables with regression models. I analyzed the data separately for urban and rural groups because the sampling methodology for these groups was different. Therefore, I present the urban and rural populations separately in this thesis.

I explored all continuous variables for a normal distribution both visually and using the Shapiro-Wilk's test for normality. I summarized the continuous HFIAS, HHS, HDDS, BMI and height-for-age Z-score data using means and standard deviations (SD) and medians and interquartile ranges (IQR). I calculated the categorical versions of these variables according to the methods that I previously outlined and reported them as frequencies. Where necessary, I constructed variables in the survey from one or more survey questions and/or I collapsed response levels to create more meaningful variables. I described the resulting variables by frequencies, means and standard deviations (SD) and/or median and interquartile ranges (IQR).

Using data from the low water season survey results, I explored the associations between the HFIAS measure of food security and dietary diversity using a Spearman's correlation. I used a

Student's T-test to test for an association between HFIAS (food secure and food insecure) and HDDS data. This was possible because the Student T-test is considered robust to non-normality with large sample sizes (59). I conducted a Chi-Squared test to determine if there was an association between childhood stunting and household food insecurity, as measured by the HFIAS, for both urban and rural populations. Additionally, I compared the results for HDDS and childhood stunting using a Student T-test in both the urban and rural populations. I examined maternal BMI categories (BMI <25 and BMI ≥25) and household food security categories for association in both urban and rural populations using a Chi-Squared test. I compared the results for HDDS and maternal BMI using a Student T-test in both the urban and rural populations. Finally, I assessed maternal BMI (BMI <25 and BMI ≥25) and childhood stunting (stunted and not stunted) for association using a Chi-Squared test.

I prepared six sets of logistic regression models to answer my research questions. These models explore the correlates of the HFIAS, childhood stunting and maternal overweight/obesity in urban and rural populations separately using the low water season survey data. I used a similar methodology in constructing each of these models. I describe the general steps below.

1. I prepared a list of independent variables with potential significance in the causal pathway of each outcome variable.
2. I examined the outcome variable (all are dichotomous categorical variables) and each of the potential explanatory variables for associations using a univariate logistic regression. I used a p-value of ≤0.05 to define statistically significant associations.
3. I prepared a 'full model' for each outcome variable. I included variables that based on assessment of the literature were important in the causal pathway in the models regardless of the univariate logistic regression p-value. I also included all variables with a univariate logistic regression p-value of ≤0.20. I then assessed the variables in the full regression model for collinearity using a correlation matrix. If two variables were collinear, I removed the less significant variable from the model. The final model had no collinear variables and was significant using a Hosmer and Lemeshow test (p-value >0.05 for significant models). I reported a Nagelkerke Pseudo R-squared to describe the

amount of overall variability in the outcome variables explained by the model. I considered independent variables statistically significant in the model if the variable p-value was <0.05.

4. Finally, I prepared a 'reduced model' by using a backward selection process in which I removed variables one-by-one from least to most significant. After I removed each variable, I assessed the model for overall significance and for changes >10% in the beta values and standard errors of each of the remaining independent variables. If there were large changes, I retained the variable in the model. I used the same tests described above to determine the Pseudo R-squared and the overall significance of the final reduced model.

For the survey conducted in the second season, I reported only key demographic and household food security variables. I conducted seasonal comparisons of HFIAS, HHS and HDDS across seasons using a McNemar's test, a Wilcoxon Signed Rank Sum and a Paired T-test, respectively, for each of the urban and rural populations. Again, I used a confidence of 95% (p-value 0.05).

CHAPTER 3. RESULTS

In the first half of this chapter, I provide descriptive statistics for the population and information on the study objectives relating to the prevalence of household food insecurity, childhood stunting and maternal obesity as well as related variables. In the second half of the chapter, I provide the results of the exploration of bivariate associations and the series of logistic regression models that were prepared to identify associations between variables in the theoretical causal pathway and the dependent variables household food insecurity, childhood stunting and maternal obesity. In the final section, I provide the results for the second survey conducted in the high water season and the seasonal comparisons for key food security indicators.

3.1 Low Water Season Survey Results

In the main phase of the survey, which took place in the low water season, 811 urban and rural households were surveyed. I present the analytical sample for each of the surveyed households in Figure 3.1. The response rate was not recorded, but the interview team observed that few households declined to participate in the survey.

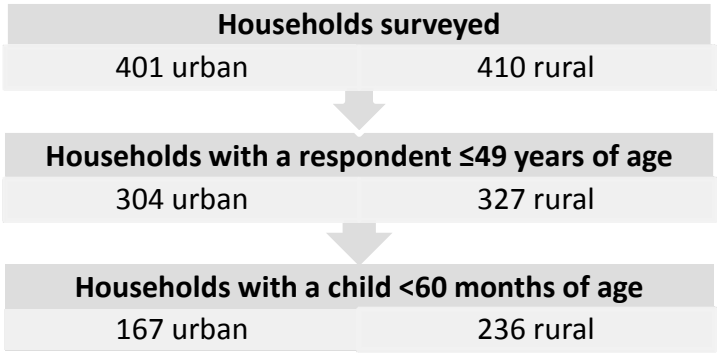

Figure 3.1 Analytical Sample

3.1.1 Urban Survey Results (Descriptive Statistics)

Distribution in the four socio-geographically determined strata was similar among strata 2, 3 and 4. However, there were fewer respondents in the low poverty and zero migration group (stratum 1) (Table 3.1).

Table 3.1 Urban Household Distribution by Strata

N=304	N	%
Stratum 1 < 40% poverty and 0% migration	23	7.6
Stratum 2 > 40% poverty and <25% migration	90	29.6
Stratum 3 >40% poverty and >25% migration	108	35.5
Stratum 4 population assumed to be involved with fishing	83	27.3

Note: Poverty and migration are defined using the Bolivian census definitions (5).

3.1.1.1 Urban Household Demographics

The average household size was 5.6 members (SD 2.1) and ranged from one to 13 people. In Table 3.2 I present data showing that the majority of respondents reported having a male household head partner and more than half of the respondents had a child less than five years of age living in the home. Very few respondents self-reported as Indigenous and almost all of the respondents' primary language of communication was Spanish (Table 3.2).

Table 3.2 Urban Household Demographics

	N	%
Households with a head male (N=304)	249	81.9
Households with a child <60 months of age (N=303)	164	54.1
Indigenous (N=304)	9	3.0
Ese-Ejja	4	1.3
Quechua	3	1.0
Other Indigenous*	2	0.6
Respondent's primary language of communication (head female) (N=302)		
Spanish	299	99.0
Indigenous†	3	0.9

Note: Sample sizes differ due to missing data.

* Tacana, Cavineno, Chacobo, Aymara.

†Ese-Ejja, Quechua, Tacana, Cavineno, Chacobo, Aymara.

3.1.1.2 Urban Socio-Economic Characteristics

Literacy and Education

In Table 3.3 I present data that shows that the vast majority of respondents could read and write. However, there was a large variability in respondents' education levels in the municipality of Riberalta. A little less than one-third of respondents did not complete a primary level of education, while over one-third of respondents completed secondary school or a higher level of education (Table 3.3).

Employment and Income Characteristics

Table 3.3 also shows that almost two-thirds of the urban respondents had worked in the month before the survey. For those women who worked, almost half worked in sales and trades. Very few of the women worked in agriculture or fishing. Of the remaining respondents who did not work in the month prior to the survey, most were homemakers or students. Very few were unemployed and actively looking for work (Table 3.3). Of the households that had a head male (N=249), the vast majority of the men had employment in the last month.

The respondents were asked if the household participated in any fishing activities contributing to income or subsistence over the last year and I report the results in Table 3.3. The majority reported fishing for home consumption only and the remaining households either fished commercially or not at all. Respondents were asked if their household had other sources of income and more than half of respondents did. Government income assistance for families with children was the most widely reported additional source of income (Table 3.3).

Table 3.3 Urban Respondent Literacy, Education, Employment and Income Characteristics

	N	%
Respondent can read (N=287)	276	96.2
Respondent can write (N=287)	268	93.4
Respondent's education level (N=299)		
No formal education	10	3.3
Incomplete primary	81	27.1
Primary complete	23	7.7
Incomplete secondary	74	24.7
Secondary complete	56	18.7
Incomplete post-secondary	27	9.1
Post-secondary complete	28	9.4
Respondents employed in the last year (N=304)	196	64.5
Fishing	6	2.0
Agriculture	3	1.0
Professionals	37	12.2
Sales	81	26.6
Trades	56	18.4
Other	13	4.3
Households participating in fishing activities (N=304)	160	52.6
Commercial fishing	79	26.0
Fishing for home consumption only	81	26.6
Households with other sources of income (N=303)	182	60.1
Government child assistance	116	38.3
Other additional income*	66	21.8

Note: Sample sizes differ due to missing data.

* 'Other additional' sources of income include remittance, rent, interest, inheritance, governmental support, scholarships, and bank loans.

Wealth

Respondents were asked about a variety of factors relating to household wealth and I report these the relevant data in Table 3.4. In the urban population, almost all of the respondents lived in a house and the large majority lived in a home that was owned by a member of the household. For those that did not, the family home was most commonly owned by a relative or was rented. Most urban homes had adequate wall and roof materials, while the majority had inadequate floor materials as defined by the INE (5). I have provided information on durable

items owned in Table 3.5. Radio, TV and cellular phones were the durable items most commonly owned (Table 3.5).

Table 3.4 Urban Housing Characteristics

	N	%
Type of housing (N=302)		
House	289	95.7
Other	13	4.3
Housing ownership status (N=304)		
Owned by household member	233	76.6
Assigned	14	4.6
Owned by relative	28	9.2
Rented	22	7.2
Anti-credit	3	1.0
Other	4	1.3
Wall materials* (N=303)		
Adequate materials	270	89.1
Inadequate materials	33	10.9
Floor materials† (N=302)		
Adequate materials	101	33.4
Inadequate materials	201	66.6
Roof materials** (N=300)		
Adequate materials	270	90.0
Inadequate materials	30	10.0

Note: Sample sizes differ due to missing data.

*Adequate wall materials include brick, tabique, quinche and wood, while inadequate wall materials include adobe, chuchio, plastic tarps or other materials.

†Adequate floor materials include cement, brick, tile and wood, while inadequate materials include earth and burned flat floors.

**Adequate roof materials include corrugated zinc, corrugated cement, tile and a reinforced concrete slab, while inadequate materials included leaves and other materials.

Table 3.5 Urban Ownership of Household Items

N=298-304*	N	%
TV	266	87.5
Cellular phone	254	83.6
Radio	249	82.2
Motorcycle	182	59.9
Refrigerator	144	47.4
Bicycle	111	36.5
Sewing machine	83	27.3
Freezer	80	26.3
Computer	58	19.1
Boat	48	16.1
Water pump	48	15.8
Land line phone	48	15.8
Car	40	13.2
Internet	21	6.9

Note: Sample sizes differ due to missing data.

3.1.1.3 Urban Drinking Water Supply, Hygiene and Sanitation

The respondents were asked about the primary source of drinking water for their household. Table 3.6 shows that almost two-thirds reported an improved source of water. Of those that were not accessing acceptable sources, most were using uncovered earth wells. The large majority of households reported the same water sources for cooking and hand washing as for drinking. The respondents were asked if and how they treat their drinking water before use (all treatment methods reported were recorded). Proper water treatment methods included purchasing purified water, boiling, adding chlorine, using a ceramic filter and using a solar light purification system (60). Improper methods included straining, filtering with a cloth or decanting (60). Almost half of the respondents did not properly treat their drinking water before use (Table 3.6).

Table 3.6 Urban Household Water Source and Treatment

	N	%
Improved source of water (N=303)	201	66.1
Plumbed source	28	9.2
Spout in the garden/patio	9	3.0
Covered ring well	32	10.5
Uncovered ring well	108	35.6
Covered earth well	8	2.6
Public spout	1	0.3
Purified water	15	5.0
Unimproved source of water (N=303)	102	33.6
Uncovered earth well	83	27.3
River/Spring/Lagoon /Creek (pauro/vertiente)	7	2.3
Water from cistern	2	0.7
Cement pool	5	1.6
Other	5	1.6
Same water source for cooking and drinking (N=303)	253	83.5
Same water source for hand washing and drinking (N=303)	234	77.2
Households reporting proper water treatment methods* (N=304)	170	55.9

Note: Sample sizes differ due to missing data.

*Proper water treatment methods include boiling, chlorinating, solar light purification and ceramic filtration.

In Table 3.7 I show that the majority of homes had a toilet facility, but more than half were not considered “acceptable” by the INE definition (5). The few households that did not have access to a toilet reported using the open field, the river and neighbors’ facilities (Table 3.7).

Table 3.7 Urban Household Toilet Facilities

	N	%
Households with toilet facilities (N=302)	290	96.0
Households with acceptable toilet facilities (N=293)	110	37.1
Plumbed	70	23.9
Septic	40	13.2
Households with unacceptable toilet facilities (N=293)	183	62.5
Blind well	181	61.8
Other	2	0.7
Homes that share their toilet (N=283)	41	14.5
Alternative facilities for homes with no toilet (N=9)		
Open field	3	33.3
River or other water way	3	33.3
Other	3	33.3

Note: Sample sizes differ due to missing data.

3.1.1.4 Urban Household Food Security

Urban Household Food Insecurity Measures

The respondents' HFIAS scores ranged from zero to 24 on a scale of zero to 27 with a median response of 2.0 (IQR 0-6) and a mean response of 3.4 (SD 4.4). The categorical HFIAS results, which I present in Table 3.8, show that 55% of the respondents reported some level of food insecurity. Within the HFIAS, there are three domains of food insecurity including anxiety over food, quality of food and quantity of food. Over half of urban respondents reported experiencing each of these aspects of food insecurity (Table 3.8). The HHS scores ranged from zero to nine. The mean score was 0.3 (SD 0.8) with a median score of 0 (IQR 0-0). According to the categorical HHS very few households had moderate hunger and only one household reported severe hunger (Table 3.8).

For the households that had enough information to calculate a HDDS (N=297), scores ranged from three to 12 with a median of nine (IQR 8-11) and a mean of 9.2 (SD 1.8) on a scale of zero to 12. Based on the Shapiro-Wilk's test, the HDDS distribution is not normally distributed ($p<0.01$). I present the number of respondents having eaten each of the food HDDS food groups the day prior to the survey in Table 3.8. Respondents were asked if the previous day had been a normal day with regard to the food groups consumed or if it was unusual in any way. Of the respondents (N=300), 14% (N=43) indicated that they had an abnormal day the previous day. Of those who reported a reason for an abnormal day (N=31), 45% said they "were not hungry" and 18% said they were sick. Only one reported having eaten more than normal. Another 23% said they ate differently for "other reasons" but did not specify what these were. The remainder did not provide a reason.

Table 3.8 Urban Household Food Insecurity, Hunger and Dietary Diversity in the Low Water Season

	N	%
Household food security as assessed by the Household Food Insecurity Access Scale (N=303)		
Food Secure	136	44.9
Mildly Food Insecure	44	14.5
Moderately food insecure	67	22.1
Severely food insecure	56	18.5
Households experiencing food insecurity by domain* (N=302-304)		
Households experiencing anxiety over food	157	51.6
Households with decreased quality of food	198	65.6
Households with decreased intake or physical consequence of food insecurity	165	54.5
Household hunger as assessed by the Household Hunger Scale (N=303)		
Little to no hunger	275	90.8
Moderate hunger	27	8.9
Severe hunger	1	0.3
Household consumption of food groups as assessed by the Household Dietary Diversity Score (N=300-304)		
Cereals	296	97.7
White tubers	257	84.8
Vegetables	219	72.0
Fruit	278	91.7
Meat or poultry	290	95.7
Fish	95	31.5
Eggs	176	57.9
Legumes or nuts	136	44.7
Dairy products	239	78.6
Oil/fat	281	93.4
Sugar/honey	282	93.4
Other foods	238	79.1
Household consumption of additional food categories of interest		
Vitamin A rich fruit or vegetables	219	72.3
Organ meats	59	19.5
Sugar rich beverage	211	70.3

Note: Sample sizes differ due to missing data. The Household Food Insecurity Access Scale was developed by Coates et al. (2007) (26). The Household Hunger Scale was developed by Ballard et al. (2011) (31). The Household Dietary Diversity Score was developed by Swindale and Bilinsky (2006) (32).
* Food security domains are derived from the Household Food Insecurity Access Scale (26).

Homestead Food Production and Food Assistance

When asked about home food production, less than one in three urban households produced crops for home consumption in the year prior to the survey. Of those that did, most produced carbohydrate rich staples plantains, rice, corn and yucca, while very few produced legumes or vegetables. Over half of the families reported hunting wild meat or gathering wild foods from the forest to supplement their diet in the year prior to the survey. Additionally, more than two out of five respondents reported receiving food assistance in the year prior to the survey. The most common form of food assistance was a child who received meals at school. Some households reported receiving food at work and from government funded social programs. I present the full data in Table 3.9.

Table 3.9 Urban Household Food Production, Hunting and Gathering Practices and Food Assistance

	N	%
Households that produced crops in the prior year (N=302)	85	28.1
Type of crop produced (multiple responses possible)		
Rice	57	18.9
Yucca	43	14.2
Corn	45	14.9
Plantains	52	17.2
Beans	28	9.3
Vegetables	27	8.9
Households that raised animals in the prior year (N=303)	186	61.4
Type of animal bi-products produced (multiple responses possible)		
Egg	164	54.1
Milk	8	2.6
Other	13	4.3
Households that consumed wild meat hunted by a family member in the prior year(N=297)	156	52.5
Households that consumed wild foods collected by a family member in the prior year (N=300)	164	54.7
Households with food assistance in the prior year (N=303)	131	43.2
Source of food assistance (N=130) (multiple responses possible)		
Work	16	12.3
Gov. Social support	13	10.0
Food rations	4	3.1
Money to buy food	8	6.2
Food bank	3	2.3
School food program	89	68.5
Other	9	6.9

Note: Sample sizes differ due to missing data.

3.1.1.5 Urban Household Diet and Fish Consumption

Each respondent was asked if she ate any food item from each of the 12 HDDS food categories over the 24 hour period prior to the survey (Table 3.8). Almost all of the women reported eating a source of carbohydrate, animal protein and fruit. Similarly, a large majority of respondents ate dairy products. However, more than one-quarter of respondents did not consume any vegetables or vitamin A rich fruits or vegetables in the specified period. Finally, almost all the women reported consuming ate least one source of added sugar the day prior to the survey.

Respondents were asked about the type of animal protein prepared for their household the previous day and I present the results in Table 3.10. Overall, meat had a higher popularity than fish did at the time of the survey. Only small percentage of households did not eat any meat or fish the previous day. Of those that did, over half ate meat only, over one quarter ate meat and fish and very few ate fish only. For the respondents that reported not eating fish the previous day (N=221), 63% said they had eaten fish two days prior to the survey and, therefore, did not eat fish on the day in question. Another 14% reported that they did not have enough money to purchase fish and 7% indicated there was either limited access to markets or that the market had no fish to purchase.

The respondents were asked how they typically obtained fish consumed at home. The majority usually purchased fish, but some households regularly did their own fishing (Table 3.10). Most respondents reported that fish arrived to the home fresh and some reported the fish was partially or totally frozen. Over half of the respondents used the fish immediately, while the others would at times preserve fish for later consumption. The main methods of preservation reported were cold storage (on ice or in a refrigerator) or as 'charque', a fried jerky like meat, both of which are food safe methods if prepared correctly. A few households reported improper storage of fish by covering it with a cloth.

In terms of the respondents' attitudes towards fish consumption, almost all of the respondents believed that fish was important for health, a good source of energy, important for women's health and important for children's growth and development (Table 3.10). Very few

respondents were neutral about the health benefits of fish or felt it was unhealthy. I present the data on household fish consumption, procurement and preservation practices, and fish consumption related health beliefs in Table 3.10.

Table 3.10 Urban Household Fish Consumption, Procurement and Preservation Practices, and Health Beliefs

	N	%
Animal source protein consumed the previous day (N=304)		
No meat or fish	32	10.5
Fish only	10	3.3
Meat only	189	62.2
Meat and fish	73	24.0
Usual source of fish for the family (N=290)		
Caught by a family member	56	19.3
Bought	157	54.1
Sometimes caught or bought	77	26.6
Fish preservation upon arrival to the home (N=297)		
Fresh	211	71.0
Partly frozen	54	18.2
Frozen	30	10.1
Other	2	0.7
Fish is preserved in the home (N=300)		
Yes	80	26.7
Sometimes	52	17.3
No	168	56.0
Method of home preservation of fish (N=116) (Multiple responses possible)		
Cold storage (ice or refrigerator)	93	80.2
'Charque' fried/dried	28	24.1
Smoked	9	7.8
Covered with a cloth	8	6.9
Other	6	5.2
Respondent believes fish consumption is important for health (N=298)	287	96.3
Health category associated with fish consumption (N=284-285*) (Multiple responses possible)		
Source of energy	258	90.5
Important for women's health	231	81.3
Important for children's growth and development	231	81.3

Note: Sample sizes differ due to missing data.

3.1.1.6 Urban Children's Characteristics

A total of 167 urban households had a child <60 months of age, however nine children's age was reported in years only but not months. For urban households that had a child <60 months of age, for which age was reported in months (N=158), the median child's age was 17 months (IQR 9-36) and the mean child's age was 22 months (SD 17). Among the urban children, there was a total of 25 children ≤six months of age, 69 children between six and ≤24 months of age and another 64 between 24 and <60 months of age. The distribution of age was more heavily weighted to children under 24 months of age as the youngest child in the home was chosen for analysis in this study.

Breastfeeding and Complementary Feeding (Children ≥ Six Months)

Respondents were asked to answer questions about breastfeeding and complementary feeding practices for the youngest child in the home ≥six months (N=133). Almost all of the women reported breastfeeding for the full first six months of the child's life, which follows WHO breastfeeding recommendations (49). The average age at which children ≥six month of age were started on complementary foods was seven months (SD 4) and ranged from two to 24 months. The children ≥six month of age stopped breastfeeding at an average of 13 months (SD 6), but the age at termination of breastfeeding ranged from one to 36 months.

I categorized the children ≥six months of age according to the timing of commencement of regular complementary feeding according to the WHO's *Indicators for Assessing Infant and Young Child Feeding Practices* (36). The majority of children were started on complementary foods at the appropriate time around six months of age (between six and nine months of age) (Table 3.11). However, nearly half were started on foods too early (before six months of age) or too late (after nine months of age). It also appears that breastfeeding may not have been exclusive up to six months for many mother-child pairs because when asked if any solid or semi-solid food was fed to the child before six months of age, a large majority of mothers reported some food had been given to the child (Table 3.11).

Table 3.11 Breastfeeding and Complementary Feeding Practices for Urban Children ≥Six Months

	N	%
Duration of breastfeeding (N=117)		
Breastfed the whole six months	112	95.7
Breastfed part of the first six months	1	0.9
Not breastfed	4	3.4
Commencement of regular complementary feeding (N=119)*		
Early (<6 months)	28	23.5
Timely (6-8.9 months)	74	62.2
Late (≥9 months)	17	14.3
Children fed solid or semi-solid food before six months (N=119)	82	68.9

Note: Sample sizes differ due to missing data.

*Complementary feeding timing categories are defined by the WHO's *Indicators for Assessing Infant and Young Child Feeding Practices* (2010) (36).

Urban Children's Dietary Diversity (Children Six to <24 Months)

Urban respondents were asked about the dietary diversity (IDDS) for their child between six and <24 months of age (N=63). The IDDS scores were based on the previous 24 hour period before the survey. The results ranged from zero to seven on a scale of zero to seven with a median of four (IQR 4-5) and a mean of 4.3 (SD 1.6). In the day prior to the survey, a large majority of the children had breast milk and water and less than half had cow's milk or infant formula (Table 3.12). Many children were also consuming liquids that are not recommended such as sweetened drinks like pop, fruit juice, sugar water, tea and coffee. A large majority of children had a source of carbohydrate and animal source protein the previous day. However, fewer than three out of four children consumed any vegetables or fruit the previous day. Additionally, more than one out of five children did not have fat or oil included in their diet the previous day, which could indicate the foods being fed to the children have a low energy density. I present the data on children's IDDS food groups in Table 3.12. Most of the children (86.2%) had a "typical" eating day. Among those that did not, four were not hungry. Over half did not report a reason for the day not being "typical".

Table 3.12 Food Groups Consumed in the 24 Hours Previous to the Survey by Urban Children Six to <24 Months as Assessed by the Individual Dietary Diversity Score

N=63	N	%
Liquids consumed during the 24 hours		
Breast milk	47	74.6
Formula	22	34.9
Water	56	88.9
Sweetened water, fruit juice, soda-pop	55	87.3
Soup, broth	53	84.1
Cow's milk	27	42.9
Tea, coffee	35	55.6
Individual Dietary Diversity Score groups consumed in the 24 hours		
Cereals or tubers	56	88.9
Vitamin A rich fruits or vegetables	49	77.8
Other fruits or vegetables	43	68.3
Meat, poultry or fish	55	87.3
Eggs	20	31.7
Legumes or nuts	23	36.5
Dairy products (not including formula and breast milk)	27	42.9
Additional food categories of interest		
Fat/oil	53	84.1
Fish	24	38.1

Note: The Individual Dietary Diversity Score is presented by Swindale and Bilinsky (2006) (32) and the WHO (2010) (36).

In Table 3.13, I present the WHO indicators that show that one in five children six to <24 months had inadequate dietary diversity (less than four food groups consumed) and one in 10 were eating too few meals. Therefore, over two out of five children did not meet the minimum requirement for an acceptable diet (Table 3.13).

Table 3.13 The Diet of Urban Children Six to <24 Months as Assessed by key WHO Indicators

	N	%
Children with a Minimum Dietary Diversity† (N=63**)		
Inadequate diversity (3 or fewer groups)	13	20.6
Adequate diversity (4 or more groups)	50	79.4
Children consuming the Minimum Meal Frequency† for their age group (N=60**)		
Too few meals	14	23.3
Appropriate number of meals	46	76.7
Children with a Minimally Acceptable Diet (frequency + diversity)† (N=61**)		
Unacceptable diet	25	41.0
Minimally acceptable or better diet	36	59.0

Note: Sample sizes differ due to missing data. WHO means World Health Organization. The Minimum Dietary Diversity, Minimum Meal Frequency and Minimally Acceptable Diet are defined by the WHO (2010) (36).

Diarrhea (Children <24 Months)

Respondents were asked if their child <24 months of age (N=68) had diarrhea in the last two weeks (note there were missing data for 26 children). Of these 47% (N=32) reported their child had diarrhea in the last two weeks. As seen in Table 3.14, the large majority of these mothers sought help to treat the diarrhea. Most of these mothers went to the hospital and some reported seeking help from family, friends and neighbors. Very few went to traditional healers or midwives for attention. Of the mothers who issued treatment to their child for diarrhea (some of whom did not seek help to treat the diarrhea), almost all gave their child western pharmaceuticals. Some mothers also gave oral rehydration solution to their child and/or traditional medicines.

When mothers were asked how often a sick child should be breastfed (N=165), less than half of the mothers (46%)reported the correct answer that the child should be breastfed more than usual , while 32.3% reported less than usual and 21.8% reported the same amount.

Table 3.14 Occurrence and Treatment of Diarrhea in Urban Children <24 Months in the 2 Weeks Prior to the Survey

	N	%
Mother sought help to treat the diarrhea (N=26)	23	88.5
Source of help sought		
Hospital	15	57.7
Private clinic	3	11.5
Midwife	1	3.8
Traditional healer	0	0
Friends/neighbor/mother	11	42.3
Other	6	23.1
Caregivers who issued treatment for the diarrhea (N=32)	26	81.3
Type of treatment issued (multiple responses possible)		
Western medicine (pills, syrup, injection)	22	68.8
Traditional medicine	10	31.3
Oral rehydration solution	9	28.1
Other	6	18.8

Note: Sample sizes differ due to missing data.

Anthropometric Measures of Urban Children

In the urban population, the average weight-for-age Z-score sat just below 0 at -0.3 (SD 1.6), indicating that on average this group is slightly lighter than the healthy children measured for WHO's standard growth curve. More children were both underweight (12.3% CI: 8.0% to 18.4%) and overweight (6.5% CI: 3.5% to 11.5%) than the 2.1% that would be expected in a healthy population (Table 3.15). Children's height-for-age Z-scores ranged from -6.0 to 5.2 with a mean of -1.2 (SD 2.1) and a median of -1.2 (IQR -2.4 to -1.2), both well below the average of zero for a healthy population. The distribution of height-for-age Z-scores had a cluster in the lower end of the scale, indicating that there was a group of children with low height-for-age pulling the average down. When categorized by the WHO's Z-score cut offs for stunting, it was found that 35.0% (CI: 27.4% to 42.9%) of urban children were stunted (Table 3.15). Children's weight-for-height Z-scores ranged from -4.5 to 4.8. The mean hovered just above zero at 0.4 (SD 1.7). A total of 7.5% (CI: 4.3% to 13.0%) of children fell into the wasted category (Table 3.15), which is

higher than the 2.1% expected in a healthy population. The middle-upper arm circumference (MUAC) was also measured for each child to help identify wasted children. The MUAC ranged from 70 to 250 mm, with a mean of 154mm (SD 21). Based on the MUAC measurements, less than 3.0% (CI: 1.0% to 6.6%) of the children were wasted (Table 3.15).

Table 3.15 Anthropometric Status as Assessed by the WHO Standards for Urban Children <60 Months

	N	%
Weight-for-age (N=155)		
Severely underweight (< -3 z)	6	3.9
Underweight (-3 to <-2z)	13	8.4
Healthy range (-2 to +2z)	126	81.3
Overweight (>+2 to+ 3z)	7	4.5
Obese (>+3 z)	3	1.9
Stunting as determined by height-for-age (N=141)		
Severely stunted (<-3 z)	26	18.4
Stunted (-3 to <-2z)	23	16.3
Not stunted (≥-2z)	92	65.2
Weight-for-height (N=146)		
Severely wasted (< -3z)	7	4.8
Wasted (-3 to <-2z)	4	2.7
Healthy range (-2 to +2z)	113	77.4
Overweight (>2 to 3z)	15	10.3
Obese (>3z)	7	4.8
Wasting as determined by MUAC (N=152)		
Not wasted (mm≥115)	148	97.4
Wasted (mm<115)	4	2.6

Note: Sample sizes differ due to missing data. WHO means World Health Organization.

3.1.1.7 Urban Women's Variables

The age of the urban respondents ranged from 15 to 49 with a median of 33 (IQR 27-40) and a mean of 33.6 (SD 8.6). The IDDS for respondents (N=297) ranged from three to eight on a scale of zero to 12, with an average of 6.3 (SD 1.3), median of seven (IQR 6-7). I report the percentage of women who consumed each of the HDDS food groups the day prior to the survey

in Table 3.16. Vitamin A rich fruits and vegetables and legumes and nuts were the least commonly consumed food groups.

Table 3.16 Food Groups Consumed by Urban Women of Child Bearing Age in the 24 Hours Prior to the Survey as Assessed by the Individual Dietary Diversity Score in the Low Water Season

N=301-304	N	%
Individual Dietary Diversity Score groups consumed in the 24 hour		
Cereals, tubers or roots	299	98.7
Vitamin A rich fruits or vegetables	219	72.0
Other fruits or vegetables	261	86.1
Meat, poultry or fish	299	98.7
Eggs	176	57.9
Legumes or nuts	136	44.7
Dairy products	239	78.6
Fat/oil foods	281	93.4

Note: Sample sizes differ due to missing data. The Individual Dietary Diversity Score is presented by Swindale and Bilinsky (2006) (32).

The average urban respondent's BMI was 27 (SD 6) and ranged from 15 to 60 (N=272). Both the distribution of women's BMI and women's height were not normally distributed using the Shapiro-Wilks test. The women's height (cm) and BMI were not significantly correlated (Spearmans -0.03; P=0.58). Using the standard cut-offs for BMI categories (58), I found that very few women were underweight, while well over half of the women were overweight or obese (56.7% CI: 50.7% to 62.4%). I present the proportions of women in each BMI category in Table 3.17.

Table 3.17 Urban Women's Body Mass Index

N=272	N	% (CI)
Underweight (BMI <18.5)	11	4.0 (2.3, 7.1)
Healthy range (BMI 18.5-24.9)	107	39.2 (33.7, 45.3)
Overweight (BMI 25-29.9)	83	30.5 (25.3, 36.2)
Obese (BMI ≥30)	71	26.1 (21.2, 31.6)

Note: Body Mass Index is calculated as kg/m^2.

3.1.2 Rural Survey Results (Descriptive Statistics)

In the following section I detail the results of the main household survey conducted in the low water season for the rural population. As the survey questions were the same for both the urban and rural populations, I offer less description of the data in this section when the data are similar to the urban population results.

3.1.2.1 Characteristics of the Rural Population

In Table 3.18 I list the number of households sampled from each of the 15 rural villages.

Table 3.18 Rural Household Distribution by Community in the Low Water Season

N= 327	N	%
Miraflores	54	16.5
Trinidadcito	52	15.9
Portachuelo Bajo	42	12.8
Galilea	42	12.8
Monte Sinahi	19	5.8
Anexo Remanso	19	5.8
Villa Cotoca	17	5.2
Canada	14	4.3
Anexo el Carmen	13	4.0
Candelaria	12	3.7
27 de Mayo	11	3.4
Santuario	11	3.4
Portachuelo Alto	10	3.1
Flor de Octubre	7	2.1
Lago el Carmen	4	1.2

3.1.2.2 Rural Household Demographics

The average household ranged in size from two to 14 members, with an average of 5.5 members (SD 2). Table 3.19 shows that the majority of respondent reported having a head male partner and a large majority of respondents had a child less than five years of age living in the home. Well over half of the rural respondents self-identified as Indigenous, with the largest group identifying as Ese Ejja, a historically nomadic group that is often stigmatized by other

groups in the region (as per a personal communication with T. Perez, 2012). Spanish was the primary language of communication for most of the respondents, however it was not uncommon for the Ese Ejja Indigenous respondents to primarily speak their native language as was true of some of the other Indigenous households.

Table 3.19 Rural Household Demographics

	N	%
Households with a head male (N=327)	313	95.7
Households with a child <60 months of age (N=327)	236	72.2
Indigenous (N=326)	183	56.1
Tacana	53	16.3
Ese Ejja	90	27.6
Cavineno	33	10.1
Other Indigenous*	7	2.1
Respondent's primary language of communication (head female) (N=326)		
Spanish	248	76.1
Tacana	4	1.2
Ese Ejja	51	15.6
Cavineno	22	6.7
Other Indigenous†	1	0.3

Note: Sample sizes differ due to missing data.
*Chacobo, Aymara, Quechua.
†Chacobo, Aymara, Quechua.

3.1.2.3 Rural Socio-Economic Characteristics

Literacy and Education

The majority of respondents could read and write (Table 3.20). However, there was a large variability in respondents' education levels. Over half of the respondents did not complete primary school, while less than 10% completed secondary school or less than 5% completed any higher education.

Employment and Income Characteristics

Almost half of respondents had worked for income in the month prior to the survey (Table 3.20). Of those that worked, the largest group worked in agriculture. Among the women who did not work, almost all were homemakers. Of the households that had a head male (N=249), the vast majority of the men had employment in the last month (95%). In the rural population, very few households did not participate in fishing activities (Table 3.20). A large number of households were involved in commercial fishing and the remainder fished for home consumption only. Over half of the households had additional sources of income, with the most common source being income assistance for families.

Table 3.20 Rural Respondent Literacy, Education, Employment and Income Characteristics

	N	%
Respondent can read (N=302*)	263	87.1
Respondent can write (N=303*)	261	86.1
Respondent's education level (N=320*)		
No formal education	23	7.2
Incomplete primary	143	44.7
Primary complete	49	15.3
Incomplete secondary	52	16.3
Secondary complete	30	9.4
Incomplete post-secondary	11	3.4
Post-secondary complete	12	3.8
Respondents employed in the last year(N=327)	160	48.9
Fishing	4	1.2
Agriculture	95	29.1
Professionals	32	9.8
Sales	9	2.8
Trades	8	2.4
Other	12	3.7
Households participating in fishing activities (N=327)	305	93.3
Commercial fishing	122	37.3
Fishing for home consumption only	183	56.0
Households with other sources of income (N=327)	192	58.7
Government child assistance	148	45.3
Other additional income*	44	13.5

Note: Sample sizes differ due to missing data.
*'Other additional' sources of income include remittance, rent, interest, inheritance, governmental support, scholarships, and bank loans.

Wealth

In the rural population, almost all of the respondents lived in a house and the vast majority of the respondents' households owned their home (Table 3.21). A small portion of respondents lived in a home that was owned by a family member not living within the household or in a home provided by the government. Most of the homes had walls made of adequate materials,

but few had adequate flooring or roofing. In terms of durable items owned, only radios were owned by more than half of the families, while the majority of durable items were owned by less than 10% of respondents' households (Table3.22).

Table 3.21 Rural Housing Characteristics

N=327	N	%
Type of housing		
House	323	98.8
Other	4	1.2
Housing ownership status		
Owned by household member	274	83.8
Assigned	17	5.2
Owned by relative	26	8.0
Rented	2	0.6
Anti-credit	1	0.3
Other	7	2.1
Wall materials*		
Adequate materials	260	79.5
Inadequate materials	67	20.5
Floor materials†		
Adequate materials	37	11.3
Inadequate materials	290	88.7
Roof materials**		
Adequate materials	93	28.4
Inadequate materials	234	71.6

*Adequate wall materials include brick, tabique, quinche and wood, while inadequate wall materials include adobe, chuchio, plastic tarps or other materials.

†Adequate floor materials include cement, brick, tile and wood, while inadequate materials include earth and burned flat floors.

** Adequate roof materials include corrugated zinc, corrugated cement, tile and a reinforced concrete slab, while inadequate materials included leaves and other materials.

Table 3.22 Rural Ownership of Household Items

N=326-327	N	%
Radio	177	54.1
Motorcycle	91	27.8
TV	87	26.6
Boat	39	11.9
Bicycle	31	9.5
Cellular phone	20	6.1
Sewing machine	17	5.2
Water pump	15	4.6
Internet	7	2.1
Computer	5	1.5
Car	5	1.5
Refrigerator	4	1.2
Freezer	3	0.9
Land line phone	1	0.3

Note: Sample sizes differ due to missing data.

3.1.2.4 Rural Drinking Water Supply, Hygiene and Sanitation

Few rural households accessed improved sources of water as I show in Table 3.23. Of those that were not accessing acceptable sources, most were using creek water, followed by uncovered earth wells and springs. The large majority of households reported the same water sources for cooking and hand washing as for drinking. Only one in five households reported properly treating their drinking water before use.

Over three-quarters of the rural homes had toilet facilities but almost all of them were unacceptable as seen in Table 3.24. A number of households shared a toilet facility with another household. For those households that did not have access to a toilet facility, most used the open field, while some used the river or waterway (Table 3.24).

Table 3.23 Household Water Supply (Rural)

	N	%
Improved source of water (N=324)	52	16.0
Plumbed source	6	1.9
Spout in the garden/patio	9	2.8
Covered ring well	1	0.3
Uncovered ring well	10	3.1
Covered earth well	6	1.9
Public spout	20	6.2
Purified water	0	0.0
Unimproved source of water (N=324)	272	84.0
Uncovered earth well	57	17.6
River	4	1.2
Spring	48	14.8
Lagoon	16	4.9
Creek	143	44.1
Water from cistern	0	0
Cement pool	0	0
Other	4	1.2
Same water source for cooking and drinking (N=325)	311	95.7
Same water source for hand washing and drinking (N=327)	309	94.5
Households reporting proper water treatment methods* (N=325)	65	20.0

Note: Sample sizes differ due to missing data.

*Proper water treatment methods include boiling, chlorinating, solar light purification and ceramic filtration.

Table 3.24 Rural Household Toilet Facilities

	N	%
Households with toilet facilities (N=326)	251	77.0
Households with acceptable toilet facilities (N=326)	5	1.5
Plumbed	5	1.5
Septic	0	0
Households with unacceptable toilet facilities (N=326)	245	75.2
Blind well	240	73.6
Other	5	1.5
Homes that share their toilet (N=294)	47	15.9
Alternative facilities for homes with no toilet (N=74)		
Open field	58	78.4
River or other water way	9	12.2
Other	7	9.5

3.1.2.5 Rural Household Food Security

Rural Household Food Insecurity Measures

The HFIAS results for the rural respondents ranged from zero to 20 on a scale of zero to 27. The median score was five (IQR 0-8) and the mean was 5.1 (SD 4.7). The rural HFIAS had a skewed distribution. The categorical results for HFIAS show that the majority of household had some level of food insecurity as can be seen in Table 3.25. Over half of the respondents reported experiencing the three domains of food insecurity: anxiety over food, decreased quality of food and decreased intake of food. The results of the HHS ranged from zero to three with a mean of 0.4 (SD 0.9) and a median of zero (IQR 0-0). According to the categorical HHS, most households had little to no hunger, a few had moderate hunger and none had severe hunger (Table 3.25).

The HDDS ranged from zero to 12 with a mean of 7.3 (SD 2.1) and a median of seven (IQR 6-9) on a scale of zero to 12. I report the number of households that reported consuming each of the HDDS food groups in Table 3.25. According to the Shapiro-Wilk's test, the HDDS distribution is not normally distributed ($p<0.01$). Most of the households (84%) reported the previous day was a "typical" eating day. Of those that did not have a normal day, 36% were having a celebration day, 26% reported they were not hungry, and 10% were sick.

Table 3.25 Rural Household Food Insecurity, Hunger and Dietary Diversity in the Low Water Season

	N	%
Household food insecurity as assessed by the Household Food Insecurity Access Scale(N=327)		
Food Secure	103	31.5
Mildly Food Insecure	35	10.7
Moderately food insecure	111	33.9
Severely food insecure	78	23.9
Households experiencing food insecurity by domain* (N=327)		
Households experiencing anxiety over food	205	62.7
Households with decreased quality of food	196	60.0
Households with decreased intake or physical consequence of food insecurity	170	52.0
Household hunger as assessed by the Household Hunger Scale (N=327)		
Little to no hunger	285	87.2
Moderate hunger	42	12.8
Severe hunger	0	0
Household consumption of food groups as assessed by the Household Dietary Diversity Score (N=325-327)		
Cereals	324	99.4
White tubers	218	66.9
Vegetables	84	25.7
Fruit	275	84.6
Meat or poultry	190	58.3
Fish	235	72.3
Eggs	102	31.2
Legumes or nuts	74	22.6
Dairy products	129	39.4
Fat/oil	301	92.3
Sugar/honey	290	89.0
Other foods	164	50.3
Household consumption of additional food categories of interest		
Vitamin A rich fruits or vegetables	84	25.8
Organ meats	38	11.7
Sugar rich beverage	131	40.2

Note: Sample sizes differ due to missing data. The Household Food Insecurity Access Scale was developed by Coates et al. (2007) (26). The Household Hunger Scale was developed by Ballard et al. (2011) (31). The Household Dietary Diversity Score was developed by Swindale and Bilinsky (2006) (32).

* Food security domains are derived from the Household Food Insecurity Access Scale (26).

Homestead Food Production and Food Assistance

The large majority of rural households produced crops for home consumption the year prior to the survey (Table 3.26). Among the most popular crops were carbohydrate rich crops including rice, corn, plantains and yucca, but legumes and vegetables were also grown by many households. Additionally, almost all of the household raised animals for home consumption and almost all of those households ate eggs from household raised chickens. A large majority of household also reported consuming wild meat they had hunted and wild foods collected by family members during the year prior to the survey. Importantly, more than half of the households received food assistance of some kind in the year prior to the survey. The most common form of food assistance was a school food program for children, followed by government social support, food provided by work and food bank rations (Table 3.26).

Table 3.26 Rural Household Food Production, Hunting and Gathering Practices and Food Assistance

	N	%
Households that produced crops in the prior year (N=327)	276	84.4
Type of crop produced (multiple responses possible)		
Rice	215	65.7
Yucca	189	57.8
Corn	207	63.3
Plantains	201	61.5
Beans	168	51.4
Vegetables	146	44.6
Households that raised animals in the prior year (N=327)	300	91.7
Type of animal bi-products produced (multiple responses possible)		
Egg	275	84.1
Milk	5	1.5
Other	19	5.8
Households that consumed wild meat hunted by a family member in the prior year (N=325)	271	83.4
Households that consumed wild foods collected by a family member in the prior year (N=325)	279	85.8
Households with food assistance in the prior year (N=327)	197	60.2
Source of food assistance (N=197*) (multiple responses possible)		
Work	16	8.1
Gov. social support	20	10.2
Food rations	5	2.5
Money to buy food	6	3.0
Food bank	14	7.1
School food program	88	44.7
Other	11	5.6

Note: Sample sizes differ due to missing data.

*37 observations were missing data specifying source of food assistance.

3.1.2.6 Rural Household Diet and Fish Consumption

Almost all of the respondents reported eating at least one source of carbohydrate, animal protein and fruit the day prior to the survey (Table 3.35). Few ate vegetables or vitamin A rich vegetables or fruit. Almost all of the households reported eating a source of added sugar.

Additionally, almost all respondents prepared either fish or meat the previous day for their household, with fish being the more popular option (Table 3.37). For households that did not eat fish the previous day (N=83), 50% reported they had eaten fish two days earlier and therefore did not have fish again, while 28% said they did not have access to fishing (for either political or seasonal reasons). Others said they had insufficient money to purchase fish (11%) or that they did not have time to go fishing that day (10%).

When asked about the usual source of fish consumed at home, most of the households usually consumed fish caught by a family member, while very few usually purchased fish (Table 3.27). Almost all of the respondents received fish fresh to their home rather than frozen or in another form. Half of household preserved fish at least sometimes and most often made ‘charque’ or smoked the fish. Very few households used some form of cold storage to preserve their fish.

Similar to the urban population, almost all of the rural respondents believe that fish is important for health, is a good source of energy, and is important for women’s health and for children’s growth and development. I present data on household fish consumption, procurement and preservation practices, and fish consumption related health beliefs in Table 3.27.

Table 3.27 Rural Household Fish Consumption, Procurement and Preservation Practices, and Health Beliefs

	N	%
Animal source protein consumed the previous day (N=327)		
No meat	18	5.5
Fish only	147	45.0
Meat only	74	22.6
Meat and fish	88	26.9
Usual source of fish for the family (N=323)		
Caught by a family member	253	78.3
Bought	15	4.6
Sometimes caught or bought	55	17.0
Fish preservation upon arrival to the home (N=327)		
Fresh	320	97.9
Partly frozen	7	2.1
Frozen	0	0
Other	0	0
Fish is preserved in the home (N=327)		
Yes	121	37.0
Sometimes	47	14.4
No	159	48.6
Method of home preservation of fish (N=156-157) (Multiple responses possible)		
Cold storage (ice or refrigerator)	47	30.1
“Charque” fried/dried	129	82.2
Smoked	61	38.9
Covered with a cloth	28	17.8
Other	10	6.4
Respondent believes fish consumption is important for health (N= 327)	318	97.2
Health category associated with fish consumption (N=316-318) (Multiple responses possible)		
Source of energy	293	92.1
Important for women’s health	276	86.8
Important for children’s growth and development	277	87.1
Other	49	15.5

Note: Sample sizes differ due to missing data.

3.1.2.7 Rural Children's Characteristics

A total of 236 rural households had a child <60 months of age. There were 25 children for which age was not reported in months, but was reported in years. For the rural households that had a child <60 months for which age was reported in months (N=211), the child's age ranged from zero to 58 months, with a median of 17 months (IQR 8-33) and a mean of 21 months (SD 16). There were a total of 33 children between zero and ≤six months, 101 between six and ≤24 months and 77 between 24 and <60 months of age.

Breastfeeding and Complementary Feeding (Children ≥ Six Months)

Almost all of the women with a child ≥six months of age (N=178) reported breastfeeding for the full first six months of the child's life (Table 3.28). The average age at which children ≥six months of age were started on complementary foods was seven months (SD 3) and ranged from one to 18 months of age. The age at termination of breastfeeding ranged from one to 36 months with an average of 14 months (SD 7). The majority of children were started on complementary foods at the appropriate age (between six and nine months), while almost one quarter were started on foods either too early or too late (Table 3.28). However, far more than half of the mothers reported giving some solid or semi-solid food to their child before the child was six months of age.

Table 3.28 Breastfeeding and Complementary Feeding Practices for Rural Children ≥Six Months

	N	%
Infant breast feeding practices before six months of age (N=154)		
Breastfed the whole six months	150	97.4
Not breastfed	4	2.6
Commencement of regular complementary feeding (N=153)*		
Early (<6 months)	20	13.1
Timely (6-8.9 months)	111	72.5
Late (≥9 months)	22	14.4
Children fed solid or semi-solid food before six months (N=153)	95	62.1

Note: Sample sizes differ due to missing data.

*Complementary feeding categories are defined by the WHO's *Indicators for Assessing Infant and Young Child Feeding Practices* (2010) (36).

Rural Children's Dietary Diversity (Children Six to <24 Months)

Rural respondents reported the IDDS for their children six to <24 months (N=91), which ranged from zero to seven on a scale of zero to seven for rural children. The mean score was 3.2 (SD 1.5) with a median of three (IQR 2-4). Table 3.29 shows that most of the children were breastfed and consumed water, while fewer had infant formula or cow's milk the previous day. A large majority of the children were given sweetened drinks such as pop, fruit juice or sugar water and over half were given tea or coffee the previous day. A large majority of children had a source of carbohydrate and animal source protein the previous day, with a high percentage consuming fish. Almost half of the children did not eat a vitamin A rich vegetable or fruit the previous day and almost half did not have any other fruit or vegetable the previous day. Additionally, one out of five children did not have fat or oil in their diet. Importantly, most of the children (83.5%) had a "typical" eating day. Among those that did not the most common reason was the child was not hungry, it was a day of celebration or the child was sick. Only one respondent reported that there was not enough food available.

Based on the WHO indicators (36), over half of children six to <24 months had inadequate dietary diversity and almost one-quarter were eating too few meals. Based on this information, it was found that well over half of children did not meet the minimum requirement for an acceptable diet (Table 3.30).

Table 3.29 Food Groups Consumed in the 24 Hours Previous to the Survey by Rural Children Six to <24 Months as Assessed by the Individual Dietary Diversity Score

N=91	N	%
Liquids consumed during the previous 24 hours		
Breast milk	76	83.5
Formula	19	20.9
Water	86	94.5
Sweetened water, fruit juice, soda-pop	65	71.4
Soup, broth	81	89.0
Cow's milk	10	11.0
Tea, coffee	50	54.9
IDDS groups consumed in the previous 24 hours		
Cereals, tubers or roots	79	86.8
Vitamin A rich fruits or vegetables	52	57.1
Other fruits or vegetables	50	54.9
Meat, poultry or fish	70	76.9
Eggs	14	15.4
Legumes or nuts	12	13.2
Dairy products (not including formula and breast milk)	20	22.0
Additional food categories of interest		
Fat/oil	75	82.4
Fish	58	63.7

Note: The Individual Dietary Diversity Score is presented by Swindale and Bilinsky (2006) (32) and the WHO (2010) (36).

Table 3.30 The Diet of Rural Children Six to <24 Months as Assessed by key WHO Indicators

	N	%
Children with a Minimum Dietary Diversity (N=91)		
Inadequate diversity (3 or fewer groups)	50	54.9
Adequate diversity (4 or more groups)	41	45.1
Children consuming the Minimum Meal Frequency for their age group (N=86)		
Too few meals	22	25.6
Appropriate number of meals	64	74.4
Children with a Minimally Acceptable Diet (frequency + diversity) (N=90)		
Unacceptable diet	59	65.6
Minimally acceptable or better diet	31	34.4

Note: Sample sizes differ due to missing data. WHO means World Health Organization. The Minimum Dietary Diversity, Minimum Meal Frequency and Minimally Acceptable Diet are defined by the WHO (2010) (36).

Diarrhea (Children <24 Months)

Respondents were asked if the youngest child <24 months of age (N=120) had diarrhea in the last two weeks and a total of 39.2% had. A large majority of the mothers whose child had diarrhea in the last two weeks sought help to treat the diarrhea (Table 3.31). Most of these mothers went to the hospital and some sought help from family, friends and neighbors. Very few went to traditional healers or midwives for care. Of the mothers who issued treatment to their child for diarrhea, almost all gave western pharmaceuticals. Some of these women gave oral rehydration solution and/or traditional medicines to their children.

When asked how many times they believe a sick child should be breastfed (N=320), 41.9% of respondents said more than usual, the correct answer, while 11.6% said the same amount and 46.6% said less than usual.

Table 3.31 Occurrence and Treatment of Diarrhea in Rural Children <24 Months in the Two Weeks Prior to the Survey

	N	%
Mother sought help to treat the diarrhea (N=40)	34	85.0
Source of help sought		
Hospital	17	42.5
Private clinic	1	2.5
Midwife	0	0
Traditional healer	2	5.0
Friends/neighbor/mother	8	20.0
Other	5	12.5
Caregivers who issued treatment for the diarrhea (N=47)	41	87.2
Type of treatment issued (multiple responses possible)		
Western medicine (pills, syrup, injection)	36	76.7
Traditional medicine	6	12.8
Oral rehydration solution	13	27.7
Other	7	14.9

Note: Sample sizes differ due to missing data.

Anthropometric Measures of Rural Children

In the rural population, the weight-for-age Z-score ranged from -6.0 to 4.6, with a mean of -0.6 (SD 1.5). Based on the WHO cut-offs, 12.6% (CI: 8.8% to 17.9%) of children were underweight (Table 3.32). The Z-scores for height-for-age ranged from -5.8 to 4.7 with a mean of -1.7 (N=196), well below the average for healthy children set at zero. A total of 42.4% (CI: 35.6% to 49.4%) of rural children were stunted (Table 3.32). The weight-for-height Z-scores ranged from -4.9 to 4.4, with a mean of 0.3 (SD 1.5). Children's MUAC's raged from 90 to 188 mm, with a mean of 154 mm (SD 21). According to the weight-for-height Z-scores, 7.0% (CI: 4.2% to 11.4%) of children were wasted, while according to the MUAC cut-offs, 5.0% (CI: 2.7% to 9.0%) were wasted (Table 3.32).

Table 3.32 Anthropometric Status as Assessed by the WHO Standards for Rural Children <60 Months

	N	%
Weight-for-age (N=206)		
Severely underweight (< -3 z)	8	3.9
Underweight (-3 to <-2z)	18	8.7
Healthy range (-2 to +2z)	169	82.0
Overweight (>+2 to+ 3z)	6	2.9
Obese (>+3 z)	5	2.4
Stunting as determined by height-for-age (N=196)		
Severely stunted (<-3 z)	40	20.4
Stunted (-3 to <-2z)	43	21.9
Not stunted (≥-2z)	113	57.7
Weight-for-height (N=201)		
Severely wasted (< -3z)	7	3.5
Wasted (-3 to <-2z)	7	3.5
Healthy range (-2 to +2z)	165	82.1
Overweight (>2 to 3z)	16	8.0
Obese (>3z)	6	3.0
Wasting as determined by MUAC (N=210)		
Not wasted (mm≥115)	200	95.2
Wasted (mm<115)	10	4.8

Note: Sample sizes differ due to missing data. WHO means World Health Organization.

3.1.2.8 Rural Women's Variables

The rural respondents' ages ranges from 14 to 49 with a median age of 30 years (IQR 24-37) and a mean of 31 years (SD 9). The IDDS for respondents (N=301) ranged from two to eight on a scale of zero to 12, with a mean of 4.8 (SD 1.3) and a median of five (IQR 4-6). I present the proportion of women who consumed each of the IDDS food groups in Table 3.33.

Table 3.33 Food Groups Consumed by Rural Women in the 24 Hours Prior to the Survey as Assessed by the Individual Dietary Diversity Score in the Low Water Season

N=325-327	N	%
Individual Dietary Diversity Score groups consumed in the 24 hour		
Cereals, tubers or roots	325	99.7
Vitamin A rich fruits or vegetables	241	74.2
Other fruits or vegetables	223	68.6
Meat, poultry or fish	301	92.3
Eggs	102	31.2
Legumes or nuts	74	22.6
Dairy products	129	39.4
Fat/oil	301	92.3

Note: Sample sizes differ due to missing data. The Individual Dietary Diversity Score is presented by Swindale and Bilinsky (2006) (32).

The rural women's BMI ranged from 16 to 45, with a mean of 25.2 (SD 4.2). Both the distribution of women's BMI and women's height were not normally distributed using the Shapiro-Wilk's test. The women's height (cm) and BMI were not significantly correlated (Spearmans -0.03; P=0.57) (N=313). Using the standard cut-offs for BMI categories (58), I found that very few women were underweight (1.3% CI: 0.5% to 3.2%), while just under half of the women were overweight or obese (46.0% CI: 40.6 to 51.6%) (Table 3.34).

Table 3.34 Rural Women's Body Mass Index

N=313	N	% (CI)
Underweight (BMI <18.5)	4	1.3 (0.5, 3.2)
Healthy range (BMI 18.5-24.9)	165	52.7 (47.2, 58.2)
Overweight (BMI 25-2.9.9)	101	32.3 (27.3, 37.6)
Obese (BMI >=30)	43	13.7 (10.3, 18.0)

Note: Body Mass Index is calculated as kg/m^2.

3.2 Associations between Household Food Security and Dietary Diversity (Low Water Season)

As a continuous variable, the HDDS was correlated with the continuous HFIAS for both urban (N=297) and the rural (N=324) populations. The correlations between HDDS and HFIAS were ρ =-0.27 (P< 0.01) and ρ =-0.13 (P=0.02), respectively. This indicates that as households become increasingly food insecure (larger HFIAS) they tend to also report lower dietary diversity (smaller HDDS). I found that the urban food secure group had a significantly higher mean HDDS compared to the food insecure group using a Student's T-test. This indicates that the urban food secure group on average consumed a more diverse diet than the food insecure group. For the rural group, the means were not significantly different from one another (Table 3.35).

Table 3.35 T-Test for HDDS and HFIAS (Urban and Rural)

		HDDS		
Urban	**N**	**Mean**	**SD**	**P-value**
HFIAS: Food Secure	133	9.6	1.7	**<0.01**
HFIAS: Food Insecure*	164	8.8	1.9	
Rural				
HFIAS: Food Secure	102	7.6	2.4	0.14
HFIAS: Food Insecure*	222	7.2	1.9	

Note: HDDS means Household Dietary Diversity Score. HFIAS means Household Food Insecurity Access Scale. SD is Standard Deviation. The HFIAS was developed by Coates et al. (2007) (26). The HDDS was developed by Swindale and Bilinsky (2006) (32).

* Household food insecurity is defined as households scoring as mildly, moderately or severely food insecure according to the HFIAS (26).

3.3 Correlates of HFIAS (Low Water Season)

3.3.1 Urban Correlates of HFIAS

I present the results of the logistic regression models for household food insecurity as measured by HFIAS in Table 3.36. In the full model, households that received some sort of food assistance in the previous year were more than two times more likely to be food insecure. This variable remained significant in the reduced model. Additionally, the reduced model identified households with a respondent who was employed as a professional or in sales to be about half as likely to be food insecure compared to households where the respondent was unemployed. Finally, the reduced model showed that households that consumed wild meat in the previous year were almost two times more likely to be food insecure compared to those that did not. Of note, households with inadequate flooring were found to have an increased chance of being food insecure, but this finding had only borderline significance. The reduced model accounted for 15% of the overall variability between food secure and food insecure households.

Table 3.36 Urban Logistic Regression Models Examining Associations between Household Food Insecurity and Variables in its Causal Pathway

Variables	Events (N)		Univariate Models		Multivariate Model Full (N=276)		Multivariate Model Reduced (N=276)	
	Food Insecure	Food Secure	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Number of household members	166	138	1.00 (1.01, 1.08)	<0.05	1.01 (0.87, 1.17)	0.94	n/a	
Age of respondent (years)	166	136	1.01 (0.99, 1.01)	0.10	1.02 (0.99. 1.06)	0.21	n/a	
Households with a head male								
No	32	23	1.0		1.0		n/a	
Yes	134	115	1.2 (0.9, 1.5)	0.23	0.7 (0.3, 1.4)	0.29		
Households with a child <60 months of age								
No	74	63	1.0		1.0		n/a	
Yes	92	75	1.2 (0.9, 1.7)	0.19	1.2 (0.6, 2.2)	0.59		
Respondent education level								
None or <primary	56	35	1.0		1.0		n/a	
Primary to <secondary	60	37	1.6 (1.1, 2.4)	0.02	1.2 (0.6, 2.3)	0.68		
Secondary to <post-secondary	48	63	0.8 (0.5, 1.1)	0.16	0.7 (0.4, 1.5)	0.42		
Housing floor materials†								
Adequate	42	59	1.0		1.0		1.0	
Inadequate	123	78	1.5 (1.2, 2.1)	<0.01	1.5 (0.8, 2.8)	0.23	1.7 (1.0, 3.0)	0.05
Cellular phone owned within the household								
No	37	13	1.0		n/a		n/a	
Yes	129	125	1.0 (0.8, 1.3)	0.80				
Refrigerator owned within the household								
No	99	61	1.0		1.0		n/a	
Yes	67	77	1.2 (1.1, 1.4)	0.02	0.5 (0.3, 1.0)	0.05		
Car owned within the household								
No	113	151	1.0		1.0		n/a	
Yes	25	15	1.1 (1.0, 1.3)	0.05	0.8 (0.3, 1.8)	0.54		
Drinking water accessed**								
Improved	102	99	1.0		1.0		n/a	
Unimproved	63	39	1.6 (1.1, 2.4)	0.02	1.3 (0.7, 2.3)	0.44		
Toilet facilities††								
Adequate	53	55	1.0		1.0		n/a	
Inadequate	105	78	1.4 (1.0, 1.8)	0.05	0.7 (0.3, 1.2)	0.20		
Respondent occupation								
None	64	43	1.0		1.0		1.0	
Professional or sales	50	68	0.7 (0.5, 1.1)	0.10	0.5 (0.3, 1.0)	0.05	0.5 (0.3, 0.9)	0.03
Trades, agriculture, fishing or other	51	27	1.9 (1.2, 3.0)	<0.01	0.8 (0.4, 1.7)	0.62	1.0 (0.5, 2.0)	0.96

Variables	Events (N)		Univariate Models		Multivariate Model Full (N=276)		Multivariate Model Reduced (N=276)	
	Food Insecure	Food Secure	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Household involvement with fishing activities								
None	70	74	1.0		1.0		n/a	
Commercial fishing	45	34	1.3 (0.8, 2.1)	0.22	1.5 (0.7, 3.0)	0.28		
Home consumption	51	30	1.7 (1.1, 2.7)	0.02	1.9 (0.9, 3.7)	0.07		
Additional household income sources								
None	53	68	1.0		1.0			
Gov. child support	77	39	2.0 (1.3, 2.9)	<0.01	1.4 (0.7, 2.9)	0.32	n/a	
Other sources***	35	31	1.1 (0.7. 1.8)	0.62	1.0 (0.5, 2.0)	0.93		
Household produced crops in the last year								
No	119	99	1.0		1.0		n/a	
Yes	46	39	1.2 (0.8, 1.8)	0.45	0.6 (0.3, 1.0)	0.07		
Household raised animals in the last year								
No	55	63	1.0		1.0		n/a	
Yes	111	75	1.5 (1.1, 2.0)	0.01	1.4 (0.8, 2.4)	0.31		
Households consumed wild foods collected by a family member in the last year								
No	59	82	1.0		n/a		n/a	
Yes	104	52	2.0 (1.4, 2.8)	<0.01				
Household consumed wild meat hunted by a family member in the last year								
No	61	75	1.0		1.0		1.0	
Yes	102	62	1.6 (1.2, 2.3)	<0.01	1.8 (1.0, 3.1)	0.05	1.9 (1.1, 3.1)	0.01
Household had food assistance of some kind in the last year†††								
No	81	92	1.0		1.0		1.0	
Yes	85	46	1.8 (1.3, 2.6)	<0.01	2.1 (1.2, 3.9)	0.02	2.1 (1.3, 3.6)	<0.01
Hosmer and Lemeshow Test (P-value)					0.79		0.92	
Nagelkerke R Squared					0.23		0.15	

Note: CI is Confidence Interval. OR is Odds Ratio. Household food insecurity is defined as households scoring as mildly, moderately or severely food insecure according to the Household Food Insecurity Access Scale. The Household Food Insecurity Access Scale was developed by Coates et al. (2007) (26).

† Adequate floor materials include cement, brick, tile and wood, while inadequate materials include earth and burned flat floors.

**Improved water sources include plumbed, garden spout, covered ring well, uncovered ring well, covered earth well, public spout and purified water, while unimproved sources include uncovered earth well, river, spring, lagoon, creek, truck cistern, cement pool and other sources.

††Adequate toilet facilities include plumbed and septic systems, while inadequate include blind wells, other systems and no toilet.

*** 'Other sources' of income include remittance, rent, interest, inheritance, governmental support, scholarships, and bank loans.

†††Sources of food assistance include work, government social support, food rations, money transfer to purchase food, food bank, school food program, or other sources.

3.3.2 Rural Correlates of HFIAS

I present the results of the logistic regression models for household food insecurity as measured by HFIAS for the rural population in Table 3.37. In the full model households with a respondent that self-identified as Indigenous were more than three times more likely to be food insecure compared to those with a non-Indigenous respondent. This remained significant in the reduced model. Similarly, households that consumed wild meat in the previous year were more than three times as likely to be food insecure compared to those that did not. This variable also remained significant in the reduced model. Additionally, in the reduced model for each additional household member there was a 19% chance increase in the household being food insecure. Finally, households where the respondent was employed in trades or similar occupations was less than half as likely to be food insecure compared to those with respondents who did not work. The reduced model accounted for 18% of the overall variability between food secure and insecure households.

Table 3.37 Rural Logistic Regression Models Examining Associations between Household Food Insecurity and Variables in its Causal Pathway

	Events (N)		Univariate Models		Multivariate Model Full (N=315)		Multivariate Model Reduced (N=315)	
Variables	Food Insecure	Food Secure	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Number of household members	224	103	1.16 (1.11, 1.21)	<0.01	1.13 (0.95, 1.34)	0.18	1.19 (1.04, 1.36)	0.01
Age of respondent (years)	224	103	1.03 (1.02, 1.03)	<0.01	1.03 (0.98, 1.07)	0.25	n/a	
Households with a head male								
No	7	7	1.0		1.0		n/a	
Yes	217	96	2.3 (1.8, 2.9)	<0.01	2.2 (0.6, 8.8)	0.25		
Households with a child <60 months of age								
No	56	35	1.0		1.0		n/a	
Yes	168	68	2.5 (1.9, 3.3)	<0.01	1.3 (0.6, 2.7)	0.49		
Respondent self-identified as Indigenous								
No	142	41	1.0		1.0		1.0	
Yes	81	62	3.5 (2.5, 4.9)	<0.01	3.2 (1.8, 5.7)	<0.01	3.1 (1.8, 5.3)	<0.01
Respondent education level								
None or <primary	117	49	1.0		1.0		n/a	
Primary to <secondary	76	25	3.0 (1.9, 4.8)	<0.01	1.6 (0.8, 3.1)	0.16		
Secondary to <post-secondary	28	25	1.1 (0.7, 1.9)	0.68	0.8 (0.4, 1.8)	0.67		
Housing floor materials†								
Adequate	22	15	1.0		1.0		n/a	
Inadequate	202	88	2.3 (1.8, 2.9)	<0.01	1.1 (0.5, 2.6)	0.82		
Cellular phone owned within the household								
No	214	93	1.0		1.0		n/a	
Yes	10	10	1.0 (0.4, 2.4)	1.00	0.6 (0.2, 1.8)	0.37		
Motorcycle owned within the household								
No	162	74	1.0		1.0		n/a	
Yes	62	29	1.5 (1.3, 1.7)	<0.01	1.1 (0.6, 2.1)	0.75		
Drinking water accessed**								
Improved	32	20	1.0		1.0		n/a	
Unimproved	191	81	2.4 (1.8, 3.1)	<0.01	1.0 (0.5, 2.1)	0.94		
Respondent occupation								
None or primary incomplete	118	49	1.0		1.0		1.0	
Fishing and agriculture	72	27	2.7 (1.7, 4.2)	<0.01	0.9 (0.4, 1.7)	0.66	0.8 (0.5, 1.5)	0.56
Professionals, sales, trades and other	34	27	1.3 (0.8, 2.1)	0.37	0.5 (0.2, 0.9)	0.04	0.4 (0.2, 0.8)	0.02

	Events (N)		Univariate Models		Multivariate Model Full (N=315)		Multivariate Model Reduced (N=315)	
Variables	Food Insecure	Food Secure	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Household involvement with fishing activities								
None	10	12	1.0		1.0		n/a	
Commercial fishing	90	32	2.8 (1.9, 4.2)	<0.01	1.5 (0.5, 4.7)	0.50		
Home consumption	124	59	2.1 (1.5, 2.9)	<0.01	1.4 (0.5, 4.1)	0.58		
Additional household income sources								
None	86	48	1.0		1.0		n/a	
Gov. child support	111	37	3.0 (2.1, 4.4)	<0.01	1.2 (0.6, 2.3)	0.67		
Other sources††	26	18	1.4 (0.8, 2.6)	0.23	0.5 (0.2, 1.3)	0.18		
Household produced crops in the last year								
No	30	21	1.0		1.0		n/a	
Yes	194	82	2.4 (1.8, 3.1)	<0.01	0.9 (0.4, 2.0)	0.81		
Household raised animals in the last year								
No	17	8	1.0		1.0		n/a	
Yes	207	93	2.2 (1.7, 2.8)	<0.01	0.4 (0.1, 1.4)	0.16		
Households consumed wild foods collected by a family member in the last year								
No	27	27	1.0		n/a		n/a	
Yes	197	74	2.7 (2.0, 3.5)	<0.01				
Household consumed wild meat hunted by a family member in the last year								
No	23	23	1.0		1.0		1.0	
Yes	201	78	2.6 (2.0, 3.3)	<0.01	3.6 (1.7, 7.6)	<0.01	3.2 (1.6, 6.4)	<0.01
Household had food assistance of some kind in the last year***								
No	80	47	1.0		1.0		n/a	
Yes	144	54	2.7 (2.0, 3.6)	<0.01	1.0 (0.5, 1.9)	0.95		
Hosmer and Lemeshow Test (P-value)					0.62		0.66	
Nagelkerke R Squared					0.23		0.18	

Note: CI is Confidence Interval. OR is Odds Ratio. Household food insecurity is defined as households scoring as mildly, moderately or severely food insecure according to the Household Food Insecurity Access Scale. The Household Food Insecurity Access Scale was developed by Coates et al. (2007) (26).

† Adequate floor materials include cement, brick, tile and wood, while inadequate materials include earth and burned flat floors.

**Improved water sources include plumbed, garden spout, covered ring well, uncovered ring well, covered earth well, public spout and purified water, while unimproved sources include uncovered earth well, river, spring, lagoon, creek, truck cistern, cement pool and other sources.

†† 'Other sources' of income include remittance, rent, interest, inheritance, governmental support, scholarships, and bank loans.

***Sources of food assistance include work, government social support, food rations, money transfer to purchase food, food bank, school food program, or other sources.

3.4 Correlates of Childhood Stunting (Low Water Season)

3.4.1 Associations between Household Food Insecurity and Childhood Stunting

In both urban and rural populations, there was a statistically significant association between childhood stunting and household food security status; however, the relationships are inverse to each other (Table 3.38). In the urban population, there were 2.4 greater odds that a stunted child would be in a food insecure home compared to a food secure home. In the rural population, there were 2.2 greater odds that a stunted child would be in a food secure home.

Table 3.38 Association between HFIAS and Stunting (Children zero to <60 months)

Urban	Food Insecure (N)	Food Secure* (N)	OR (CI)	P-value
Children with normal height†	47	47	2.4 (1.1-5.1)	**0.02**
Stunted children	31	13		
Rural				
Children with normal height†	93	23	0.5 (0.2-0.9)	**0.02**
Stunted children	52	28		

Note: CI is Confidence Interval. HFIAS means Household Food Insecurity Access Scale. OR is Odds Ratio. Household food insecurity is defined as households scoring as mildly, moderately or severely food insecure according to the HFIAS. The HFIAS was developed by Coates et al. (2007) (26).

*Food secure households are the reference group.

† Children with a normal height are the reference group.

The association between HDDS and childhood stunting was not statistically significant for either the urban or rural population (Table 3.39).

Table 3.39 Association between HDDS and Stunting (Children zero to <60 months)

		HDDS		
Urban	**N**	**Mean**	**SD**	**P-value**
Children with normal height*	91	9.0	1.9	0.59
Stunted children	44	8.8	1.9	
Rural				
Children with normal height*	113	7.0	1.8	0.43
Stunted children	80	7.3	2.2	

Note: HDDS means Household Dietary Diversity Score. SD is Standard Deviation. The HDDS was developed by Swindale and Bilinsky (2006) (32). Stunting is defined as having a height less than 2 SD below the mean height-for-age (11).

* Children with a normal height are the reference group.

3.4.2 Urban Correlates of Childhood Stunting

I present the univariate and multivariate logistic regressions results for associations with childhood stunting for children <60 months of age in the urban population in Table 3.40. Both univariate and multivariate logistic regression showed that household food insecurity was not associated with childhood stunting, when other factors were controlled for. The full regression model showed that respondents who believed a sick child should be breast fed the same amount were more than four times likely to have a stunted child compared to respondents who thought a sick child should be breastfed more. This variable remained significant in the reduced model. The reduced model accounted for 22% of the observed variability. The reduced model also found that for each one centimeter increase in a respondent's height, there was about 1% less chance the respondent's child would be stunted. Of note, in the reduced model a borderline significance was found for households with inadequate toilet facilities having 2.4 increased chances of having a stunted child.

Table 3.40 Urban Logistic Regression Models Examining Associations between Childhood Stunting (Children <60 Months) and Variables in its Causal Pathway

Variables	Events		Univariate Models		Multivariate Model Full (N=119)		Multivariate Model Reduced (N=119)	
	Stunted	Not Stunted	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Number of household members	48	90	0.911 (0.862, 0.963)	<0.01	0.979 (0.733, 1.307)	0.88	n/a	
Child's age (months)	48	90	0.984 (0.971, 1.000)	0.12	0.998 (0.966, 1.032)	0.92	n/a	
Mean age of respondent (years)	48	90	0.980 (0.970, 0.991)	<0.01	0.974 (0.908, 1.045)	0.46	n/a	
Respondent's height (cm)	48	85	0.996 (0.994, 0.999)	<0.01	0.995 (0.977, 1.014)	0.63	0.992 (0.986, 0.998)	<0.01
Household food insecurity as measured by HFIAS†								
Food Secure	15	45	1.0		1.0		n/a	
Food Insecure	33	45	0.7 (0.5, 1.1)	0.18	2.6 (0.9, 7.3)	0.07		
Households with a head male								
No	8	8	1.0		n/a		n/a	
Yes	40	82	0.5 (0.3, 0.7)	<0.01				
Respondent education level								
None or <primary	21	27	1.0		1.0		n/a	
Primary to <secondary	15	30	0.5 (0.3, 0.9)	0.03	0.7 (0.2, 2.2)	0.53		
Secondary to <post-secondary	11	32	0.3 (0.2, 0.7)	<0.01	0.8 (0.3, 3.1)	0.80		
Housing floor materials**								
Adequate	11	31	1.0		1.0		n/a	
Inadequate	37	58	0.6 (0.4, 0.96)	0.03	0.9 (0.3, 2.8)	0.81		
Drinking water accessed††								
Improved	32	54	1.0		1.0		1.0	
Unimproved	16	36	0.4 (0.2, 0.8)	<0.01	0.4 (0.1, 1.0)	0.05	0.5 (0.2, 1.1)	0.08
Drinking water treatment methods***								
Proper	29	37	1.0		n/a		n/a	
Improper	19	53	0.8 (0.5, 1.3)	0.35				
Toilet facilities†††								
Adequate	11	31	1.0		1.0		1.0	
Inadequate	36	55	0.7 (0.4, 0.99)	0.05	2.9 (0.9, 8.9)	0.07	2.4 (1.0, 5.9)	0.05
Respondent occupation								
None	20	36	1.0		1.0		n/a	
Professional or sales	16	35	0.5 (0.3, 0.8)	0.01	1.4 (0.4, 4.8)	0.58		
Trades, agri., fishing or other	12	19	0.6 (0.3, 1.3)	0.21	2.9 (0.7, 12.0)	0.14		
Household involvement with fishing activities								
None	22	42	1.0		1.0		n/a	
Commercial fishing	14	25	0.6 (0.3, 1.1)	0.08	1.4 (0.4, 4.5)	0.59		
Home consumption	12	23	0.5 (0.3, 1.0)	0.07	1.0 (0.3, 3.2)	0.96		

Variables	Events		Univariate Models		Multivariate Model Full (N=119)		Multivariate Model Reduced (N=119)	
	Stunted	Not Stunted	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Additional household income sources								
None	16	37	1.0		1.0		n/a	
Gov. child support	19	29	0.7 (0.4, 1.2)	0.15	2.2 (0.6, 7.9)	0.21		
Other sources****	12	24	0.5 (0.3, 1.0)	0.05	0.8 (0.2, 3.0)	0.78		
Household produced crops in the last year								
No	36	62	1.0		1.0		n/a	
Yes	12	27	0.4 (0.2, 0.9)	0.02	0.6 (0.2, 2.0)	0.42		
Household raised animals in the last year								
No	17	34	1.0		1.0		n/a	
Yes	31	56	0.6 (0.4, 0.9)	0.01	1.8 (0.6, 5.2)	0.25		
Households consumed wild foods collected by a family member in the last year								
No	20	36	1.0		n/a		n/a	
Yes	28	49	0.6 (0.4, 0.9)	0.02				
Household consumed wild meat hunted by a family member in the last year								
No	23	39	1.0		1.0		n/a	
Yes	25	49	0.5 (0.3, 0.8)	0.01	0.4 (0.1, 1.1)	0.08		
Household had food assistance of some kind in the last year††††								
No	29	49	1.0		1.0		n/a	
Yes	19	41	0.5 (0.3, 0.8)	0.01	0.4 (0.1, 1.2)	0.11		
Amount mothers believe a sick child should be breastfed								
More than usual	18	43	1.0		1.0		1.0	
The same amount	21	22	1.0 (0.5, 1.7)	0.88	4.1 (1.4, 11.9)	0.01	3.2 (1.3, 8.0)	0.01
Less than usual	9	24	0.4 (0.2, 0.8)	0.01	0.8 (0.2, 2.8)	0.71	0.9 (0.3, 2.7)	0.91
Child's sex								
Female	22	47	1.0		1.0		n/a	
Male	26	43	0.6 (0.4, 0.98)	0.04	1.6 (0.6, 4.1)	0.37		
Respondent's BMI*****								
BMI < 25	23	38	1.0		1.0		n/a	
BMI ≥25	24	46	0.6 (0.4, 1.0)	0.06	0.7 (0.2, 2.0)	0.50		
Hosmer and Lemeshow Test (P-value)					0.73		0.59	
Nagelkerke R Squared					0.35		0.22	

Note: CI is Confidence Interval. OR is Odds Ratio. Stunting is defined as having a height less than two standard deviations below the mean height-for-age (11). Household food insecurity is defined as households scoring as mildly, moderately or severely food insecure according to the HFIAS (26). The Household Food Insecurity Access Scale was developed by Coates et al. (2007) (26).

† HFIAS is the Household Food Insecurity Access Scale.

**Adequate floor materials include cement, brick, tile and wood, while inadequate materials include earth and burned flat floors.

††Improved water sources include plumbed, garden spout, covered ring well, uncovered ring well, covered earth well, public spout and purified water, while unimproved sources include uncovered earth well, river, spring, lagoon, creek, truck cistern, cement pool and other sources.

***Proper water treatment methods include boiling, chlorinating, solar light purification and ceramic filtration.

†††Adequate toilet facilities include plumbed and septic systems, while inadequate include blind wells, other systems and no toilet.

**** 'Other sources' of income include remittance, rent, interest, inheritance, governmental support, scholarships, and bank loans.

†††† Sources of food assistance include work, government social support, food rations, money transfer to purchase food, food bank, school food program, or other sources.

*****Body Mass Index (BMI) is calculated as kg/m^2.

3.4.3 Rural Correlates of Childhood Stunting

I present the univariate and multivariate logistic regressions results for associations with childhood stunting for children <60 months of age in the rural population in Table 3.41. Both univariate and multivariate logistic regression showed that food secure households were less than half as likely to have a stunted child compared to food secure households. This relationship remained significant in the reduced model. Similarly, for each additional month of age of a child there was a 2% increased likelihood the child would be stunted. This was found to be significant in both the full and reduced models. Finally, both the full and reduced models found respondents who were employed as professionals or in sales were half as likely to have a stunted child as those who were unemployed. The reduced model only accounted for 12% of the observed variability.

Table 3.41 Rural Logistic Regression Models Examining Associations between Childhood Stunting (Children <60 Months) and Variables in its Causal Pathway

Variables	Events		Univariate Models		Multivariate Model Full (N=185)		Multivariate Model Reduced (N=185)	
	Stunted	Not Stunted	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Number of household members	83	113	0.955 (0.912, 0.999)	0.05	1.090 (0.907, 1.309)	0.36	n/a	
Child's age (months)	83	113	0.988 (0.979, 0.998)	0.02	1.021 (1.000, 1.043)	0.05	1.020 (1.003, 1.037)	0.02
Mean age of respondent (years)	83	113	0.997 (0.987, 1.000)	0.56	n/a		n/a	
Respondent's height (cm)	82	111	0.998 (0.996, 1.000)	0.03	0.994 (0.979, 1.008)	0.39	n/a	
Household food insecurity as measured by HFIAS†								
Food Secure	27	24	1.0		1.0		1.0	
Food Insecure	56	89	0.6 (0.5, 0.9)	0.01	0.4 (0.2, 0.9)	0.03	0.4 (0.3, 0.8)	<0.01
Respondent self-identified as Indigenous								
No	36	46	1.0		1.0		n/a	
Yes	46	67	0.7 (0.5, 1.0)	0.05	1.2 (0.6, 2.4)	0.66		
Respondent education level								
None or <primary	45	55	1.0		1.0		n/a	
Primary to <secondary	25	41	0.6(0.4, 1.0)	0.05	0.8 (0.4, 1.8)	0.62		
Secondary to <post-secondary	12	14	0.9 (0.4, 1.9)	0.86	1.2 (0.4, 3.3)	0.76		
Housing floor materials**								
Adequate	11	10	1.0		1.0		n/a	
Inadequate	72	103	0.7 (0.5, 0.9)	0.02	0.7 (0.2, 2.0)	0.49		
Drinking water accessed††								
Improved	13	18	1.0		1.0		n/a	
Unimproved	69	94	0.7 (0.5, 1.0)	0.05	1.3 (0.5, 3.3)	0.53		
Drinking water treatment methods***								
Proper	20	25	1.0		1.0		n/a	
Improper	63	87	0.7 (0.5, 1.0)	0.05	1.3 (0.6, 2.7)	0.54		
Respondent occupation								
None	55	62	1.0		1.0		1.0	
Professional or sales	16	34	0.5 (0.3, 0.9)	0.01	0.4 (0.2, 0.9)	0.03	0.5 (0.2, 0.9)	0.04
Trades, agri., fishing or other	12	17	0.7 (0.3, 1.5)	0.36	0.6 (0.2, 1.6)	0.28	0.7 (0.3, 1.7)	0.45
Additional household income sources								
None	38	46	1.0		1.0		n/a	
Gov. child support	39	52	0.8 (0.5, 1.1)	0.17	1.1 (0.5, 2.5)	0.83		
Other sources†††	6	15	0.4 (0.2, 1.0)	0.06	0.5 (0.1, 1.9)	0.31		
Household produced crops in the last year								
No	13	13	1.0		1.0		n/a	
Yes	70	100	0.7 (0.4, 1.1)	0.02	0.8 (0.3, 2.1)	0.60		

Variables	Events		Univariate Models		Multivariate Model Full (N=185)		Multivariate Model Reduced (N=185)	
	Stunted	Not Stunted	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Household raised animals in the last year								
No	6	9	1.0		1.0		n/a	
Yes	77	103	0.7 (0.6, 1.0)	0.05	1.1 (0.3, 3.7)	0.84		
Households consumed wild foods collected by a family member in the last year								
No	15	12	1.0		n/a		n/a	
Yes	68	100	0.7 (0.5, 0.9)	0.01				
Household consumed wild meat hunted by a family member in the last year								
No	8	12	1.0		1.0		n/a	
Yes	75	100	0.8 (0.6, 1.0)	0.06	2.1 (0.6, 6.7)	0.22		
Household had food assistance of some kind in the last year****								
No	30	41	1.0		1.0		n/a	
Yes	53	71	0.7 (0.5, 1.1)	0.11	1.0 (0.5, 2.1)	0.99		
Amount mothers believe a sick child should be breastfed								
More than usual	23	53	1.0		n/a		n/a	
The same amount	46	47	1.0 (0.7, 1.5)	0.98				
Less than usual	12	13	0.9 (0.4, 2.0)	0.84				
Child's sex								
Female	38	52	1.0		1.0		n/a	
Male	45	61	0.7 (0.5, 1.1)	0.12	1.0 (0.5, 1.9)	0.93		
Respondent's BMI††††								
BMI < 25	47	66	1.0		1.0		n/a	
BMI ≥25	34	45	0.8 (0.5, 1.2)	0.22	1.0 (0.5, 1.9)	0.97		
Hosmer and Lemeshow Test (P-value)					0.32		0.90	
Nagelkerke R Squared					0.17		0.12	

Note: CI is Confidence Interval. OR is Odds Ratio. Stunting is defined as having a height less than two standard deviations below the mean height-for-age (11). Household food insecurity is defined as households scoring as mildly, moderately or severely food insecure according to the HFIAS (26). The Household Food Insecurity Access Scale was developed by Coates et al. (2007) (26).

† HFIAS is the Household Food Insecurity Access Scale.

**Adequate floor materials include cement, brick, tile and wood, while inadequate materials include earth and burned flat floors.

††Improved water sources include plumbed, garden spout, covered ring well, uncovered ring well, covered earth well, public spout and purified water, while unimproved sources include uncovered earth well, river, spring, lagoon, creek, truck cistern, cement pool and other sources.

***Proper water treatment methods include boiling, chlorinating, solar light purification and ceramic filtration.

††† 'Other sources' of income include remittance, rent, interest, inheritance, governmental support, scholarships, and bank loans.

**** Sources of food assistance include work, government social support, food rations, money transfer to purchase food, food bank, school food program, or other sources.

†††† Body Mass Index (BMI) is calculated as kg/m^2.

3.5 Correlates of Maternal BMI (Low Water Season)

3.5.1 Associations between HFIAS and Maternal BMI

The results of the Chi-Squared test indicated that maternal BMI categories (BMI <25 and BMI ≥25) and household food security categories in both urban and rural populations were not statistically significant (Table 3.42).

Table 3.42 Association between HFIAS and Maternal Overweight/Obesity

Urban	Food Insecure (N)	Food Secure* (N)	OR (CI)	P-value
BMI<25†	70	48	0.8 (0.5-1.2)	0.25
BMI≥25	81	74		
Rural				
BMI<25†	116	53	1.1 (0.7-1.8)	0.67
BMI≥25	102	42		

Note: BMI is Body Mass Index. CI is Confidence Interval. HFIAS is the Household Food Insecurity Access Scale. OR is Odds Ratio. Household food insecurity is defined as households scoring as mildly, moderately or severely food insecure according to the HFIAS (26). BMI is calculated as kg/m2

*Food secure households are the reference group.

† BMI<25 is the reference group.

The results of the Student's T-test indicate that there was no statistically significant association between HDDS and maternal BMI for either the urban and rural populations (Table 3.43).

Table 3.43 Association between HDDS and Maternal Overweight/Obesity

		HDDS		
Urban	**N**	**Mean**	**SD**	**P-value**
BMI <25*	117	9.1	1.98	0.87
BMI ≥25	151	9.2	1.75	
Rural				
BMI <25*	167	7.2	2.02	0.20
BMI ≥25	143	7.5	2.09	

Note: BMI is Body Mass Index. HFIAS is the Household Food Insecurity Access Scale. SD is Standard Deviation. Household food insecurity is defined as households scoring as mildly, moderately or severely food insecure according to the HFIAS (26). BMI is calculated as kg/m2
* BMI<25 is the reference group.

3.5.2 Urban Correlates of Women's BMI

I present the results of the univariate and multivariate logistic regressions modes for maternal overweight/obesity in the urban population in Table 3.44. The reduced model accounted for only 8% of the variability between overweight/obese women and the healthy/underweight women. Household food insecurity was not associated with maternal overweight/obesity when other factors were controlled for. The model found that for each additional year of age the respondent had a 4% increased risk of being overweight/obese. Similarly, women who lived in a household that had produced crops in the last year were 2.7 times more likely to be overweight/obese compared to those in households that did not.

Table 3.44 Urban Logistic Regression Models Examining Associations between Maternal Overweight/Obesity and Variables in its Causal Pathway

Variables	Events		Univariate Models		Multivariate Model Full (N=257)		Multivariate Model Reduced (N=257)	
	BMI ≥25	BMI <25	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Number of children <60 months of age	155	118	1.02 (0.91, 1.21)	0.78	n/a		n/a	
Mean age of respondent (years)	155	118	1.01 (1.002, 1.02)	0.01	1.05 (1.01, 1.08)	<0.01	1.04 (1.01, 1.07)	0.02
Respondent's height (cm)	154	118	1.02 (1.01, 1.03)	0.03	0.99 (0.95, 1.04)	0.80	n/a	
Individual Dietary Diversity Score	153	116	1.05 (1.01, 1.10)	0.03	0.98 (0.78, 1.22)	0.83	n/a	
Household food insecurity as measured by HFIAS†								
Food Secure	74	48	1.0		1.0		n/a	
Food Insecure	81	70	1.2 (0.8, 1.6)	0.37	0.6 (0.3, 1.1)	0.09		
Households with a child <60 months of age								
No	73	46	1.0		n/a		n/a	
Yes	82	72	1.1 (0.8, 1.6)	0.42				
Households with a head male								
No	26	22	1.0		1.0		n/a	
Yes	129	96	1.3 (1.03, 1.8)	0.03	1.2 (0.6, 2.6)	0.56		
Respondent education level								
None or <primary	52	32	1.0		1.0		n/a	
Primary to <secondary	45	42	1.1 (0.7, 1.6)	0.75	0.8 (0.4, 1.6)	0.60		
Secondary to <post-secondary	57	42	1.4 (0.9, 1.0)	0.13	1.1 (0.5, 2.3)	0.78		
Housing floor materials**								
Adequate	46	41	1.0		1.0		n/a	
Inadequate	109	75	1.5 (1.1, 2.0)	0.01	1.7 (0.9, 3.2)	0.10		
Bicycle owned within the household								
No	100	74	1.0		n/a		n/a	
Yes	55	44	1.3 (0.8, 1.9)	0.27				
Motorcycle owned within the household								
No	66	45	1.0		n/a		n/a	
Yes	89	73	1.2 (0.9, 1.7)	0.21				
Drinking water accessed††								
Improved	109	71	1.0		n/a		n/a	
Unimproved	46	46	1.0 (0.7, 1.5)	1.00				
Drinking water treatment methods***								
Proper	85	66	1.0		1.0		n/a	
Improper	70	52	1.3 (0.9, 1.9)	0.10	1.2 (0.7, 2.1)	0.48		
Respondent occupation								
None	52	42	1.0		1.0		n/a	
Professional or sales	62	45	1.4 (0.9, 2.0)	0.10	1.0 (0.5, 2.0)	0.91		
Trades, agriculture, fishing or other	41	30	1.4 (0.9, 2.2)	0.19	1.0 (0.5, 2.0)	0.93		

Variables	Events		Univariate Models		Multivariate Model Full (N=257)		Multivariate Model Reduced (N=257)	
	BMI ≥25	BMI <25	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Household involvement with fishing activities								
None	68	62	1.0		1.0		n/a	
Commercial fishing	43	28	1.5 (1.0, 2.5)	0.08	1.3 (0.6, 2.7)	0.49		
Home consumption only	44	28	1.6 (1.0, 2.5)	0.06	1.6 (0.8, 3.1)	0.19		
Additional household income sources								
None	64	46	1.0		1.0		n/a	
Gov. child support	44	58	1.3 (0.9, 2.0)	0.17	0.7 (0.3, 1.3)	0.25		
Other sources†††	28	32	1.1 (0.7, 1.9)	0.61	0.7 (0.3, 1.5)	0.40		
Household produced crops in the last year								
No	99	94	1.0		1.0		1.0	
Yes	55	24	2.3 (1.4, 3.7)	<0.01	2.6 (1.4, 5.1)	<0.01	2.7 (1.5, 4.9)	<0.01
Household raised animals in the last year								
No	53	51	1.0		1.0		n/a	
Yes	102	67	1.5 (1.1, 2.1)	0.01	1.4 (0.8, 2.5)	0.24		
Household consumed wild meat hunted by a family member in the last year								
No	67	53	1.0		1.0		n/a	
Yes	87	63	1.4 (1.0, 1.9)	0.05	0.8 (0.5, 1.5)	0.55		
Household had food assistance of some kind in the last year****								
No	87	72	1.0		1.0		n/a	
Yes	68	46	1.5 (1.02, 2.1)	0.04	1.5 (0.8, 2.7)	0.21		
Consumed vegetables in the 24 hours previous to the survey								
No	46	35	1.0		n/a		n/a	
Yes	109	83	1.3 (1.0, 1.7)	0.06				
Consumed soda-pop in the 24 hours previous to the survey								
No	48	32	1.0		n/a		n/a	
Yes	105	86	1.2 (0.9, 1.6)	0.17				
Hosmer and Lemeshow Test (P-value)					0.52		0.19	
Nagelkerke R Squared					0.14		0.08	

Note: BMI is Body Mass Index. CI is Confidence Interval. OR is Odds Ratio. BMI is calculated as kg/m2. Household food insecurity is defined as households scoring as mildly, moderately or severely food insecure according to the Household Food Insecurity Access Scale. The Household Food Insecurity Access Scale was developed by Coates et al. (2007) (26).

†HFIAS is the Household Food Insecurity Access Scale.

** Adequate floor materials include cement, brick, tile and wood, while inadequate materials include earth and burned flat floors.

††Improved water sources include plumbed, garden spout, covered ring well, uncovered ring well, covered earth well, public spout and purified water, while unimproved sources include uncovered earth well, river, spring, lagoon, creek, truck cistern, cement pool and other sources.

*** Proper water treatment methods include boiling, chlorinating, solar light purification and ceramic filtration.

††† 'Other sources' of income include remittance, rent, interest, inheritance, governmental support, scholarships, and bank loans.

**** Sources of food assistance include work, government social support, food rations, money transfer to purchase food, food bank, school food program, or other sources.

3.5.3 Rural Correlates of Maternal BMI

I present the results of the univariate and multivariate logistic regressions results for associations with maternal overweight/obesity in the rural population in Table 3.45. The reduced model accounted for only 24% of the observed variability. Household food insecurity was not associated with maternal overweight/obesity when other factors were controlled for. The model suggests that for each additional year of age the respondent had a 9% increased risk of being overweight or obese. It was also found that women with complete secondary school or any post-secondary education were 3.8 times more likely to be overweight or obese compared to those with less than primary education.

Table 3.45 Rural Logistic Regression Models Examining Associations between Maternal Overweight/Obesity and Variables in its Causal Pathway

Variables	Events		Univariate Models		Multivariate Model Full (N=300)		Multivariate Model Reduced (N=300)	
	BMI ≥25	BMI <25	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Number of children <60 months of age	144	169	0.82 (0.73, 0.92)	<0.01	0.80 (0.60, 1.08)	0.15	n/a	
Mean age of respondent (years)	144	169	1.00 (0.99, 1.01)	0.73	1.07 (1.03, 1.11)	<0.01	1.09 (1.06, 1.12)	<0.01
Respondent's height (cm)	144	169	1.00 (0.98, 1.01)	0.16	0.98 (0.94, 1.02)	0.30	n/a	
Individual Dietary Diversity Score	134	155	1.0 (0.9, 1.0)	0.22	n/a		n/a	
Household food insecurity as measured by HFIAS†								
Food Secure	42	53	1		1		n/a	
Food Insecure	102	116	0.9 (0.7, 1.1)	0.34	1.2 (0.7, 2.3)	0.51		
Respondent self-identified as Indigenous								
No	64	72	1.0		1		n/a	
Yes	79	97	0.8 (0.6, 1.1)	0.18	0.8 (0.5, 1.5)	0.52		
Households with a child <60 months of age								
No	54	32	1		n/a		n/a	
Yes	90	137	0.7 (0.5, 0.9)	<0.01				
Respondent education level								
None or <primary	68	92	1		1		1	
Primary to <secondary	42	55	0.8 (0.5, 1.1)	0.19	1.5 (0.8, 2.8)	0.20	1.4 (0.8, 2.4)	0.28
Secondary to <post-secondary	34	16	2.1 (1.2, 3.9)	0.01	3.5 (1.5, 7.9)	<0.01	3.8 (1.8, 8.1)	<0.01
Housing floor materials**								
Adequate	22	13	1		1		1	
Inadequate	122	156	0.8 (0.6, 0.9)	0.04	0.5 (0.2, 1.3)	0.16	0.5 (0.2, 1.1)	0.10
Bicycle owned within the household								
No	127	156	1		n/a		n/a	
Yes	17	13	1.3 (0.6, 2.7)	0.47				
Motorcycle owned within the household								
No	101	125	1		n/a		n/a	
Yes	43	44	1.0 (0.6, 1.5)	0.92				
Drinking water accessed††								
Improved	25	27	1		1		n/a	
Unimproved	118	140	0.8 (0.7, 1.1)	0.17	1.1 (0.5, 2.1)	0.96		
Drinking water treatment methods***								
Proper	35	28	1		1		n/a	
Improper	107	141	0.8 (0.6, 0.9)	0.03	0.7 (0.4, 1.4)	0.33		
Respondent occupation								
None	66	95	1		n/a		n/a	
Professional or sales	46	48	1.0 (0.6, 1.4)	0.84				
Trades, agriculture, fishing or other	32	26	1.2 (0.7, 2.1)	0.43				

Variables	Events		Univariate Models		Multivariate Model Full (N=300)		Multivariate Model Reduced (N=300)	
	BMI ≥25	BMI <25	OR (95% CI)	P-value	OR (95% CI)	P-value	OR (95% CI)	P-value
Household involvement with fishing activities								
None	9	10	1		1		n/a	
Commercial fishing	49	70	0.7 (0.5, 1.0)	0.06	0.5 (0.2, 1.8)	0.30		
Home consumption only	86	89	1.0 (0.7, 1.3)	0.82	0.8 (0.3, 2.6)	0.71		
Additional household income sources								
None	44	82	1		1		n/a	
Gov. child support	73	71	1.0 (0.7, 1.4)	0.87	1.3 (0.7, 2.4)	0.45		
Other sources†††	26	16	1.6 (0.9, 3.0)	0.13	2.3 (0.9, 5.6)	0.07		
Animal source protein eaten in household the previous day								
None	9	9	1		1		1	
Fish	63	75	0.8 (0.6, 1.2)	0.31	0.7 (0.2, 2.0)	0.50	0.7 (0.3, 2.0)	0.52
Meat	26	45	0.6 (0.4, 0.9)	0.03	0.3 (0.1, 1.0)	0.06	0.4 (0.1, 1.1)	0.08
Fish and meat	46	40	1.2 (0.8, 1.8)	0.52	0.9 (0.3, 2.7)	0.87	0.9 (0.3, 2.6)	0.84
Household produced crops in the last year								
No	22	26	1		1		n/a	
Yes	122	143	0.9 (0.7, 1.1)	0.20	1.0 (0.5, 2.3)	0.91		
Households consumed wild foods collected by a family member in the last year								
No	28	23	1		1		n/a	
Yes	116	144	0.8 (0.6, 1.0)	0.08	0.6 (0.3, 1.2)	0.13		
Household had food assistance of some kind in the last year****								
No	50	70	1		n/a		n/a	
Yes	94	97	1.0 (0.7, 1.3)	0.83				
Consumed vegetables in the 24 hours previous to the survey								
No	106	128	1		n/a		n/a	
Yes	38	41	0.9 (0.6, 1.4)	0.74				
Consumed soda-pop in the 24 hours previous to the survey								
No	84	105	1		n/a		n/a	
Yes	60	63	1.0 (0.7, 1.3)	0.79				
Hosmer and Lemeshow Test (P-value)					0.92		0.77	
Nagelkerke R Squared					0.27		0.24	

Note: BMI is Body Mass Index. CI is Confidence Interval. OR is Odds Ratio. BMI is calculated as kg/m2. Household food insecurity is defined as households scoring as mildly, moderately or severely food insecure according to the Household Food Insecurity Access Scale. The Household Food Insecurity Access Scale was developed by Coates et al. (2007) (26).

† HFIAS is the Household Food Insecurity Access Scale.

** Adequate floor materials include cement, brick, tile and wood, while inadequate materials include earth and burned flat floors.

††Improved water sources include plumbed, garden spout, covered ring well, uncovered ring well, covered earth well, public spout and purified water, while unimproved sources include uncovered earth well, river, spring, lagoon, creek, truck cistern, cement pool and other sources.

*** Proper water treatment methods include boiling, chlorinating, solar light purification and ceramic filtration.

††† 'Other sources' of income include remittance, rent, interest, inheritance, governmental support, scholarships, and bank loans.

**** Sources of food assistance include work, government social support, food rations, money transfer to purchase food, food bank, school food program, or other sources.

3.6 Associations between Childhood Stunting and Maternal BMI

I found no significant associations between maternal BMI and childhood stunting using a Chi-Squared test in either the urban or rural populations (Table3.46).

Table 3.46 Association between Maternal Overweight/Obesity and Childhood Stunting (Children <60 Months)

	Urban		Rural	
	Stunted	Not Stunted*	Stunted	Not Stunted*
BMI <25†	38	23	66	47
BMI ≥25	50	20	48	31
Odds Ratio	0.7		0.9	
CI	0.3-1.4		0.5-1.6	
P-value	0.27		0.74	

Note: BMI is Body Mass Index. CI is Confidence Interval. BMI is calculated as kg/m2. Stunting is defined as having a height less than 2 standard deviations below the mean height-for-age (11).

* Children with a normal height are the reference group.

† BMI <25 is the reference group.

3.7 High Water Season Survey Results

In the high water season, 135 urban and 244 rural households with a female of child bearing age were interviewed. Results for key variables are described below.

3.7.1 Select Urban Survey Results

3.7.1.1 Urban Household Demographics

Among the urban population during the high water season survey, 85% (N=115) of the households had a head male and 64% (N=87) had a child.

3.7.1.2 Urban Household Food Security

The results for HFIAS among the urban respondents (N=135) ranged from zero to 12, with a mean of 1.7 (SD 2.6) and a median of zero (IQR 0-3). The results for the HHS ranged from one to three, with a mean of 0.2 (SD 0.5) and a median of zero (IQR 0-0). I present the categorical results for HFIAS, households experiencing each of the HFIAS domains, and HHS in Table 3.47. The results for the HDDS ranged from five to 12, with a mean of 8.8 (SD 1.4) and a median of 9 (IQR 8-10). A total of 13 respondents (9.6%) reported having an atypical eating day the previous day.

Table 3.47 Urban Household Food Insecurity and Hunger in the High Water Season

N=135	N	%
Household food security as assessed by the Household Food Insecurity Access Scale		
Food Secure	86	63.7
Mildly Food Insecure	9	6.7
Moderately food insecure	15	11.1
Severely food insecure	25	18.5
Households experiencing food insecurity by domain* (Multiple responses possible)		
Households experiencing anxiety over food	52	38.5
Households with decreased quality of food	37	27.4
Households with decreased intake or physical consequence of food insecurity	42	31.1
Household hunger as assessed by the Household Hunger Scale		
Little to no hunger	132	97.8
Moderate hunger	3	2.2
Severe hunger	0	0

Note: The Household Food Insecurity Access Scale was developed by Coates et al. (2007) (26). The Household Hunger Scale was developed by Ballard et al. (2011) (31).

* Food security domains are derived from the Household Food Insecurity Access Scale (26).

3.7.2 Select Rural Survey Results

3.7.2.1 Rural Household Demographics

I present the distribution of rural households within the 15 villages selected for the survey in Table 3.48. In the rural population in the high water season, 98% (N=239) of the households had a head male and 77% (N=187) had a child <60 months of age.

Table 3.48 Rural Household Distribution by Community in the High Water Season

N= 244	N	%
Trinidadcito	36	14.8
Miraflores	35	14.3
Portachuelo Bajo	29	11.9
Galilea	27	11.1
Monte Sinahi	17	7.0
Anexo Remanso	16	6.6
Candelaria	15	6.1
Santuario	14	5.7
Portachuelo Alto	13	5.3
Villa Cotoca	12	4.9
Canada	10	4.1
27 de Mayo	8	3.3
Flor de Octubre	5	2.0
Anexo el Carmen	4	1.6
Lago el Carmen	3	1.2

3.7.2.2 Rural Household Food Security

The results for the rural HFIAS (N=244) ranged from zero to 20, with a median of 3.0 (IQR 0-11.75) and a mean of 5.5 (SD 6.0). The results for HHS ranged from zero to three with a median of zero (IQR 0-0) and a mean of 0.4 (SD 0.9). I present the categorical results for HFIAS, the households experiencing each of the domains of food insecurity and HHS in Table 3.49. The results for the HDDS ranged from two to 11, with a mean of 7.1 (SD 1.7) and a median of 7.0 (IQR 6-8). Only six respondents (2.5%) reported not having a typical eating day the day before the survey.

Table 3.49 Rural Household Food Insecurity and Hunger in the High Water Season

N=244	N	%
Household food security as assessed by the Household Food Insecurity Access Scale		
Food Secure	98	40.2
Mildly Food Insecure	23	9.4
Moderately food insecure	93	38.1
Severely food insecure	30	12.3
Households experiencing food insecurity by domain*		
Households experiencing anxiety over food	126	51.6
Households with decreased quality of food	110	45.1
Households with decreased intake or physical consequence of food insecurity	139	57.0
Household hunger as assessed by the Household Hunger Scale		
Little to no hunger	235	96.3
Moderate hunger	9	3.7
Severe hunger	0	0

Note: The Household Food Insecurity Access Scale was developed by Coates et al. (2007) (26). The Household Hunger Scale was developed by Ballard et al. (2011) (31).

* Food security domains are derived from the Household Food Insecurity Access Scale (26).

3.8 Seasonal Comparison of Food Security Status

In the following section, I present the results of the paired comparisons of the three food security variables measured in the low and high water seasons.

3.8.1 Urban Seasonal Comparison

In the urban population a total of 133 households were measured in both seasons. I found urban food insecurity (HFIAS food insecure versus food secure) to be significantly different between seasons, with a higher percentage of households reporting food insecurity in the low water season (Table 3.50). The urban HHS (continuous score) was not different between seasons. Finally, the urban HDDS (continuous score) was different between seasons, with a slightly higher average score in the low water season.

Table 3.50 Urban Paired Seasonal Comparisons of Food Security Indicators

N=132-133	Low Water	High Water	Stat used	P-value
HFIAS (% food insecure)	52	36	McNemar- related samples	0.01
HHS (mean, SD)	0.3 (0.8)	0.2 (0.5)	Wilcoxon Signed Rank test	0.34
HDDS (mean, SD)	9.2 (1.8)	8.7 (1.4)	Paired T-test	0.01

Note: HDDS means Household Dietary Diversity Score. HFIAS means Household Food Insecurity Access Scale. HHS means Household Hunger Scale. SD is Standard Deviation. Sample sizes vary due to missing data. The HFIAS was developed by Coates et al. (2007) (26). Household food insecurity is defined as households scoring as mildly, moderately or severely food insecure according to the HFIAS (26). The HHS was developed by Ballard et al. (2011) (31). The HDDS was developed by Swindale and Bilinsky (2006) (32).

3.8.2 Rural Seasonal Comparison

In the rural population, a total of 195 households were measured in both seasons. In the rural population, I found HFIAS, HHS and HDDS to be different between seasons (Table 3.51). There were more households that reported food insecurity and hunger during the low water season. However, the average HDDS score was slightly higher in the low water season.

Table 3.51 Rural Paired Seasonal Comparisons for Food Security Indicators

N=191-195	Low Water	High Water	Stat used	P-value
HFIAS (% food insecure)	72	62	McNemar- related samples	0.03
HHS (mean, SD)	0.5 (0.9)	0.2 (0.5)	Wilcoxon Signed Rank test	<0.01
HDDS (mean, SD)	7.4 (2.0)	7.1 (1.7)	Paired T-test	0.04

Note: HDDS means Household Dietary Diversity Score. HFIAS means Household Food Insecurity Access Scale. HHS means Household Hunger Scale. SD is Standard Deviation. Sample sizes vary due to missing data. The HFIAS was developed by Coates et al. (2007) (26). Household food insecurity is defined as households scoring as mildly, moderately or severely food insecure according to the HFIAS (26). The HHS was developed by Ballard et al. (2011) (31). The HDDS was developed by Swindale and Bilinsky (2006) (32).

CHAPTER 4. DISCUSSION OF RESULTS

To my knowledge, this is the first study to explore food insecurity and nutrition status of the urban and rural population around Riberalta, the economic center of the Department of Beni in Bolivia's Northern Amazon. My main findings were a very high prevalence of household food insecurity as measured by the HFIAS (55% urban and 69% rural), a low prevalence of hunger as measured by the HHS (9% urban and 13% rural) and a moderately high dietary diversity as measured by the HDDS (score of nine and seven out of 12 for urban and rural respectively) for both the urban and rural populations during the low water season. In the paired comparison, urban households were more food insecure and had slightly higher dietary diversity in the low compared to the high water season. In the rural population, households were more food insecure, had more hunger and had slightly higher dietary diversity in the low water season. The prevalence of household food insecurity was much higher than previously reported by the World Food Program in 2009 for Beni (33% of households), however direct comparison is problematic as the previous study did not use the HFIAS to measure food insecurity (8).

Other important findings in both the urban and rural groups were a very high prevalence of childhood stunting (35% and 42% respectively) and a low to moderate prevalence of both underweight (13% and 12% respectively) and wasting (8% and 7% respectively) (11). In all cases, these rates were higher than 2008 rates reported by the DHS for the Department of Beni (18% stunted, 3% underweight, 2% wasted) (1). Among both urban and rural women of childbearing age, there was a low prevalence of underweight (4% and 1% respectively) and a much higher prevalence of overweight (30% and 32% respectively) and obesity (26% and 14% respectively). The proportion of women who were under and overweight were similar to those reported by the 2008 DHS for the Department of Beni (2% underweight, 30% overweight and 21% obese) (1), with the exception that fewer rural women were obese compared to the DHS estimate. The finding of obesity in women and stunting in children in both urban and rural populations indicates that there is a double burden of malnutrition.

Based on the HFIAS food security domains, there was a high portion of respondents that reported anxiety around food, decreased quality of food and decreased intake of food, indicating that all three domains of food insecurity measured were important in the experience of food insecurity. Despite the high prevalence of food insecurity in the urban and rural populations, moderate hunger was reported by few urban or rural households in either season and severe hunger was almost nonexistent. This suggests that overall energy intake is not a primary issue in either the urban or rural communities, a conclusion supported by the high prevalence of maternal overweight/obesity and low prevalence of underweight.

Associations between HFIAS and HDDS

The significant negative correlations between the continuous HFIAS and HDDS for both the urban [ρ =-0.27 (P< 0.01)] and rural [ρ =-0.13 (P=0.02)] groups suggest that as food insecurity increases, dietary diversity decreases, however both associations are quite weak. With the dichotomized HFIAS, the average HDDS was different (9.6 versus 8.8) in the urban (P <0.01) but not in the rural sample (P= 0.14). Although the difference was significant for the urban group, it is too small to be practical for differentiating between food security statuses. When households that were measured in both seasons were compared, I found that food insecurity was higher in the low water season as was dietary diversity. Together these results show that the relationship between HFIAS and HDDS is not a clear one. I identified no studies that directly compared HFIAS and HDDS. However, two studies were identified that suggest as HFIAS increases dietary diversity decreases. In a study of 1,056 households in Burkina Faso, HFIAS was negatively associated and dietary diversity was positively associated with the household dietary mean adequacy ratio (MAR) (61). Similarly, the authors of a study of 300 households in Mozambique presented graphs showing a significant negative association between categorical and continuous forms of HFIAS and HDDS, but no correlation of the continuous variables was provided (62). Although these studies were conducted in very different populations than the current study, they do support a general trend of negative association between HFIAS and HDDS, similar to that reported in the current study.

Correlates of HFIAS

I used HFIAS as the dependent variable in multiple logistic regression models to identify correlates of food insecurity. After controlling for multiple confounders in the urban reduced model, households with inadequate flooring were 1.7 times more likely to be food insecure compared to those with adequate flooring; households with a respondent employed as a professional or in sales were half as likely to be food insecure compared to households with a respondent who was unemployed; households that received some kind of food assistance in the last year were 2.1 time more likely to be food insecure compared to those that did not; and households that hunted and consumed wild meat in the last year were 1.9 times more likely to be food insecure compared to those that did not. For the rural group, significant correlates of HFIAS showed: that for each additional member of the household there was a 20% increase in odds of being food insecure; households with a respondent who self-identified as Indigenous were 3.1 times more likely to be food insecure; households with a respondent employed as professionals or in sales or trades were 0.4 times a likely to be food insecure compared to those with respondents who were unemployed; and households that hunted and consumed wild meat in the last year were 3.2 times more likely to be food insecure compared to those that did not. In both the urban and rural models, the significant correlates had very large effect sizes, which indicate large magnitudes of association. However, the models containing the significant variables only accounted for a small amount of the overall variability between food secure and food insecure households (15% and 18% respectively). This means that even if the effect sizes are large, they account for a small amount of the overall variability in food security status. Therefore, it is clear that one or more correlates of HFIAS that are important in determining the food security status were not measured correctly or were not included in these models.

I identified no other studies that used logistic regression analysis to identify correlates of HFIAS in any Bolivian or Latin American population. I found one study that conducted linear regression with HFIAS as a continuous variable. This study of 67 people from an HIV impacted population in Kenya looked at associations between results for the HFIAS score and found that for each additional child in the family the HFIAS score increased by 1.1, the lack of a spouse increased

the HFIAS score by 3.4 and there was a 0.17 increase in HFIAS for each additional year increase in the age of the respondents (63). I did not treat HFIAS as continuous in the present study because HFIAS is an ordinal scale making the interpretation of the results of a linear regression less meaningful than those of logistic regression. Other studies I identified that address the correlates of household food insecurity do so by discussing general population vulnerability data (8,16,64) or by examining bivariate associations between household food insecurity and other variables that are presumed to be important (64,65). Population level vulnerability data are important to illuminate the general causes of food insecurity within a context but do not offer household level information. Bivariate associations offer household level information but do not account for potential confounding factors and erroneous associations related to multiple comparisons. Therefore, the current study is important because it looks at correlates of HFIAS food insecurity at the household level and controls for multiple comparisons through logistic regression. Although results from other studies cannot be directly compared to the results of this study, there are themes that emerge in the literature concerning the correlates of household food insecurity.

Among the most widely cited correlates of household food insecurity is socio-economic status (63,64,66), which includes occupation, education and income. In the current study, I found that women's occupation was independently associated with household food insecurity in both populations. These results for women's occupation are consistent with the results from the 2008 DHS where a higher percentage of women in the highest wealth tertile were employed in similar occupations (1). They are also consistent with findings in other populations such as Guatemala, where employment rates were shown to be lower among women and men in households with higher food insecurity (65).

Interestingly, the family's involvement in fishing was significant for both the urban and rural population in bivariate associations, but the significance disappeared in the regression models, indicating that this occupation and subsistence activity was not significantly influential on HFIAS food security status when other factors were controlled for. Mothers' education level was significant in both populations in bivariate comparisons, but the significance disappeared in the

multi-variate regression models. This indicates that while maternal education may be involved in household food insecurity, when other factors are considered, it likely does not play a big role in determining household food security status. In a sample of 2,244 Guatemalan mothers analyzed by Chaparro in 2012, low levels of education were similarly shown to increase with degree of food insecurity status in a bivariate association (65), however no multivariate analysis was conducted in Chapparo's study.

Income was not measured in the present study. However, indicators of household wealth (for example, housing materials, ownership of durable items, access to electricity and type of water source) were measured. In bivariate associations, several of these indicators were significant in both the urban and rural populations. I did not find any to be significantly associated with food insecurity in the regression models. Likely, this is because each factor on its own was not strong enough to be significant. However, a composite score may have been strong enough to show a significant association. A composite score is being developed by the Bolivian research team based on the Bolivian INE methods, but was not ready for use in these regression models. For comparison, a study of 120 households in Mozambique found the lowest group on an economic scale, including income, land, animals and housing, was associated with higher food insecurity as measured by the HFIAS ($P < 0.001$) (62). In the present study, urban families that received food assistance in the last year were more likely to be food insecure compared to families that did not. This is likely reflective of household income to some extent. However, it is possible that information on household income may have been more closely associated with household food insecurity. Together, these results demonstrate that socio-economic status is an important correlate of food insecurity and that the mother's occupation appears to be the most important socio-economic construct in this population.

In both populations, households that depended on wild food sources (fishing, hunting and gathering) were two to three times more likely to be food insecure. This could be associated with poverty and/or may be related to a negative perception of reliance on wild foods and/or a less predictable availability of wild foods compared to market foods. Any of these factors could increase HFIAS food insecurity scores by increasing "anxiety" around obtaining food (the first

construct of HFIAS). For example, Apaza et al. (2002) reported that consumption of wild meat by Tsimane Indigenous peoples in the Bolivian Amazon was positively associated with increased cost of market sources of meat and fish (67). As such, households reliant on wild meat may perceive greater food insecurity because of the high cost of market foods rather than because of decreased access to food sources. Additionally, there has been a reported decrease in the number of wild game animals due to over-hunting in the Bolivian Amazon (67). This game scarcity may mean unpredictability around obtaining wild foods, which may also be responsible for increased anxiety around wild food procurement and could even decrease quality and quantity of food consumed. Caution is warranted in comparing these studies to the present study as they examined one particular Indigenous group native to a different area of the Bolivian Amazon, which likely differs from the populations in the current study.

In the rural regression models, Indigenous households were more likely to be food insecure, which matches the WFP's observations in their 2009 survey (8). Other scholarly works have also identified Indigenous groups around the world as bearing a disproportionate level of poverty, inadequate access to nourishment and clean water resulting in malnutrition and disease (68). In Guatemala, Chaparro found the percentage of women reporting an Indigenous ethnicity went up with increasing food insecurity (65). Similarly, in Canada's North among the Inuit population 63% of households were food insecure compared to only 9% of Canadian households (69). As such, these results show that the Indigenous communities throughout the Americas face higher levels of adverse conditions resulting in poor health and, unfortunately, the present study shows a similar effect in food insecurity.

Finally, season appears to influence household food insecurity in both urban and rural populations where the prevalence of food insecurity was lower in the high water than the low water season. The lower prevalence of food insecurity during the high water season may be related to the Castana nut harvest which is a seasonal source of income for many families and was in its last weeks at the time of the high water survey.

In summary, I found few correlates of HFIAS defined food insecurity, including those that might be expected. This may be due to the use of a dichotomized HFIAS as the outcome measure, a

process that decreases the amount of information used in the analysis. As such it is possible that some variables that might have been significant were not. Additionally, this could decrease the amount of observed variability in household food insecurity accounted for by the model. What's more, food secure households (HFIAS score zero) versus households with any level of food insecurity may not have been the most meaningful division of the data. For example, households could have been divided into food secure and mildly food insecure versus moderately and severely food insecure. This may have better differentiated between households only experiencing anxiety around food versus those actively making changes to the quality and quantity of food consumed. This construct was explored in early phases of the data analysis, but appeared to be less meaningful than the selected division at that time. It is also possible that this finding may indicate that the present study did not measure the correlating constructs in a meaningful way, although this is unlikely as survey questions were derived from validated sources. Finally, these findings may indicate that the HFIAS tool has limitations in identifying household food insecurity in a meaningful way.

Limitations of HFIAS as a Measure of Household Food Insecurity

There have been a number of critics of HFIAS as a measure of food insecurity. Heady and Ecker suggest that most tools, including the HFIAS, do a poor job of measuring 'shocks' to food availability and access (70). Food shocks are common in Bolivia's Northern Amazon Basin because of flooding and other natural disasters; however food shocks were not directly measured in this study. Dependence on food aid over the past year was measured, but this is likely too long a period to correlate well to 'shocks'. In another review of food security measures, Pangaribowo, Gerber and Torero discuss the idea that 'stability' over time should be a fourth domain considered in the definition of food security along with access, availability and utilization (66). These authors argue for measuring the number of days a person is permanently or temporarily disabled and the duration of the household food stock at the individual and household levels to get at the concept of stability (66). The "months of adequate food provisioning" variable developed by FANTA (71) may also be useful for this. If these variables

had been accounted for in our survey, my analysis might have accounted for more of the observed variability.

Potential Causes of Childhood Stunting

As previously discussed there were high rates of stunting in both the urban and rural populations. Drawing from the UNICEF Conceptual Framework for Malnutrition (Figure 1.2), some of the potential 'basic causes' of malnutrition identified survey results include a high portion of respondents with low levels of education, especially in the rural population, and high rates of unemployment among responding women (35% urban, 51% rural). One potential 'underlying cause' of stunting identified by the survey in both populations is access to food, as evidenced by the high rates of household food insecurity. Another potential 'underlying cause' is unhealthy environments as evidenced by a large number of households having inadequate housing, indicated by inadequate floors (67% urban, 89% rural), and few households having adequate food storage capabilities such as a refrigerator (47% urban, 1% rural). Additionally, many households did not have improved sources of water (33% urban, 84% rural) and many did not treat their drinking water properly (44% urban, 80% rural). If a home does not have a clean source of water that is properly treated, drinking water could be a source of pathogenic contamination that could cause infection, one of the 'immediate causes' of malnutrition. In fact, many urban and rural children experienced diarrhea in the two weeks prior to the survey (47% urban, 39% rural), suggesting a high rate of infection. Unfortunately, diarrhea was only measured among children less than 24 months and other types of infections were not measured. As such this relationship cannot be further explored through regression analysis. Although I am not able to attribute the diarrhea to poor living conditions, it is logical that they may be linked. Other studies show inconsistent effects of water source on stunting. The Chaparro study in Guatemala did not find an association between water sources and stunting (65), but a large study done in eight countries did (72). Finally, many households did not have adequate toilet facilities (63% urban, 98% rural). The type of toilet facility within a home can be used as a proxy for household sanitation (60). If a household is less sanitary a child may be exposed to pathogens through the environment, which could lead to increased infection. A

study looked at 660 asymptomatic infants (3-9 months of age) in eight countries and found children with the highest infection activity related to environmental enteropathy compared to the lowest infection activity grew 1.1 centimeters less over a six month period (73). This demonstrates an association between inflammatory responses related to growth failure (73).

Another potential 'immediate cause' of malnutrition is poor dietary intake as many respondents did not follow recommended infant and young child feeding practices. The large majority of children six months and older were breast fed for at least six months (95% urban, 97% rural), however many were not exclusively breast fed during this period (67% urban, 62% rural). Additionally, many children six months or older were started on complementary foods either too early or too late (38% urban, 28% rural). Among children six to 24 months, many did not have a minimally acceptable diet (41% urban, 67% rural) and dietary diversity was inadequate for some children (21% urban, 55% rural). What's more most mothers did not know that their sick child should be breastfed more than a healthy child (54% urban, 58% rural). This suggests the possibility that poor dietary intake could be contributing to stunting.

Correlates of Childhood Stunting

A primary focus of this study is the relationship between household food insecurity and childhood stunting. Therefore, an important finding of this study is that there does not appear to be an association between household food insecurity (HFIAS and HDDS) and childhood stunting in either the urban or rural populations. The average HDDS score was not different for stunted and normal-height children for either the urban (P=0.59) or rural (P= 0.43) populations. When HFIAS was analyzed as a dichotomous variable, childhood stunting was 2.4 times more likely in food insecure homes in the urban population, but paradoxically 2.2 times more likely in a food secure home in the rural population. In the urban population, the significance of the relationship disappeared in logistic regression models controlling for other variables. In the rural population, the association between stunting and food secure households was retained in the models. This indicates that stunting was not associated with food insecurity as measured by the HFIAS independent of other variables in either urban or rural populations and in the rural

population it was associated with household food security. It is unknown why stunting is associated with household food security in the rural population.

This finding differs from other studies that have found a positive relationship between stunting and food insecurity in other populations such as Guatemala (65), Peru, Nepal, Tanzania, Pakistan, Brazil, Bangladesh, India, South Africa (72), Bangladesh, Ethiopia and Vietnam (70). For example, the Chaparro study looked at over 10,000 Guatemalan children and found severe household food insecurity was associated with a 0.09 reduction in height-for-age Z-score, while moderate food insecurity was associated with a 0.08 reduction compared to children in food secure households (65). While, each of these studies used different sampling and analysis methodologies, all showed the opposite association to what was observed in the rural sample in the current study. In their review of food security measurement tools, authors Headey and Ecker strongly critique the subjective measure tools, including the HFIAS, for not sufficiently capturing hidden hunger (micronutrient deficiencies), but they report strong associations between HFIAS categories and stunting (70). They also suggest that dietary diversity measures, including HDDS, do a better job at approximating macro and micro nutrient intake (70) and therefore, in theory, should better capture the link between food insecurity and anthropometric nutrition status. However, this was not demonstrated in the current study.

The series of logistic regression models examining the correlates of stunting included a number of other factors associated with stunting. In the urban population these models showed that for each centimeter increase in height of a child's mother, there was 1% less chance that the child would be stunted. Mothers who believed a sick child should be breastfed the same amount as when healthy were 3.2 times more likely to have a stunted child compared to those who believed a sick child should be breastfed more. Of note, households with inadequate toilet facilities were 2.4 times more likely to have a stunted child, although this variable was borderline insignificant in the reduced model and insignificant in the full model. Similarly, households with access to unimproved sources of water were about half as likely to have a stunted child compared to those with access to improved water but this variable was borderline insignificant in the full model and insignificant in the reduced model. The rural models for

childhood stunting show that for each additional month of age, a child is 2% more likely to be stunted. Additionally, respondents who were employed as professions or in sales were half as likely to have a stunted child compared to those who were unemployed.

The urban models show that two variables related to disease were significantly, or almost significantly, correlated to childhood stunting: improper knowledge of feeding a sick child and inadequate toilet facilities. This finding helps to support the hypothesis that infection or disease associated with unhealthy environments is a contributor to stunting. Other studies show inconsistent association with toilet facilities and stunting. The study conducted in Guatemala with a sample of over 10,000 children found that children in households with a toilet connected to the sewer had an 0.12 increase in height-for-age Z-score (65), while the Psaki's study in eight countries did not demonstrate an association (72).

The urban model also showed that maternal height was weakly but significantly associated with stunting. An association between maternal height and childhood stunting was also found in the Chaparro study in Guatemala, a country with a high prevalence of stunting. The study found that for each centimeter increase in height a child's height-for-age Z-score increased by 0.06 centimeters (65). Other studies have found similar associations (74,75). This may be indicative of an intergenerational effect of stunting either through biology, culture or socioeconomic status (76), a topic under investigation and debate.

In the rural model, I found that the respondent's occupation was associated with stunting, showing that socio-economic status may be associated with stunting in the rural group. However, in Chaparro's Guatemalan study, mother's employment status was not associated with stunting showing that mother's occupation is not always a correlate of stunting (65). Also in the rural model, older age was associated with stunting, likely indicating that stunting worsens over time. As the child is exposed to the influencing factor(s) (e.g. pathogenic infection or poor nutrient intake) for longer periods of time, they are more likely to become stunted. Studies have shown that stunting rates tend to increase in prevalence and severity from birth to about 24 months of age and plateau through 48 months of age (44). Therefore, it makes sense that this study shows a positive association between stunting rates and age. A study among

460 Tsimane children suggested that stunting worsens at weaning (14), which would also appear as age related stunting.

Importantly, variables that have been associated with stunting in other contexts were not associated with stunting in this population. These include maternal education (65,77), mother's age (65), mother's education level (65,72,78), number of children (65,78), Indigenous ethnicity (65,77) and wealth indicators (74,77). For example, Sereebutra looked at the correlates of stunting in 131 Guatemalan children and found that children with illiterate parents who lived in households with four or more children were associated with stunting (78). Of note, in the present study few parents were illiterate. Lourenco looked at the correlates of stunting among 256 Brazilian Amazonian children in a longitudinal study and found socio-economic factors such as household wealth and land ownership to be significant (74). However, the logistic regression models for the present study found few of the socio-economic variables to be significant. Again, this may be because individually the variables were too weak to show an effect.

There are important limitations of this analysis of the correlates of childhood stunting. First, the samples, especially the urban sample, were smaller than I calculated for. Secondly, both the urban and rural reduced regression models for stunting accounted for a moderate percentage of the overall variability in stunting (22% and 12% respectively) indicating that important factors affecting childhood stunting were not captured in this study. Thirdly, variables that could play a role in stunting based on the theoretical pathway to stunting either were not collected or the data were not useful to the regression analysis. For example, some data were collected from children in a limited age range, which reduced the sample size for these variables. An example of a potentially important variable that was not accounted for is helminth infection. In a sample of 349 Amazonian Peruvian children aged seven to 24 months, researchers found that at 14 months of age, 37% of the children had helminth infections and that moderate to more severe infections were associated with stunting (79). In a study of 460 children in Beni, 75% of the children were found to have helminth infections (14). This type of infection was not measured in this study but could be important.

In conclusion, the survey detected potential contributors to stunting such as inadequate dietary intake, unhealthy environments and high rates of diarrhea. The regression models that I prepared to support these hypotheses may have been inadequately powered to be confident that all associations were captured and I purposefully excluded variables with small sample sizes from the analysis. However, the urban model did identify variables linked to unhealthy environments and the rural model found a socio-economic factor, mother's lack of an occupation, to be associated with stunting. Thus I can only make cautious hypotheses that childhood stunting is related to inadequate dietary intake, unhealthy environments and high rates of diarrhea rather than household food insecurity per se.

Overweight and Obesity among Women

Measuring potential determinants of women's overweight/obesity was not a primary focus of data collection in the survey. However, the survey did detect some information that might be associated with women's overweight/obesity. For example, some households owned bicycles while others owned cars and motorcycles. This could be associated with physical activity and energy expenditure among respondents. Also, women's dietary diversity was high. In Latin America's nutrition transition, populations are moving away from leading highly active lifestyles and eating diets based in whole foods such as vegetables and complex carbohydrates. The populations are increasingly leading more sedentary lifestyles and consuming diets that include more highly-processed food rich in saturated fats and refined sugar (80). The current study was able to capture a cross section of dietary components among the urban and rural samples through the HDDS. Almost all of the respondents in both the urban and rural groups consumed a source of added sugar, fatty foods and, for many, a sugar sweetened beverage the day previous to the survey. In this study, among the least commonly consumed food groups at the household level were vegetables, fish (urban respondents only) and legumes. This shows that high energy and low nutrient dense foods may be favored over foods with lower energy density and higher nutrient density in some households. These findings are consistent with Bermudez and Tucker's report on the changing dietary trends across Latin America where populations are tending to decrease vegetable intake and increase sugar and saturated fat intake (81).

However, this study did not collect data on the quantity or quality of the women's diets, which limits the conclusions that I can draw around how diet might contribute to overweight/obesity.

Correlates of Overweight and Obesity among Women

I included the survey variables potentially associated with respondents' weight in logistic regression models. From these models, I found that women's overweight/obesity was not associated with household food security status (HFIAS or HDDS) in either the urban or rural populations. In the urban population, the reduced regression model found a 4% increased chance of overweight/obesity for each additional year of age of the respondents. Additionally, in the urban population, a household that produced crops in the last year was 2.7 times more likely to have an overweight/obese respondent than a household that did not grow crops. In the rural population, the reduced regression model also found a 9% increased chance of overweight/obesity for each additional year of age of the respondents. Additionally, the model showed that respondents who had secondary school or higher education were 3.8 times more likely to be overweight/obese. This shows that some variables related to socio-economic status were associated with overweight/obesity in these populations, but many were not. Variables that might be expected to be associated with overweight/obesity such as potential proxies for physical activity (owning a bicycle, car, motorcycle or television) or proxies for diet (IDDS, the type of meat eaten the previous day, consumption of vegetables or sugary beverages the previous day) were not.

Other studies have looked at the correlates of obesity across Latin America. One study conducted in Trinidad looked at the relationship between food security status and obesity among 290 women 24-89 years of age and found no association (82). A study looking at the increasing rates of obesity and overweight in Bolivia from 1994-1998 found obesity was associated with living in urban environments, education, increased age, higher numbers of children and not speaking Quechua (one of the larger Indigenous language groups in Bolivia), among other factors (83). Although this study was conducted across Bolivia and is not specifically applicable to the study population around Riberalta, it shows that socio-economic and demographic variables appear to be associated with obesity in Bolivia. Other factors that

are thought to play into the high rates of obesity across Latin America are genetics and diet (84). These factors were either not measured or were not clearly reflected in the findings of the present study.

These results likely indicate that the variables used as proxies for these concepts were inadequate. It is feasible that variations of these variables might have shown significant associations. For example, the diet variables used in this study (all derived from the HDDS scale) did not capture the quantity of foods eaten, which is not an adequate representation of the diet. This is supported by the low percentage of variability between overweight/obese women and those that are not accounted for by the urban and rural reduced models (8% and 24%).

The main limitation of this component of the study was that the survey was not designed to identify correlates of obesity. Therefore, to sufficiently address maternal overweight/obesity, potential correlates would need to be identified and further explored. However, I conclude that food insecurity and related variables do not appear to be associated with maternal overweight/obesity in this analysis.

Double Burden of Malnutrition

In this study, both the urban and rural populations face a double burden of malnutrition with high rates of childhood stunting and high rates of maternal obesity in their communities. However, there did not appear to be an association between maternal overweight/obesity and childhood stunting. The cross sectional nature of this study limits the ability to make inferences beyond the existence of overweight/obesity and stunting in mother-child pairs. Thus, I cannot exclude the possibility that childhood stunting and maternal obesity are related in the study population. Evidence from the literature examining this association is inconsistent. According to Martorell and Zongrone's review on the intergenerational effects of stunting, these effects are well documented and are likely attributable to socio-economic and cultural factors (76). However, a study examining childhood stunting and maternal obesity using DHS cross sectional data from 54 countries (N=339,202) reported the association between maternal obesity and childhood stunting is a product of cross sectional statistical analysis as overweight mother and

stunted child pairs do not exceed expected levels based on the prevalence of each condition in the populations (85). Based on the results of my analysis, it appears that maternal overweight/obesity and childhood stunting may not be associated.

4.1 Study Strengths and Limitations

This study has many strengths. First, the survey successfully captured a wide variety of food security and health information from urban Riberalta and surrounding villages, which is an under studied populations in Bolivia's Amazon. Additionally, the survey measured a wide variety of valid demographic, socioeconomic, dietary, hygiene and nutritional indicators that are widely used in the Bolivian population (1,5) and populations around the world (1,60) which allow for comparison of these populations to other populations. Second, there was a large and representative sample of the urban population and, although the rural sample was from conveniently selected villages, the selection was designed to reflect the diversity in the area. Third, multiple measures of food insecurity were used giving a broader picture of food security in the area. Fourth, household food insecurity and nutrition status were measured at the same time, which allowed for me to examine potential associations between the two. This has not been previously done in this population. Finally, food security status was measured in two seasons, which allowed for assessment of seasonal change.

There are also a number of important limitations of this study. This study was a cross-sectional exploratory study and therefore causality between variables could not be established. As such, the results of the analysis are hypothesis forming as opposed to hypothesis testing. There were also a few key limitations in the study sampling methodology. First, the sampling methodology differed between urban and rural groups. The urban sample was a stratified random sample, making the results generalizable to the wider population. However, the rural sample was an unweighted analysis of conveniently selected villages, which makes the finding ungeneralizable. Secondly, the sample size of children was small because the participant inclusion criteria did not include having a child in the home. Third, the study was not specifically designed to identify all

the correlates of childhood stunting or maternal overweight/obesity. As such, information on potentially important correlates of childhood stunting or maternal overweight/obesity were not collected. Finally, surveys are prone to systematic response bias where one portion of the population is more likely to adjust their response in a particular direction due to social desirability and/or approval bias (avoiding criticism or seeking praise). This effect may be increased in orally administered surveys where an interviewer has overt or unintended reactions to respondents' replies (38). Additionally, if a respondent feels there might be a benefit associated with certain answers or if they feel uncomfortable giving sensitive information, this may influence given answers in one direction or another. However, in this study, measures were taken to reduce response bias. Therefore, I do not feel that response bias unduly affected this survey's outcome compared to other similar surveys. Despite the limitations of the study, I was successful in exploring all of my research objectives.

4.2 Implications for Practice and Recommendations

This study has shown a very high prevalence of household food insecurity in both the urban and rural communities, with some differences across seasons. As such, interventions focusing on food insecurity are appropriate and should focus on improving occupational opportunities for women and increasing household income. In the urban population, special focus should be put on these issues in the low-water season before the Castana nut harvest and special focus should be placed on Indigenous groups in the region. However, more work is needed to develop these themes and identify more specific and pointed actions.

Based on the study conducted, it does not appear that food insecurity is related to childhood stunting or maternal obesity, but further exploration, especially with regards to maternal obesity, is required. As such, food security interventions might not be expected to decrease the large portion of children and women suffering from under and overnutrition, respectively. However, food insecurity and nutrition interventions might overlap in the development of infrastructure such as improving water sources and building sanitary latrines, which might help to decrease the prevalence of childhood stunting in the long term.

With caution I hypothesize that the potential causes of childhood stunting are unhealthy environments and inappropriate breastfeeding and infant and young child feeding practices. Therefore, interventions for stunting should focus on exclusive breastfeeding for six months, appropriate and sanitary complementary food preparation and feeding practices, best practices for feeding a sick child and safe food handling and storage practices. Because stunting has the best chance of being reversed before two years of age (44,45), pregnant women and mothers with children under 24 months of age should be the focus of interventions. The WHO has comprehensive guidelines for breastfeeding and complementary feeding that should form the basis of any intervention messaging (49). These findings are in line with globally recognized needs to improve breastfeeding and complementary feeding practices around the world to improve stunting rates (12). Additionally, many households need improved drinking water sources, improved toilet facilities and appropriate drinking water treatment practices. By improving the hygiene and sanitation of the environment, it is possible that stunting rates could be decreased.

Finally, maternal overweight and obesity is widespread in both urban and rural populations and should be addressed to help prevent the development of chronic diseases for the affected women. Unfortunately, this study was unable to identify specific ways that this challenge can be addressed. Principles from North American dietary recommendations, which are designed for a sedentary population faced with high rates of overweight and obesity, may be appropriate for women in the Bolivian Amazon to balance the energy equation by eating more vegetables and less added sugar and using less fat in cooking (86). However, women's diet and activity patterns would need to be specifically examined to form specific recommendations.

CHAPTER 5. CONCLUSION AND FUTURE RESEARCH

This study has revealed new and more complete information on the food security and nutrition status of the urban and rural populations in and around Riberalta in Bolivia's Northern Amazon. Prior to this study, there was little evidence on household food security status, rates of childhood undernutrition and the double burden of malnutrition in this population. This study was the first to look at the prevalence and correlates of these issues in a systematic way using a representative sample. The results indicate a high prevalence of household food insecurity, childhood stunting and maternal obesity in both the urban and rural fisher populations in the Riberalta area of Bolivia's Northern Amazon. This demonstrates that strategies are needed to improve these health outcomes.

In the study populations, food insecurity was associated with unemployment among respondents, household reliance on hunting for meat, some socio-economic factors and Indigenous ethnicity. Additionally, both populations were more food secure during the high water season. This suggests that improving occupational opportunities might improve food insecurity, especially in the lean season. It also suggests that Indigenous groups may benefit from targeted interventions. However, it appears that there are more factors affecting household food insecurity that were not accounted for in this analysis, which may include participation in the Castana nut harvest, access to market, food 'shocks' and household food stores. Importantly, food insecurity, as measured by HFIAS and HDDS, was not shown to be associated with childhood stunting or maternal overweight/obesity. Rather, childhood stunting, in the rural population, may be a consequence of inappropriate diet and infection associated with poor breastfeeding, infant and young child feeding practices, contaminated water sources and/or inadequate sanitation. Although food security improvement and stunting prevention initiatives may target different households, there could be overlap in infrastructure development, including improving drinking water and toilet facilities and improving drinking water treatment practices. However, it is likely that maternal knowledge and behavior change around breastfeeding, infant and young child feeding practices and food handling may also need improvement to have impact on stunting rates. Maternal overweight/obesity was

associated with increased age in both populations and was associated with home production of crops in the urban population and respondents with high status work in the rural population indicating that socio-economic factors may also be associated with overweight/obesity. However, the study was not specifically designed to identify the correlates of women's overweight and obesity so more work is needed in this area. Importantly, while there is a double burden of malnutrition, maternal overweight/obesity did not appear to be associated with childhood stunting.

To summarize, the results suggest that the high rates of household food insecurity, childhood stunting and maternal obesity are not significantly associated. As such, it is questionable that improving food insecurity by this definition would alone eliminate childhood stunting or maternal obesity. Therefore, interventions addressing these issues should target appropriate households and members of the community. There are limitations to this study and further research is needed to develop and test the hypotheses presented.

With respect to future research, correlates of food insecurity could be explored through qualitative research, such as focus groups (87), with the aim of identifying additional factors that may be affecting food security. For example, exploration of the character, frequency and impact of 'shocks' and the related coping mechanisms might offer more information on the causes of food insecurity. This information could then be used to review and improve the current survey instrument. For the variables that were found to be associated with food insecurity such as occupational opportunities for women, household wealth and dependence on 'wild' foods, more work, ideally in the form of focus groups, is needed to identify opportunities for effective interventions in these key areas. It would be ideal to include the community in this process as their knowledge and buy-in is important to the success of an innovation or intervention at the community level (88).

Additionally, further investigation is needed into the causes of stunting in this community, especially among urban children. This study has identified infant and young child feeding practices as being potentially modifiable risk factors for stunting in the rural sample. Future studies should focus on assessing in more detail breastfeeding, first foods and complementary

food preparation, water treatment and safe food handling practices during the first thousand days (up to 24 months of age), which is the window of opportunity to impact a child's growth trajectory. Because there were only a small number of children less than 24 months who were stunted, another household survey targeting households with children less than 24 months of age is warranted. In light of the quantitative work already done, an alternative next step would be to explore these topics in qualitative focus groups in conjunction with planning for interventions. Data collected could be used to inform additional survey questions to be included in future household surveys.

The correlates of maternal obesity need to be assessed for both the urban and rural populations. Another survey designed to identify correlates of obesity would be an appropriate starting place as the present survey did not collect sufficient information on variables known to be associated with overweight and obesity such as physical activity and dietary quality and quantity. It would be appropriate to conduct more extensive investigation into women's diets using a series of non-consecutive 24 hour recalls to better capture dietary intake (38).

To conclude, household food insecurity, childhood stunting and maternal obesity are all highly prevalent in these study populations. However, none of these appear to be significantly related. Therefore, improving HFIAS food security status alone is not likely to reverse stunting and obesity rates. As this was the first exploratory study in this population on this topic, further research into the correlates of household food insecurity, childhood stunting and maternal obesity is warranted as a matter of urgency.

WORK CITED

(1) Coa R, Ochoa LH. Encuestra national de demografia y salud (demographic health survey-Bolivia) [Internet]. Measure DHS. 2009 Oct; Available at: http://www.measuredhs.com/Publications/Publication-Search.cfm?ctry_id=2&country=Bolivia. Accessed Nov 1, 2013.

(2) Fonadier07 (original map), MacedonianBoy (derivative). Map of the departments of Bolivia in English [Internet]. 2012; Available at: http://en.wikipedia.org/w/index.php?title=File:Bolivia_departments_en.svg&page=1 . Accessed Jan 1, 2013.

(3) Central Intelligence Agency. The world factbook: Bolivia [Internet]. 2012; Available at: https://www.cia.gov/library/publications/the-world-factbook/geos/bl.html. Accessed Oct 1, 2012.

(4) World Bank. Data: Bolivia [Internet]. 2012; Available at: http://data.worldbank.org/country/bolivia. Accessed Oct 1, 2012.

(5) Instituto National de Estadistica (Bolivia). Estadisticas e indicadores economicos y sociodemograficos de Bolivia [Internet]. INE- Bolivian Government. 2010; Available at: http://www.ine.gob.bo/pdf/bo_es_na/ben_2010_1.pdf. Accessed Nov 1, 2013.

(6) World Bank. GDP (current US $): Bolivia [Internet]. World Bank. 2011; Available at: http://data.worldbank.org/indicator/NY.GDP.MKTP.CD. Accessed Jan 1, 2013.

(7) United Nations Development Program. Human development index [Internet]. United Nations. 2011; Available at: http://hdr.undp.org/en/statistics/hdi/. Accessed Oct 1, 2012.

(8) World Food Program. Evaluación en profundidad de la seguridad alimentaria de las familias afectadas por fenómenos recurrentes en Beni, en Santa Cruz, en Cochabamba, en Chuquisaca y en Pando [Internet]. WFP. 2009; Available at: http://home.wfp.org/stellent/groups/public/documents/ena/wfp205524.pdf. Accessed Nov 1, 2013.

(9) Food and Agriculture Organization of the United Nations. Food security indicators: Bolivia [Internet]. FAO (United Nations). 2012; Available at: http://www.fao.org/economic/ess/ess-fs/fs-data/ess-fadata/en/. Accessed Oct 1, 2012.

(10) Food and Agriculture Organization of the United Nations. FAOSTAT: Bolivia [Internet]. FAO (United Nations). 2012; Available at: http://faostat3.fao.org/home/index.html . Accessed Oct 1, 2012.

(11) World Health Organization. Global database on child growth and malnutrition: description [Internet]. WHO. 1997; Available at: http://www.who.int/nutgrowthdb/about/introduction/en/index5.html. Accessed Nov 1, 2012.

(12) Lutter CK, Daelmans BM, de Onis M, Kothari M, Ruel MT, Arimond M, et al. Undernutrition, poor feeding practices, and low coverage of key nutrition interventions. Pediatrics 2011; 128(6):1418-1427. DOI: 10.1542/peds.2011-1392

(13) Foster Z, Byron E, Reyes-García V, Huanca T, Vadez V, Apaza L, et al. Physical growth and nutritional status of Tsimane' Amerindian children of lowland Bolivia. Am J Phys Anthropol 2005;126:343-351. DOI: 10.1002/ajpa.20098

(14) Benefice E, Luna Monroy S, Jiménez S, López R. Nutritional status of Amerindian children from the Beni River (lowland Bolivia) as related to environmental, maternal and dietary factors. Public Health Nutr 2006;9:327-335. DOI: 10.1079/PHN2005852

(15) World Health Organization. Special issue - Diet, nutrition and the prevention of chronic diseases: scientific background papers of the joint WHO/FAO expert consultation, Geneva, 28 January - 1 February 2002. Public Health Nutr 2004;7(1A):99-250.

(16) World Food Program, Ministerio de Desarrollo Agropecuario y Medio Ambiente de Bolivia. Resultados de la encuesta de seguridad alimentaria y nutricional en municipios vulnerables de Bolivia [Internet]. WFP. 2006; Available at: http://es.wfp.org/content/bolivia-resultados-de-la-encuesta-de-seguridad-alimentaria-y-nutricional-en-municipios-vulnerables. Accessed Nov 1, 2013.

(17) World Health Organization. Food security [Internet]. WHO. 2012; Available at: http://www.who.int/trade/glossary/story028/en/. Accessed Oct 1, 2012.

(18) Melgar-Quinonez H, Zubieta A, McNelly B, Nteziyaremye A, Gerardo M, Dunford C. Household food insecurity and food expenditure in Bolivia, Burkina Faso, and the Philippines. J Nutr 2006;136(5):1431-1437S. Available at: http://jn.nutrition.org.ezproxy.library.ubc.ca/content/136/5/1431S.abstract

(19) Pinstrup-Andersen P. Food security: definition and measurement Food Sec 2009;1(1):5-7. DOI: DOI 10.1007/s12571-008-0002-y

(20) Food and Agriculture Organization of the United Nations. World Food Summit: Rome Declaration on world food security and World Food Summit plan of action [Internet]. FAO (United Nations). 1996; Available at: http://www.fao.org/docrep/003/w3613e/w3613e00.HTM. Accessed Nov 1, 2013.

(21) Moore J, Stinson L, Welniak E. Income measurement surveys: a review. Stat J IAOS 2000;16(4):331-361.

(22) Ferguson BD, Tandon A, Gakidou E, Murray CJL. Estimating permanent income using indicator variables- Paper 44 [Internet]. WHO. 2003; Available at: http://www.who.int/healthinfo/paper44.pdf. Accessed Nov 1, 2013.

(23) Webb P, Coates J, Frongillo EA, Rogers BL, Swindale A, Bilinsky P. Measuring household food insecurity: why it's so important and yet so difficult to do. J Nutr 2006;136(5):1404-1408S. Available at: http://nutrition.highwire.org/content/136/5/1404S.full

(24) Coates J, Frongillo EA, Rogers BL, Webb P, Wilde PE, Houser R. Commonalities in the experience of household food insecurity across cultures: what are measures missing? J Nutrition 2006;136(5):1438S-1448S. Available at: http://jn.nutrition.org.ezproxy.library.ubc.ca/content/136/5/1438S

(25) Swindale A, Bilinsky P. Development of a universally applicable household food insecurity measurement tool: process, current status, and outstanding issues. J Nutr 2006;136(5):1449-1452S. Available at: http://jn.nutrition.org.ezproxy.library.ubc.ca/content/136/5/1449S

(26) Coates J, Swindale A, Bilinsky P. Household Food Insecurity Access Scale (HFIAS) for measurement of food access: indicator guide- version 3 [Internet]. FANTA (USAID and FNI 360). 2007; Available at: http://www.fantaproject.org/monitoring-and-evaluation/household-food-insecurity-access-scale-hfias. Accessed Nov 1, 2013.

(27) Pérez-Escamilla R, Segall-Corrêa AM, Kurdian Maranha L, Sampaio M, Marín-León L, Panigassi G. An adapted version of the U.S. Department of Agriculture food insecurity module is a valid tool for assessing household food insecurity in Campinas, Brazil. J Nutr 2004;134(8):1923-1928. Available at: http://jn.nutrition.org.ezproxy.library.ubc.ca/content/134/8/1923

(28) Vargas S, Penny M. Measuring food insecurity and hunger in Peru: a qualitative and quantitative analysis of an adapted version of the USDA's Food Insecurity and Hunger Module. Public Health Nutr 2009;13(10):1488-1497. DOI: 10.1017/S136898000999214X

(29) Melgar-Quiñonez H, Zubieta AC, Valdez E, Whitelaw B, Kaiser L. Validation of an instrument to monitor food insecurity in Sierra de Manantlán, Jalisco. Salud Publica Mex 2005;47(6):413-422. Available at: http://search.ebscohost.com.ezproxy.library.ubc.ca/login.aspx?direct=true&db=mnh&AN=16983986&site=ehost-live

(30) Deitchler M, Ballard T, Swindale A, Coates J. Validation of a measure of household hunger for cross-cultural use [Internet]. FANTA (USAID and FNI 360). 2010; Available at: http://www.fantaproject.org/research/validation-hhs. Accessed Nov 1, 2013.

(31) Ballard T, Coates J, Swindale A, Deitchler M. Household Hunger Scale: indicator definition and measurement guide [Internet]. FANTA III (US AID and FNI 360). 2011; Available at:

http://www.fantaproject.org/monitoring-and-evaluation/household-hunger-scale-hhs. Accessed Nov 1, 2013.

(32) Swindale A, Bilinsky P. Household Dietary Diversity Score (HDDS) for measurement of household food access: indicator guide (v.2) [Internet]. FANTA (USAID and FHI 360). 2006; Available at: http://www.fantaproject.org/monitoring-and-evaluation/household-dietary-diversity-score. Accessed Nov 1, 2013.

(33) Hoddinott J, Yohannes Y. Dietary diversity as a household food security indicator [Internet]. FANTA (USAID and FNI 360). 2002; Available at: http://www.fantaproject.org/research/dietary-diversity-household-food-security. Accessed Nov 1, 2013.

(34) Kennedy G, Berardo A, Papavero C, Horjus P, Ballard T, Dop MC, et al. Proxy measures of household food consumption for food security assessment and surveillance: comparison of the household dietary diversity and food consumption scores. Public Health Nutr 2010;13(12):2010-2018. DOI: 10.1017/S136898001000145X

(35) Arimond M, Ruel MT. Dietary diversity is associated with child nutritional status: evidence from 11 Demographic and Health Surveys. J Nutr 2004;134(10):2579-2585. Available at: http://jn.nutrition.org.ezproxy.library.ubc.ca/content/134/10/2579

(36) World Health Organization. Indicators for assessing infant and young child feeding practices: part 2 measurement [Internet]. WHO. 2010; Available at: http://www.who.int/nutrition/publications/infantfeeding/9789241599290/en/. Accessed Nov 1, 2013.

(37) Cronkleton P, Guariguata MR, Albornoz MA. Multiple use forestry planning: timber and Brazil nut management in the community forests of Northern Bolivia. For Ecol Manage 2012;268:49-56. DOI: 10.1016/j.foreco.2011.04.035

(38) Gibson R. Chapter 10: anthropometric assessment of body size. Principles of nutritional assessment. 2nd ed. New York: Oxford University Press; 2005. p. 245-272.

(39) Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, et al. Maternal and child undernutrition: global and regional exposures and health consequences. Lancet 2008; 371(9608):243-260. DOI: 10.1016/S0140-6736(07)61690-0

(40) Victora CG, Adair L, Fall C, Hallal PC, Martorell R, Richter L, et al. Maternal and child undernutrition: consequences for adult health and human capital. Lancet 2008;371(9609):340-357. DOI: 10.1016/S0140-6736(07)61692-4

(41) Dewey K, Begum K. Long-term consequences of stunting in early life. Matern Child Nutr 2011;7(s3):5-18. DOI: 10.1111/j.1740-8709.2011.00349.x

(42) Martorell R, Horta BL, Adair LS, Stein AD, Richter L, Fall CHD, et al. Weight gain in the first two years of life is an important predictor of schooling outcomes in pooled analyses from five birth cohorts from low- and middle-income countries. J Nutr 2010;140(2):348-354. DOI: 10.3945/jn.109.112300

(43) Stein AD, Thompson AM, Waters A. Childhood growth and chronic disease: evidence from countries undergoing the nutrition transition. Matern Child Nutr 2005 07;1(3):2013 Nov 1-177-184. DOI: 10.1111/j.1740-8709.2005.00021.x

(44) Victora CG, de Onis M, Hallal PC, Blossner M, Shrimpton R. Worldwide timing of growth faltering: revisiting implications for interventions. Pediatrics 2010;125(3). DOI: 10.1542/peds.2009-1519

(45) Shrimpton R, Victora CG, de Onis M, Lima RC, Blössner M, Clugston G. Worldwide timing of growth faltering: implications for nutritional interventions. Pediatrics 2001;107(5):e75. DOI: 10.1542/peds.107.5.e75

(46) Bellamy C. The state of the world's children 1998 [Internet]. UNICEF. 1998; Available at: http://www.unicef.org/sowc98/. Accessed Nov 1, 2013.

(47) Whitney E, Rolfes SR. Chapter 15: life cycle nutrition: pregnancy and lactation. Understanding nutrition Belmont, USA: Thomson Wadsworth; 2005. p. 506-541.

(48) Allen LH. Anemia and iron deficiency: effects on pregnancy outcome. Am J Clin Nutr 2000;71(5):1280-1284. Available at: http://ajcn.nutrition.org.ezproxy.library.ubc.ca/content/71/5/1280s

(49) Dewey K. Guiding principles for complementary feeding of the breast fed child [Internet]. World Health Organization. 2003; Available at: http://www.who.int/nutrition/publications/guiding_principles_compfeeding_breastfed.pdf. Accessed Nov 1, 2013.

(50) Tomkins A, Watson F. Malnutrition and infection: a review- Nutrition policy discussion paper no. 5 [Internet]. United Nations Administrative Committee on Coordination/Subcommittee on Nutrition. 1989; Available at: http://www.unscn.org/layout/modules/resources/files/Policy_paper_No_5.pdf. Accessed Nov 1, 2013.

(51) World Health Organization. Physical status: the use and interpretation of anthropometry-Technical report series no. 854. [Internet]. WHO. 1995; Available at: http://www.who.int/childgrowth/publications/physical_status/en/. Accessed Nov 1, 2013.

(52) Alvarez V, Cuevas A, Olivos C. The emerging obesity problem in Latin America. Expert Rev Cardiovasc Ther 2009;7:281. DOI: 10.1586/14779072.7.3.281

(53) Benefice E, Lopez R, Luna Monroy S, Rodriguez S. Fatness and overweight in Amerindian women and children from riverine Amerindian communities of the Beni River (Bolivian Amazon). Am J Hum Biol 2007;19(1):61-73. DOI: 10.1002/ajhb.20580

(54) Associacion Faunagua. Urban and rural sample areas for the Fish for Life household survey. 2011.

(55) Espeut D. Knowledge, practices, and coverage survey 2000+ [Internet]. Child Survival Technical Support Project (USAID). 2013; Available at: http://www.mchipngo.net/controllers/link.cfc?method=tools_mande. Accessed Nov 1, 2013.

(56) World Health Organization. Child growth standards: the WHO multicenter growth reference study (MGRS) [Internet]. WHO. 2006; Available at: http://www.who.int/childgrowth/mgrs/en/. Accessed Nov 1, 2012.

(57) World Health Organization and UNICEF. WHO child growth standards and the identification of severe acute malnutrition in infants and children: a joint statement by the World Health Organization and the United Nations Children's Fund [Internet]. WHO. 2009; Available at: http://www.who.int/maternal_child_adolescent/documents/9789241598163/en/. Accessed Nov 1, 2013.

(58) World Health Organization. BMI classification [Internet]. WHO. 2006; Available at: http://apps.who.int/bmi/index.jsp?introPage=intro_3.html. Accessed Mar 1, 2013.

(59) Vittinghoff E, Glidden D, Shiboski S, McCullen C. Chapter 3.1.7: Robustness to violations of assumptions. Regression methods in biostatistics: linear, logistic, survival, and repeated measures models. New York: Springer; 2005. p. 33-35.

(60) Espeut D. Rapid knowledge coverage practice survey [Internet]. USAID. 2009; Available at: http://www.mchipngo.net/controllers/link.cfc?method=tools_mande. Accessed Nov 1, 2013.

(61) Becquey E, Martin-Prevel Y, Traissac P, Dembélé B, Bambara A, Delpeuch F. The Household Food Insecurity Access Scale and an index-member dietary diversity score contribute valid and complementary information on household food insecurity in an urban West-African setting. J Nutr 2010;140(12):2233-2240. DOI: 10.3945/jn.110.125716

(62) Selvester K, Fidalgo L, Ballard T, Kennedy G, Dop MC, Mistura L, et al. Report on use of the Household Food Insecurity Access Scale and Household Dietary Diversity Score in two survey rounds in Manica and Sofala Provinces, Mozambique, 2006-2007 [Internet]. FAO and USAID. 2008; Available at: http://www.foodsec.org/fileadmin/user_upload/eufao-fsi4dm/docs/moz_diet.pdf. Accessed Nov 1, 2013.

(63) Nagata JM, Magerenge RO, Young SL, Oguta JO, Weiser SD, Cohen CR. Social determinants, lived experiences, and consequences of household food insecurity among

persons living with HIV/AIDS on the shore of Lake Victoria, Kenya. AIDS Care 2011;24(6):728-736. DOI: 10.1080/09540121.2011.630358

(64) Battersby J. The state of urban food insecurity in Cape Town. Queens University 2011. Available at: http://queensu.ca/samp/afsun/files/AFSUN_11.pdf

(65) Chaparro C. Household food insecurity and nutritional status of women of reproductive age and children under 5 years of age in five departments of the Western Highlands of Guatemala: an analysis of data from the National Maternal-Infant Health Survey 2008–09 of Guatemala [Internet]. FANTA (USAID and FNI 360). 2012; Available at: http://www.fantaproject.org/research/household-food-security-nutrition-guatemala. Accessed Nov 1, 2013.

(66) Pangaribowo EH, Gerber N, Torero M. Food and nutrition security indicators: a review-Working Paper 05 [Internet]. Food Secure. 2013; Available at: http://www3.lei.wur.nl/FoodSecurePublications/05_Pangaribowo%20Gerber%20Torero_FNS%20Indicators.pdf. Accessed Nov 1, 2013.

(67) Apaza L, Wilkie D, Byron E, Huanca T, Leonard W, Perez E, et al. Meat prices influence the consumption of wildlife by the Tsimane' Amerindians of Bolivia. Oryx 2002;34(4):382-388. DOI: 10.1017/S003060530200073X

(68) Gracey M, King M. Indigenous health part 1: determinants and disease patterns. Lancet 2009;374(9683):65-75. http://dx.doi.org.ezproxy.library.ubc.ca/10.1016/S0140-6736(09)60914-4

(69) Huet C, Rosol R, Egeland GM. The prevalence of food insecurity is high and the diet quality poor in Inuit communities. J Nutr 2012;142(3):541-547. DOI: 10.3945/jn.111.149278

(70) Headey D, Echer O. Improving the measurement of food security- Discussion paper 01225 [Internet]. International Food Policy Research Institute 2012. Available at: http://www.ifpri.org/sites/default/files/publications/ifpridp01225.pdf

(71) Bilinsky P, Swindale A. Months of Adequate Household Food Provisioning (MAHFP) for measurement of household food access: indicator guide [Internet]. FANTA III (USAID and FNI 360). 2007; Available at: http://www.fantaproject.org/monitoring-and-evaluation/mahfp. Accessed Nov 1, 2013.

(72) Psaki S, Bhutta Z, Ahmed T, Ahmed S, Bessong P, Islam M, et al. Household food access and child malnutrition: results from the eight-country MAL-ED study. Popul Health Metr 2012;10(24). Available at: http://www.pophealthmetrics.com/content/10/1/24

(73) Kosek M, Haque R, Lima A, Babji S, Shrestha S, Qureshi S, et al. Fecal markers of intestinal inflammation and permeability associated with the subsequent

acquisition of linear growth deficits in infants. Am J Trop Med Hyg 2013;88(2):390-396. DOI: 10.4269/ajtmh.2012.12-0549

(74) Lourenço BH, Villamor E, Augusto RA, Cardoso MA. Determinants of linear growth from infancy to school-aged years: a population-based follow-up study in urban Amazonian children. BMC Public Health 2012;12:265. DOI: 10.1186/1471-2458-12-265

(75) Özaltin E, Hill K, Subramanian SV. Association of maternal stature with offspring mortality, underweight, and stunting in low- to middle-income countries. JAMA 2010;303(15):1507-1516. DOI: 10.1001/jama.2010.450

(76) Martorell R, Zongrone A. Intergenerational influences on child growth and undernutrition. Paediatr Perinat Epidemiol 2012;26:302-314. DOI: 10.1111/j.1365-3016.2012.01298.x

(77) Morales R, Aguilar AM, Calzadilla A. Geography and culture matter for malnutrition in Bolivia. Econ Hum Biol 2004 12;2(3):2013 Nov 1-373-389. DOI: 10.1016/j.ehb.2004.10.007

(78) Sereebutra P, Solomons N, Aliyu MH, Jolly PE. Sociodemographic and environmental predictors of childhood stunting in rural Guatemala. Nutr Res 2006 2;26(2):65-70. DOI: 10.1016/j.nutres.2006.02.002

(79) Gyorkos TW, Maheu-Giroux M, Casapía M, Joseph SA, Creed-Kanashiro H. Stunting and helminth infection in early preschool-age children in a resource-poor community in the Amazon lowlands of Peru. Trans R Soc Trop Med Hyg 2011;105(4):204-208. DOI: 10.1016/j.trstmh.2010.12.003

(80) Rivera JA, Barquera S, Gonzalez-Cossao T, Olaiz G, Sepaolveda J. Nutrition transition in Mexico and in other Latin American countries. Nutr Rev 2004;62:S149-157. DOI: 10.1111/j.1753-4887.2004.tb00086.x

(81) Bermudez OI, Tucker KL. Trends in dietary patterns of Latin American populations. Cad Saude Publica 2003;19(Suppl 1):S87- 99. DOI: 10.1590/S0102-311X2003000700010

(82) Gulliford MC, Mahabir D, Rocke B. Food insecurity, food choices, and body mass index in adults: nutrition transition in Trinidad and Tobago. Epidemiol Res Int 2003;32:508-516. DOI: 10.1093/ije/dyg100

(83) Perez-Cueto F, Kolsteren PWVJ. Changes in the nutritional status of Bolivian women 1994-1998: demographic and social predictors. Eur J Clin Nutr 2004;58(4):660-666. DOI: 10.1038/sj.ejcn.1601862

(84) Cuevas A, Alvarez V, Olivos C. The emerging obesity problem in Latin America. Expert Rev Cardiovasc 2009;7(7):281-288. DOI: 10.1586/14779072.7.3.281

(85) Dieffenbach S, Stein AD. Stunted child/overweight mother pairs represent a statistical artifact, not a distinct entity. J Nutr 2012;142(4):771-773. DOI: 10.3945/jn.111.153387

(86) Health Canada. Eating well with Canada's food guide [Internet]. Health Canada. 2011; Available at: http://www.hc-sc.gc.ca/fn-an/food-guide-aliment/index-eng.php. Accessed Jun 1, 2013.

(87) Mack N, Woodsong C, MacQueen K, Guest G, Namey E. Qualitative research methods: a data collector's field guide [Internet]. FHI 360. 2005; Available at: http://www.fhi360.org/resource/qualitative-research-methods-data-collectors-field-guide. Accessed Nov 1, 2013.

(88) Minkler M, Wallerstein N editors. Community-based participatory research for health: from process to outcomes. 2nd ed. San Francisco: Jossey-Bass; 2008.

(89) Lwanga SK, Lemeshow S. Sample size determination in health studies: a practical manual [Internet]. World Health Organization (United Nations). 1991; Available at: http://apps.who.int/iris/handle/10665/40062. Accessed Nov 1, 2013.

(90) Magnani R. Sampling guide [Internet]. FANTA III (USAID and FHI 360). 1997; Available at: http://www.fantaproject.org/monitoring-and-evaluation/sampling. Accessed Nov 1, 2013.

APPENDIX I- SAMPLE SIZE CALCULATIONS

A series of sample size calculations were conducted to help inform the chosen sample size for this study. First a sample size was estimated for establishing a population portion with a specified absolute precision based on the methods outlined in Lwanga and Lemeshow's manual "Sample Size Determination in Health Studies: A Practical Manual" published by the WHO (89). This calculation was conducted for estimating the portion of food insecure households. The best estimate of food insecurity available for the region came from the WFP survey in 2009 and estimated 33% of households in Beni were food insecure. However, this estimate was made with a different methodology than will be employed in this survey. As such, a second calculation was done assuming a prevalence of 50% food insecurity as this would produce the "safest" (largest) sample size estimate (89). A confidence level of 95% was used. The reported estimates were derived from the table published by Lwanga and Lemeshow (89). As such, for a prevalence of 35% and a precision of 5%, a sample of 350 households would be needed. For a prevalence of 50% and a precision of 5%, a sample of 384 households would be needed.

A sample size calculation was also conducted for determining the prevalence of stunted children. Some of the stunting estimates that these calculations were based on include the 2008 DHS which reported that 22% of Bolivian children were stunted (1) and a report that 41% of Tsimane children under 3 years of age in the Beni area were stunted (14). Additionally, a safe estimate was calculated assuming a 50% prevalence of stunting. For a precision of 5%, a sample of 288, 369 or 384 children would be needed for an assumed stunting prevalence of 25%, 40% or 50% respectively. Alternatively, for a precision of 10%, 72, 92 or 96 children would be needed for an assumed stunting prevalence of 25%, 40% or 50% respectively.

For obese women, a prevalence of 50% was used based on the 2008 DHS estimate (1). With a precision of 5% and 10% a total of 384 or 92 women would be needed, respectively.

Additionally, sample size calculations were conducted to detect the difference in food insecurity between seasons and/or the difference in food insecurity between the baseline and endline of the study should the research team chooses to conduct an endline assessment.

These sample size calculations were based on the methodology described by FANTA's "Sampling Guide" (90). The calculations were conducted for household food insecurity as this was a primary outcome that could vary between seasons. Sample sizes were calculated for several levels of difference detection ranging between 5-25%. For each calculation an alpha value of 0.95, beta value of 0.80, and a design effect of 2 have been applied in the following equation:

$n = D\,[(Z_\alpha + Z_\beta)^2 * (P_1\,(1 - P_1) + P_2\,(1 - P_2))\,/(P_2 - P_1)^2]$, where

n= minimum sample size

D= design effect

Z=Z-score corresponding to the degree of desired confidence

P_1=estimate proportion at first measurement

P_2=estimate proportion at the second measurement

First, the calculations were done using the WFP estimate that 33% of households (rounded to 35%) were food insecure (citation) using the following numbers in the above equation.

D = 2

Z_α = 1.645

Z_β = 0.840

P_1 = 0.35

P_2 = 0.30, 0.25, 0.20, 0.15, 0.10

Decrease in food insecurity of 0.05, 0 .1, 0.15, 0.2, 0.25

Next, the estimates were conducted assuming that 50% of the households were food insecure using the following numbers in the above equation.

D = 2

Z_{α} = 1.645

Z_{β} = 0.840

P_1 = 0.50

P_2 = 0.45, 0.40, 0.35, 0.30, 0.25

Change in food insecurity of 0.05, 0 .1, 0.15, 0.2, 0.25

The results for these calculations are summarized the following table.

Proportion CHANGE in food insecurity	**BASELINE (P1)**	**Second measure (P2)**	**Required SAMPLE SIZE (n)**
0.05	0.35	0.30	2,161
0 .10	0.35	0.25	513
0.15	0.35	0.20	213
0.20	0.35	0.15	110
0.25	0.35	0.10	63
0.05	0.50	0.45	2,458
0 .10	0.50	0.40	605
0.15	0.50	0.35	262
0.20	0.50	0.30	142
0.25	0.50	0.25	86

To compensate for non-response and possible errors in data entry all sample size calculations should be rounded up by approximately 10% (90).

APPENDIX II- ORIGINAL SURVEY- SEASON ONE QUESTIONNAIRE

The following questionnaire is the version that was printed and used in the field during the first survey phase in October 2011.

ENCUESTA DE NUTRICIÓN Y SALUD 2011

NORTE AMAZÓNICO BOLIVIA

CONFIDENCIALIDAD

Toda la información colectada en esta encuesta es estrictamente confidencial y será usada solo con fines estadísticos o de planificación. La publicación se realizará en formato resumido y las encuestas individuales no serán publicadas.

IDENTIFICACIÓN DE LA INFORMACIÓN: SUPERVISOR
(Llenado por el supervisor)

IDENTIFICACIÓN GEOGRÁFICA

DEPARTAMENTO
1= Beni
2= Pando

☐

MUNICIPIO
1=Riberalta
2=Gonzalo Moreno
3=Sena
4=San Lorenzo
5= Otro (especificar)

_____

☐

TCO
Nombre:_____

COMUNIDAD
Nombre:_____

BARRIO / ZONA / OTB
Nombre:_____

REGISTRO DE LA ENTREVISTA

ENTREVISTADOR ASIGNADO

Nombre y apellido: _____

COORDINADOR DE GRUPO

Nombre:_____
Firma:_____
Comentarios:_____

SUPERVISOR DE GRUPO
Nombre:_____
Firma:_____
Comentarios:_____

ID. DEL ESTRATO:
☐☐☐

ID. DE LA MANZANA:
☐☐☐☐☐☐☐

ID. DEL HOGAR No.
☐☐☐

*****Antes de empezar lea el "la carta de presentación", espere el consentimiento de la persona a ser encuestada y complete el formulario*****

IDENTIFICACIÓN DE LA INFORMACIÓN - ENCUESTADOR

(Llenado por el encuestador)

REGISTRO DE VISITAS AL PREDIO/HOGAR ASIGNADO

NUMERO DE VISITA: 1

Fecha:_____
Hora de visita:_____

Dirección:
_____
Nr. Casa:
_____

1. Vivienda ocupada SIN personas presentes

→ **Pasar a VISITA 2**

2. Vivienda habitada con personas presentes pero sin persona hábil para la realización de la encuesta

→ **Pasar a VISITA 2**

3. Vivienda habitada con personas presentes y persona hábil para la realización de la encuesta, dispuesta

→ **REALIZAR LA ENCUESTA**

4. Vivienda habitada con personas presentes y persona hábil para realizar la encuesta no dispuesta para la realización de la encuesta

→ **Asignar NUEVA VIVIENDA**

5. Vivienda NO habitada

→ **Asignar NUEVA VIVIENDA**

☐

NUMERO DE VISITA: 2

Fecha:_____
Hora de visita:_____

1. Vivienda ocupada SIN personas presentes

→ **Pasar a VISITA 3**

2. Vivienda habitada con personas presentes pero sin persona hábil para la realización de la encuesta

→ **Pasar a VISITA 3**

3. Vivienda habitada con personas presentes y persona hábil para la realización de la encuesta, dispuesta

→ **REALIZAR LA ENCUESTA**

4. Vivienda habitada con personas presentes y persona hábil para realizar la encuesta no dispuesta para la realización de la encuesta

→ **Asignar NUEVA VIVIENDA**

5. Vivienda NO habitada

→ **Asignar NUEVA VIVIENDA**

☐

NUMERO DE VISITA: 3

Fecha:_____
Hora de visita:_____

1. Vivienda ocupada SIN personas presentes

→ **Asignar NUEVA VIVIENDA**

2. Vivienda ocupada con personas presentes pero sin persona hábil para la realización de la encuesta

→ **Asignar NUEVA VIVIENDA**

3. Vivienda ocupada con personas presentes y persona hábil para la realización de la encuesta, dispuesta

→ **REALIZAR LA ENCUESTA**

4. Vivienda habitada con personas presentes y persona hábil para realizar la encuesta no dispuesta para la realización de la encuesta

→ **Asignar NUEVA VIVIENDA**

5. Vivienda NO habitada

→ **Asignar NUEVA VIVIENDA**

☐

IDENTIFICACIÓN DE LA INFORMACIÓN - ENCUESTADOR

(Llenado por el encuestador)

REGISTRO DE VISITAS AL NUEVO PREDIO/HOGAR ASIGNADO

ID. DEL NUEVO HOGAR ASIGNADO No. ☐☐☐

ID. DE LA NUEVA MANZANA ASIGNADA *(solo si cambia la manzana)*: ☐☐☐☐☐☐☐

NUMERO DE VISITA: 1

Fecha:_____
Hora de visita:_____

Dirección:
_____
Nr. Casa:
_____

1. Vivienda ocupada sin personas presentes

→ Pasar a VISITA 2

2. Vivienda habitada con personas presentes pero sin persona hábil para la realización de la encuesta

→ Pasar a VISITA 2

3. Vivienda habitada con personas presentes y persona hábil para la realización de la encuesta, dispuesta

→ REALIZAR LA ENCUESTA

4. Vivienda habitada con personas presentes y persona hábil para realizar la encuesta no dispuesta para la realización de la encuesta

→ Asignar NUEVA VIVIENDA

5. Vivienda NO habitada

→ Asignar NUEVA VIVIENDA

☐

NUMERO DE VISITA: 2

Fecha:_____
_
Hora de visita:_____

1. Vivienda ocupada sin personas presentes

→ Pasar a VISITA 3

2. Vivienda habitada con personas presentes pero sin persona hábil para la realización de la encuesta

→ Pasar a VISITA 3

3. Vivienda habitada con personas presentes y persona hábil para la realización de la encuesta, dispuesta

→ REALIZAR LA ENCUESTA

4. Vivienda habitada con personas presentes y persona hábil para realizar la encuesta no dispuesta para la realización de la encuesta

→ Asignar NUEVA VIVIENDA

☐

NUMERO DE VISITA: 3

Fecha:_____
Hora de visita:_____

1. Vivienda ocupada sin personas presentes

→ Asignar NUEVA VIVIENDA

2. Vivienda ocupada con personas presentes pero sin persona hábil para la realización de la encuesta

→ Asignar NUEVA VIVIENDA

3. Vivienda ocupada con personas presentes y persona hábil para la realización de la encuesta, dispuesta

→ REALIZAR LA ENCUESTA

4. Vivienda habitada con personas presentes y persona hábil para realizar la encuesta no dispuesta para la realización de la encuesta

→ Asignar NUEVA VIVIENDA

☐

MODULO 1: MIEMBROS DEL HOGAR

Vamos a empezar la encuesta hablando de las personas que viven en su hogar.

1. ¿Cuántas personas viven en el hogar? ☐☐ Personas

	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
ANOTAR NOMBRES EN LA	*(Indagar la respuesta, no leer las opciones listadas)* **¿Cuál es la relación de parentesco de (NOMBRE) con usted?** 1= entrevistada(o) 2=esposo(a)/ conviviente 3=hijo(a) 4=madre/padre, 5= abuelo(a) 6=nieto(a) 7=hermano(a) 8=nuera/ yerno 9=suegro(a) 10= otro pariente 11=empleado(a) 12=otro no pariente	**¿Qué sexo tiene (NOMBRE)?** 1=Hombre 2=Mujer	**¿Qué edad tiene (NOMBRE)?** *(Anotar el número de años cumplidos, si es niño(a) menor de un año anotar 0)*	**¿Dónde nació (NOMBRE)?** *(Anotar el municipio)* *(Si nació en el exterior, mencionar nombre del país y año de llegada a Bolivia)*	*(Indagar respuesta)* **¿Cuál es el origen étnico de (NOMBRE)?** 1=no indígena 2=tacana 3= ese-ejja, 4=cavineño, 5=chacobo 6=otro indígena *(especificar)* 7=quechua, 8= aymara	*(Indagar respuesta)* **(NOMBRE) ¿Con que idioma mayormente se comunica?** 1=español 2=tacana 3= ese-ejja, 4=cavineño, 5=chacobo 6=quechua, 7= aymara 8=otro indígena 9=extranjero	*(Indagar respuesta)* **¿Cuál es la lengua con la que aprendió a hablar (NOMBRE)?** *(Anotar lengua materna)* 1==español 2=tacana 3= ese-ejja, 4=cavineño, 5=chacobo 6=quechua, 7= aymara 8=otro indígena 9=extranjero	*(Solo para personas mayores de 7 años de edad)* **¿(NOMBRE) sabe leer?** 1=Si 2=No	*(Solo para personas mayores de 7 años de edad)* **¿(NOMBRE) sabe escribir?** 1=Si 2=No	*(Solo para personas mayores de 7 años de edad)* **¿Actual-mente (NOMBRE) estudia en un centro de educación (escuela, colegio, universidad)?** 1=Si 2=No	**¿Cuál es el mayor nivel de estudio de (NOMBRE)?** 1=ninguna 2=nivel primario incompleto 3=nivel primario completo 4=nivel secondario incompleto 5= nivel secondario completo 6= nivel superior incompleto 7=nivel superior completo
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

MODULO 2: VIVIENDA

Ahora vamos a hablar acerca de su vivienda

(Anotar por observación: No preguntar a la encuestada(o) a menos que no esté seguro)

14. ¿Cuál es el tipo de la vivienda que ocupa el hogar?

1= Casa
2= Departamento en edificio
3= Cuarto o habitación
4= Vivienda improvisada (carpa
5= Otro (especificar):

_____ ☐

(Indagar la respuesta, puede leer las opciones listadas)

15. ¿La vivienda que ocupa el hogar es:

1=Propia de alguien del hogar
2=Cedida
3=Prestada por parientes o amigos
4=Alquilada
5=Anticrético
6= Otro (especificar)

_____ ☐

(Indagar la respuesta, puede leer las opciones listadas)

16. ¿Cuál es el principal material utilizado en el techo de la casa?

1= Calamina de zinc
2= Calamina de fibrocemento
3= Teja
4= Losa de hormigón armado
5= Hoja de patujú/motacú
6= Hoja de jatata
7= Otro (especificar):

_____ ☐

(Indagar la respuesta, puede leer las opciones listadas)

17. ¿Cuál es el principal material utilizado en los pisos?

1= Tierra
2= Cemento (no liso)
3= Piso quemado (liso)
4=Ladrillo
5= Cerámica
6= Tablas de madera
7= Machihembre o parquet
8= Otro (especificar):

_____ ☐

(Indagar la respuesta, puede leer las opciones listadas)

18. ¿Cuál es el principal material utilizado en las paredes?

1= Ladrillo/bloques de cemento/hormigón
2= Tabique
3= Tablas de madera
4= Adobe
5= Pachiuba /Tacuara
6= Chuchio
7= Hule/plástico
8= Otro (especificar):

_____ ☐

(No preguntar a la encuestada(o) a menos que no esté seguro)

19. La casa cuenta con:

(Marcar todas según corresponda)

1=Si / 2=No

1= Radio…….……..…… ☐
2= Televisor……..……..…… ☐
3= Teléfono celular…….…… ☐
4= Teléfono fijo……..……..…… ☐
5= Refrigerador……..……..… ☐
6= Frezer/Congeladora……..…… ☐
7= Computadora……..…….…..… ☐
8= Bomba eléctrica de agua…..…… ☐
9= Internet……..……..…… ☐
10= Máquina de coser o telar……..… ☐
11= Bicicleta……..……..…… ☐
12= Motocicleta……..……..…… ☐
13= Auto/Camión……..……..… ☐
14= Embarcación……..…… ☐

(Indagar la respuesta, no leer las opciones listadas)

20. ¿Cuál es la principal fuente de energía que utiliza en su hogar para cocinar?

1=Leña
2= Carbón
3=Gas (garrafa)
4=Electricidad
5=Bosta
6=Otro (especificar):

_____ ☐

21. ¿La casa cuenta con energía eléctrica para alumbrar?

1= Si
2= No → ***Pasar a la P26*** ☐

(Indagar respuesta, no leer opciones listadas)

22. ¿Cuál es la fuente de electricidad?

1= Red eléctrica/cableado
2= Generador propio
3= Generador de la comunidad
4= Panel solar
5= Otra (especificar):

_____ ☐

23. ¿Existen periodos en los que no cuenta con energía eléctrica durante el día?

1= Si
2= No→ **Pasar al MODULO 3** ☐

(Leer las opciones listadas, en caso de que sea necesario)

24. ¿Cuán frecuentemente son los cortes?

1= Regularmente/es programado
2= Irregularmente/ no es programado ☐

25. ¿Cuántas horas por día usted tiene electricidad de la red pública?

☐☐ Horas

→ **Pasar al MODULO 3**

(Indagar respuesta, no leer opciones listadas)

26. ¿Con qué ilumina su vivienda?

1= Lámpara
2= Mechero/lamparina
3= Linterna
4= Vela
5= Otra (especificar):

_____ ☐

MODULO 3: HIGIENE Y SANEAMIENTO

Ahora vamos a hablar acerca del fuente de agua y la higiene del hogar

(Leer las opciones listadas)

27. ¿La fuente de agua para beber se encuentra:

1= Dentro del predio/terreno *(Incluye patio/terreno)*
2= Fuera del predio/terreno → ***Pasar a la P29***

☐

(Indagar la respuesta, no leer opciones listadas)

28. ¿Cuál es la fuente (procedencia) principal del agua que utilizan los miembros de su familia para beber?

(Repuesta para fuente de agua dentro del hogar)

1= Red por cañería en la casa
2= Pileta en el jardín/patio
3= Noria entubada con tapa
4= Noria entubada sin tapa
5= Noria sin entubar con tapa
6= Noria sin entubar sin tapa
7=Agua de lluvia (en casa)
8=Otro (especificar):

_____ ☐

→ **Pasar a la P32**

(Indagar la respuesta, no leer opciones listadas)

29. ¿Cuál es la fuente (procedencia) principal del agua que utilizan los miembros de su familia para beber?

(Repuesta para fuente de agua fuera del hogar)

1= Noria entubada con tapa
2= Noria entubada sin tapa
3= Noria sin entubar con tapa
4= Noria sin entubar sin tapa
5=Pileta pública
6= Río
7=Arroyo
8=Laguna
9=Paúro/vertiente
10=Agua embotellada
11=Agua de cisterna
12=Piscina
13=Otro (especificar):

_____ ☐

30. ¿Cuánto tiempo tarda en ir desde la casa llegar a la fuente de agua para beber, recoger el agua y volver a su casa?

☐☐☐ Minutos

(Indagar la respuesta, no leer opciones listadas)

31. ¿Quién habitualmente recoge o acarrea el agua para beber que se emplea en su hogar?

1= Mujer adulta
2= Hombre adulto
3= Niño de menos de 15 años de edad
4= Responsabilidad compartida entre varios miembros de la familia
5= Otra (especificar):

_____ ☐

32. ¿Usted realiza algún tratamiento al agua antes de beberla?

1 = Si
2 = No → ***Pasar a la P34***

☐

(Indagar la respuesta, no leer opciones listadas)

33. ¿Qué tipo de tratamiento realiza al agua?

(Marcar todas las casillas) 1=Si / 2=No

.

1= La hierve……..... ☐
2= Le coloca cloro ……...……. ☐
3= La cuela/cola ……..……. ☐
4= La filtra con ceramica/arena……..…… ☐
5= La purifican con luz solar……....…… ☐
6= La dejan reposar y decantar…...…… ☐
7= Filtra con tela…..……...…… ☐
8. Otro (especificar):

_____ ☐

34. ¿La fuente de agua que emplea para cocinar es la misma que para beber?

1= Si → ***Pasar a la P38***
2= No

☐

(Leer las opciones listada)

35. ¿La fuente de agua para cocinar se encuentra:

1= Dentro del predio/terreno*(Incluye patio/terreno)*
2= Fuera del predio/terreno → ***Pasar a la P37***

☐

(Indagar la respuesta, no leer opciones listadas)

36. ¿Cuál es la fuente/procedencia principal del agua que utilizan los miembros de su familia para cocinar?

(Repuesta para fuente de agua dentro del hogar)

1= Red por cañería en la casa
2= Pileta en el jardín/patio
3= Noria entubada con tapa
4= Noria entubada sin tapa
5= Noria sin entubar con tapa
6= Noria sin entubar sin tapa
7=Agua de lluvia (en casa)
8=Otro (especificar):

_____
____

☐

-→ Pasar a la P38

(Indagar la respuesta, no leer opciones listadas)

37. ¿Cuál es la fuente/procedencia principal del que utilizan los miembros de su familia para cocinar?

(Repuesta para fuente de agua fuera del hogar)

1= Noria entubada con tapa
2= Noria entubada sin tapa
3= Noria sin entubar con tapa
4= Noria sin entubar sin tapa
5=Pileta pública
6= Río
7=Arroyo
8=Laguna
9=Paúro/vertiente
10=Agua embotellada
11=Agua de cisterna
12=Piscina
13=Otro (especificar):

_____

☐

38. ¿La fuente de agua que emplea para lavarse las manos es la misma que para beber?

1= Si→ ***Pasar a la P43***
2= No

☐

39. ¿La fuente de agua que emplea para lavarse las manos es la misma que para cocinar?

1= Si→ ***Pasar a la P43***
2= No

☐

(Leer las opciones listadas)

40. ¿La fuente de agua para lavarse las manos se encuentra:

1= Dentro del predio/terreno*(Incluye patio/terreno)*
2= Fuera del predio/terreno → ***Pasar a la P42***

☐

(Indagar la respuesta, no leer opciones listadas)

41. ¿Cuál es la fuente (procedencia) principal del agua que utilizan los miembros de su familia para lavarse las manos?

(Repuesta para fuente de agua fuera del hogar)

1= Red por cañería en la casa
2= Pileta en el jardín/patio
3= Noria entubada con tapa
4= Noria entubada sin tapa
5= Noria sin entubar con tapa
6= Noria sin entubar sin tapa
7=Agua de lluvia (en casa)
8=Otro (especificar):

_____

☐

→ Pasar a la P43

(Indagar la respuesta, no leer opciones listadas)

42. ¿Cuál es la fuente (procedencia) principal del agua que utilizan los miembros de su familia para lavarse las manos?

(Repuesta para fuente de agua fuera del hogar)

1= Noria entubada con tapa
2= Noria entubada sin tapa
3= Noria sin entubar con tapa
4= Noria sin entubar sin tapa
5=Pileta pública
6= Río
7=Arroyo
8=Laguna
9=Paúro/vertiente
10=Agua embotellada
11=Agua de cisterna
12=Piscina
13=Otro (especificar):

_____ ☐

43. En las últimas 24 horas, ¿Usted se lavó las manos con jaboncillo?

1 = Si
2= No → ***Pasar a la P45***

☐

(Indagar todas las respuestas. No leer las opciones listadas)

44. En las últimas 24 horas ¿Cuándo se lavó las manos con jabón o jaboncillo?

(Marcar todas las casillas, incluida otros)
1=Si / 2=No

1= Antes de manipular y preparar la comida……..……..…….. ☐
2= Antes de dar de comer a los niños…… ☐
3= Después de preparar la comida……. ☐
4= Después del trabajo de campo/trabajo de limpieza…… ☐
5= Después de cambiar/limpiar al bebe…… ☐
6= Después de comer…… ☐
7= Despues de ir al baño…… ☐
8= Otra (especificar):
_____ ☐

45. ¿Usted cuenta en su vivienda con un servicio sanitario (baño o letrina)?

1 = Si
2 = No → ***Pasar a la P48***

☐

(Indagar todas las respuestas. No leer las opciones listadas)

46. ¿Dónde descarga las aguas servidas/servicio sanitario?

1=Alcantarillado
2= Camara septica
3= Pozo ciego/Letrina
4= Otro (especificar):
_____ ☐

47. ¿Es un baño compartido con otro(s) hogar(es)?

1= Si, es compartido
2=No, es de uso exclusivo del hogar

☐

- Pasar a la P49-

(Indagar respuestas, no leer opciones listadas)

48. ¿¿Dónde va al baño?

1= Monte/campo abierto
2= Rio/arroyo/canal/acequia,etc
3= Otro (especificar):

_____
— ☐

(No preguntar a menos que no esté seguro: Recordar la respuesta de la tabla de miembros del hogar)

49. ¿Hay algún (algunos) niño(a)(s) menor(es) a 2 años en el hogar?

1 = Si
2= No → ***Pasar a MODULO 4***

☐

50. ¿El (alguno) de los niño(a)(s) menores de 2 años estuvo (estuvieron) con diarrea en las últimas 2 semanas?

1 = Si
2 = No → ***Pasar a MODULO 4***

☐

51. ¿Se le(s) dio algún tipo de tratamiento para la diarrea?

1 = Si
2 = No → ***Pasar a MODULO 4***

☐

(Indagar todas las respuestas. No leer las opciones listadas)

52. ¿Qué tipo de tratamiento?

(Marcar todas las casillas, incluida otros)
1=Si / 2=No

1= Medicina (Tabletas/jarabes/inyecciones)..... ☐
2= Medicina tradicional……..…….…..…… ☐
3= Suero/Soluciones de rehidratación oral/electrolitos……..……...…….…… ☐
4= Otro (especificar): ☐
_____

53. ¿Buscó ayuda o tratamiento para tratar la diarrea?

1 = Si
2 = No → ***Pasar a MODULO 4***

☐

(Indagar la respuesta. no leer opciones listadas)

54. ¿Dónde o de quién recibió la ayuda o tratamiento?

(Marcar todas las casillas, incluida otros)
1=Si / 2=No

1= Hospital/seguro……..…… ☐
2= Clínica privada……...…… ☐
3= Partera…… ☐
4= Medico tradicional…… ☐
5= Amigos…… ☐
6= Familiar/Vecino…… ☐
7= Madre o suegra…… ☐
8= Otro (especificar):
_____ ☐

MODULO 4: ACTIVIDADES ECONÓMICAS

Ahora necesito que hablemos sobre las ocupaciones que realiza usted y los miembros de su hogar para obtener sus ingresos económicos

(Solo para personas mayores de 5 años)

	55.	56.	57.	58.	59.	60.	61.	62.
VER NOMBRES ANOTADOS EN LA SOLAPA	**(NOMBRE) trabajó en el último mes?** 1=Si → ***Pasar a la P57*** 2=No	*(Anotar el número de la pregunta que responda afirmativamente)* **Durante el último mes, (NOMBRE) dedicó al menos un día o parte del día a:** 1=¿Trabajar en cultivos agrícolas o en la crianza de animales? 2=¿Atender o ayudar en algún negocio propio o familiar? 3= ¿Vender en la calle en un puesto o como ambulante? 4=¿Preparar alimentos, hilar, tejer, coser u otras actividades para la venta o trueque o intercambio? 5=¿Prestar servicios a otras personas por remuneración o por comida (lavar ropa ajena, cortar cabello, dar clases particulares, etc.)? 6=¿Realizar alguna otra actividad por la cual ganó dinero? 7=Ninguna actividad → ***Pasar a la P62***	**¿Cuál fue la principal ocupación de (NOMBRE)?**	*(Anotar el número de la pregunta que responda afirmativamente)* **En esa ocupación (NOMBRE):** 1=¿Contrató otras personas para que lo ayuden a realizar el trabajo? *(Patrón/empleador)* 2=¿Trabaja en asociación con otras personas? *(Socio)* 3=¿Fue contratado por otra persona? (*Obrero/Empleado)* 4=¿Realizó esta ocupación por cuenta propia? *(Trabajador cuenta propia)* 5=¿Trabajó en cooperación con otras personas fuera del ámbito familiar? *(Cooperativista)* 6=¿Trabajó con familiares? *(Trabajador familiar)* 7=¿Trabajó como aprendiz sin remuneración? *(Aprendiz sin remuneración)*	**Este mes (NOMBRE) ¿tuvo una segunda ocupación?** 1=Si 2=No → ***Pasar a la P63***	**¿Cuál es la segunda ocupación de (NOMBRE)?**	**¿Cuál de estas actividades le reporta más ingresos económicos (NOMBRE?** 1=Principal 2=Secundaria 3=no sabe **→ Pasar a la P63 -**	**¿Por qué no trabajó el último mes?** *(Llenar solo si no trabajó el último mes)* *(Indagar la respuesta)* 1=Enfermedad 2=Buscando trabajo 3= Estudiante 4=Labores de casa 5= Jubilado/ Pensionado/ rentista 6= con discapacidad 7=Otro
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								

	63.	64.	65.	66.	67.	68.
VER NOMBRES ANOTADOS EN LA	**En el último año, (NOMBRE) ¿ha realizado algún tipo de actividad pesquera con fines comerciales?** 1=Si 2=No →***Pasar a P 65***	**(NOMBRE) ¿cuánto tiempo dedica a la pesca comercial?** 1=Tiempo completo (Más del 90% del tiempo) 2= Medio tiempo (30-90% del tiempo) 4= Tiempo parcial (menos 30% del tiempo) 5=Otros (especificar)	**En el último año, (NOMBRE) ¿ha realizado algún tipo de actividad pesquera para consumo exclusivo del hogar?** 1=Si 2=No	**En el último año, (NOMBRE) ¿ha realizado algún tipo de actividad pesquera con fines deportivos?** 1=Si 2=No	**(NOMBRE) en el último año ¿ha realizado otras actividades relacionadas a la pesquería?** 1=Si 2=No →***Pasar a P69***	¿**Qué tipo de actividad realiza?** 1=Estibador (cargador de pescado) 2=Tejedor de mallas o redes 3=Hieleria 4=Constructor de embarcaciones 5=Cocinera en embarcaciones pesqueras 6=Transporte de pescado 7=Otros (especificar)
1						
2						
3						
4						
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7						
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11						
12						

69. ¿Cuentan con algún insumo para realizar pescas?

1= Si
2= No → ***Pasar a la P71***

☐

(Indagar respuestas. No leer opciones listadas)

70. ¿Cuál tipo de insumo?

(Marcar todas las casillas, incluida otros)
1=Si / 2=No

1=Propietario de embarcación pesquera Pequeña (canoa/Chalupa)…… ☐

2=Propietario de embarcación pesquera mediana (Chalupa grande)..…… ☐

3=Propietario de embarcación pesquera grande (Casco) ……..…….…… ☐

4=Equipo de pesca para pesca comercial…….…… ☐

5=Equipo de pesca para pesca deportiva…….…… ☐

Otros (especificar)

_____ ☐

71. ¿El hogar cuenta con algún ingreso económico adicional (p.e. remesas, rentas, alquileres, Bonos, Juancito Pinto, etc.)?

1= Si
2= No → **Pasar al MODULO 5**

☐

(Leer opciones listadas)

72. ¿Cuál es la fuente de ingreso adicional?

(Marcar todas las casillas, incluida otros)
1=Si / 2=No

1=Remesas…… ☐
2=Rentas…….. ☐
3=Alquileres…… ☐
4=Intereses…….. ☐
5=Asistencia familiar…….…….…… ☐
6=Herencia…….…….…….…… ☐
7= Ayuda del gobierno (Bonos Juana Azurduy, Juancito Pinto……..……..…… ☐
8= Otros (ONGs, iglesia, OTBs)……..…….… ☐
9= Becas……..……..……..…… ☐
10=Préstamos bancario → ***Pasar a la P73*** …..… ☐
11=Otros:
_____ ☐

Todas las opciones listadas a excepción de la 10 → **Pasar al MODULO-5**

(Indagar respuestas. No leer opciones listadas)

73. ¿Qué tipo de préstamo recibió?

1= Individual (Encuestada (o) u otro miembro de la familia)
2= Grupal
3= En asociación
4= En cooperativa
5= Otro (especificar):

_____ ☐

(Indagar respuestas. No leer opciones listadas)

74. Si fue individual, ¿Qué miembro del hogar recibió el crédito bancario?

1 = Esposa/mujer de la casa
2 = Esposo/Hombre de la casa
3=Ambos
4= Otro (especificar):

_____ ☐

MODULO 5: DIETA DE LOS MIEMBROS DEL HOGAR Y CONSUMO DE PESCADO

Ahora hablaremos sobre el lugar dónde comieron los miembros de su hogar ayer.

	75.	76.	77.	78.	79.
VER NOMBRES ANOTADOS EN LA SOLAPA	**Ayer, ¿Desayunó?** 1=No desayuno **Si respondió que si: ¿dónde?** 2= Hogar 3=Restaurante: 4=Pension: 5=Casa de familiares o amigos 6=En el mercado 7=En el trabajo (campo, oficina, etc.) 8=Otro	**Ayer, ¿comió merienda a media mañana?** 1=No media mañana **Si respondió que si: ¿dónde?** 2= Hogar 3=Restaurante: 4=Pension: 5=Casa de familiares o amigos 6=En el mercado 7=En el trabajo (campo, oficina, etc.) 8=Otro	**Ayer, ¿almorzó?** 1=No almorzó **Si respondió que si: ¿dónde?** 2= Hogar 3=Restaurante: 4=Pension: 5=Casa de familiares o amigos 6=En el mercado 7=En el trabajo (campo, oficina, etc.) 8=Otro	**Ayer, ¿comió merienda a media tarde?** 1=No media tarde **Si respondió que si: ¿dónde?** 2= Hogar 3=Restaurante: 4=Pension: 5=Casa de familiares o amigos 6=En el mercado 7=En el trabajo (campo, oficina, etc.) 8=Otro	**Ayer, ¿cenó?** 1=No cenó **Si respondió que si: ¿dónde?** 2= Hogar 3=Restaurante: 4=Pension: 5=Casa de familiares o amigos 6=En el mercado 7=En el trabajo (campo, oficina, etc.) 8=Otro
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

COMPOSICIÓN DE LA DIETA AYER: MADRE (ENCUESTADA)

Ahora hablemos de lo que usted comió ayer (desde que se despertó hasta que se fue a dormir por la noche).

(Leer cada una de las respuestas para cada una de las categorías)

80. AYER, ¿Usted comió alguno de los siguientes alimentos?

(Marcar todas las casillas)

1=Si / 2=No

a. Cereales: Quinua, arroz, cebada, pan, maíz, fideo, o cualquier comida preparada con granos de cereales. ☐

b. Vegetales anaranjados: Zanahoria, calabaza, camote, algún tipo de zapallo anaranjados. ☐

c. Hortalizas/tubérculos (blancos): Papa, oca, yuca, chuño o cualquier tipo de alimento de tipo hortalizas blancas. ☐

d. Vegetales de hojas verdes: Espinaca, acelga o cualquier tipo d vegetales de hojas verdes oscuras. ☐

e. Frutas anaranjadas: Mangos maduros, papaya madura, melón anaranjado, durazno, otras. ☐

f. Otra fruta o verdura: Cualquier fruta o verdura no mencionada arriba (naranja, guineo, guayaba, cebolla, lechuga, tomate, etc.). ☐

g. Víceras: Hígado, riñon, corazón. ☐

h. Carne:

Vaca/Res ……..……..…… ☐

Chancho/Cordero.…….……..…… ☐

Carne de monte ……..…… ☐

Peta ……...……..…… ☐

Lagarto ……..……..…… ☐

Pollo…….……..…… ☐

Otro ..…….. ☐

i. Huevos:

Gallina ……..……..…… ☐

Pato……..…… ☐

Tortuga /peta.……..…… ☐

Otro ..…….. ☐

j. Pescado: Cualquier tipo de pescado ☐

k. Leguminosas, legumbres: Cualquier tipo de frijoles, lentejas, arveja, o productos que los contengan. ☐

l. Nueces: Almendra, castaña productos que los contengan. ☐

m. Leche: Leche de vaca, leche en polvo, leche evaporada. ☐

n. Productos lácteos: queso, yogurt u otros productos lácteos. ☐

o. Aceites y grasas: Cualquier tipo de aceite, leche de coco o comida preparada con ella ☐

p. Azúcar/miel: cualquier tipo de azúcar o productos que contengan azúcar (galletas, o miel. ☐

q. Sodas, gaseosas, jugos de fruta, jugos de soya ☐

r. Otra *(Listar cualquier tipo de comida que sea importante en la dieta de la madre)*:

_____

_____ ☐

81. ¿AYER fue un típico día de consumo de alimento para usted?

1= Si → ***Pasar a la P83***
2= No ☐

(Indagar la repuesta, no leer las opciones listadas)

82. ¿Por qué?

1= No tenía hambre
2=Estaba enferma(o)
3= No había suficiente comida
4= Día de fiesta/se consumió más de lo usual
5= Otro (especificar):

_____ ☐

(No preguntar a menos que no esté seguro: Recordar la respuesta de la tabla de miembros del hogar)

83. ¿Tiene hijos entre 2 y 5 años?

1= Si
2= No ➔ ***Pasar a la P89*** ☐

84. ¿Usted ha consumido tabletas de hierro durante su embarazo?

1= Si
2= No
3= No estoy segura ☐

85. ¿Su hijo entre 2 y 5 años recibió leche materna durante los primeros seis meses de vida?

1= Si, los 6 meses
2= No, nada
3=Algunos meses: ☐

86. ¿A qué edad (cuantos meses) de este hijo le suspendió la lactancia (no incluye fórmulas)?

☐☐ meses

87. ¿A qué edad su hijo entre 2 y 5 años comenzó a recibir comida semi-solida o solida?

☐☐ meses

88. Su hijo entre 2 y 5 años comió algo sólido o semi sólido en los primeros 6 meses de vida?

1= Si
2= No ☐

(No preguntar a menos que no esté seguro: Recordar la respuesta de la tabla de miembros del hogar)

89. ¿Hay algún niño en el hogar de entre 6 meses y 24 meses?

1= Si
2= No ➔ ***Pasar a la P98*** ☐

90. ¿Qué edad tiene el menor de los niños(as) entre 6 meses y 2 años?

☐☐ meses

(Indagar la repuesta, no leer las opciones listadas)

91. ¿Quién es el responsable de preparar la comida para el/la/los niño(a)(s)?

1= Usted (madre/responsable de los niños)
2= Su pareja
3= Su madre o padre
4= Su hija mayor
5= Otro pariente (especificar):

_____ ☐

COMPOSICIÓN DE LA DIETA DE AYER: NIÑOS(AS) (ENTRE 6 MESES Y 2 AÑOS)

Ahora hablemos acerca de la comida consumida ayer en el hogar por el menor de los niños que se encuentra entre 6 meses y 2 años

92. Ayer ¿El niño comió algo sólido o semi sólido, incluida la noche?

(Incluye las comidas principales – desayuno, almuerzo y cena- y las meriendas)

Número total de comidas que el niño consumió el día de ayer: ☐☐

93. ¿Cuántas porciones de comida en total el (la) niño(a) comió ayer?

(Mostrar las tazas de porciones que se usan para el consumo de carnes)

1=0.5 porción o menos
2=1 porción
3=1.5 porción
4=2 porción
5= 2.5 porción
6=Más de 3 porción ☐

Leer cada una de las respuestas para cada una de las categorías)

94. AYER, ¿el (la) niño(a) comió alguno de los siguientes alimentos?

(Marcar todas las casillas)

1=Si / 2=No

a. Leche materna ☐

b. Agua pura ☐

c. Agua dulce, soda, jugos ☐

d. Sopas/caldos ☐

e. Leche en polvo para recién nacidos ☐

f. Leche de vaca, en polvo o fresca ☐

g. Te, café ☐

h. Otro líquido ☐

i. Cereales: Quinua, arroz, cebada, pan , maíz, fideo, o cualquier comida preparada con granos de cereales ☐

j. Vegetales anaranjados: Zanahoria, calabaza, camote, algún tipo de zapallo anaranjada. ☐

k. Hortalizas/tubérculos (blancos): Papa, oca, yuca, chuño o cualquier tipo de alimento de tipo hortalizas blancas ☐

l. Vegetales de hojas verdes: Espinaca, acelga o cualquier tipo d vegetales de hojas verdes oscuras. ☐

m. Frutas anaranjadas: Mangos maduros, papaya madura, melón anaranjado, durazno, otras ☐

o. Otra fruta o verdura: Cualquier fruta o verdura no mencionada arriba (naranja, guineo, guayaba, cebolla, lechuga, tomate, etc.) ☐

p. Víceras: Hígado, riñon, corazón. ☐

q. Carne:

Vaca/Res ……..……..…… ☐

Chancho/Cordero.…….……..…… ☐

Carne de monte ……..…… ☐

Peta ……...……..…… ☐

Lagarto ……..……..…… ☐

Pollo…….……..…… ☐

Otro ..…….. ☐

r. Huevos:

Gallina ……..……..…… ☐

Pato……..…… ☐

Tortuga /peta.……..…… ☐

Otro ..…….. ☐

s. Pescado: Cualquier tipo de pescado ☐

t. Leguminosas, legumbres: Cualquier tipo de frijoles, lentejas, arveja, o productos que los contengan ☐

u. Nueces: Almendra, castaña productos que los contengan ☐

v. Aceites y grasas: Cualquier tipo de aceite, grasa o leche de coco, o comida elaborada con ellos ☐

w. Otra: *(Listar cualquier tipo de comida que sea importante en la dieta del niño)*:

_____

_____ ☐

95. ¿AYER fue un típico día de consumo de alimento para el niño(a)?

1= Si ➔ ***Pasar a la P 97***
2= No ☐

(Indagar la respuesta, no leer las opciones listadas)

96. ¿Por qué no fue un típico día de comida?

1= No tenía hambre
2= Estaba enfermo
3= No había suficiente comida
4= Día de fiesta/se consumió más de lo usual
5= Otro (especificar):

_____ ☐

(Si en la sección de composición de la dieta para las últimas 24 horas del niño identificó que comió pescado preguntar y leer las opciones listadas)

97. ¿En qué forma le dio pescado?

1= En pedazos/pequeñas piezas
2= En puré
3= En sopa o licuado.
4= En polvo
5= Otro (especificar):

_____ ☐

RECORDATORIO DE 24 HORAS (AYER)
CONSUMO DE CARNES Y PESCADO: FAMILIA

Ahora vamos a hablar acerca de las carnes, y principalmente del pescado, que han consumido AYER en su hogar.

98. AYER ¿Alguno de los miembros de la familia comieron algún tipo de carne, incluido el pescado en la comida?

1= Si
2= No → ***Pasar a P99*** ☐

i. Carne de res (vaca)

1= Si
2= No → ***Pasar a ii*** ☐

Anotar en los recuadros el número que la persona entrevistada declaró que consumieron en la familia, con 0.5 de precisión

Cantidad de kilogramos: ☐☐,☐

Cantidad de tazas: ☐☐,☐

ii. Carne de monte (p.e. mono, jochi, chancho de monte, ciervo, etc.)
(No incluye aves)

1= Si
2= No → ***Pasar a iii*** ☐

Anotar en los recuadros el número que la persona entrevistada declaró que consumieron en la familia, con 0.5 de precisión

Cantidad de kilogramos: ☐☐,☐

Cantidad de tazas: ☐☐,☐

iii. Carne de chancho o cordero

1= Si
2= No → ***Pasar a iv*** ☐

Anotar en los recuadros el número que la persona entrevistada declaró que consumieron en la familia, con 0.5 de precisión

Cantidad de kilogramos: ☐☐,☐

Cantidad de tazas: ☐☐,☐

iv. Aves silvestres (p.e. pava)
(No incluye pollo)

1= Si
2= No → ***Pasar a v*** ☐

Anotar en los recuadros el número que la persona entrevistada declaró que consumieron en la familia, con 0.5 de precisión

Cantidad de kilogramos: ☐☐,☐

Cantidad de tazas: ☐☐,☐

v. Carne de Pollo

1= Si
2= No → ***Pasar a vi*** ☐

Anotar en los recuadros el número que la persona entrevistada declaró que consumieron en la familia, con 0.5 de precisión

Cantidad de kilogramos: ☐☐,☐

Cantidad de tazas: ☐☐,☐

vi. Carne de lagarto

1= Si
2= No → ***Pasar a vii***

Anotar en los recuadros el número que la persona entrevistada declaró que consumieron en la familia, con 0.5 de precisión

Cantidad de kilogramos: ,

Cantidad de tazas: ,

vii. Carne de peta

1= Si
2= No → ***Pasar a viii***

Anotar en los recuadros el número que la persona entrevistada declaró que consumieron en la familia, con 0.5 de precisión

Cantidad de kilogramos: ,

Cantidad de tazas: ,

viii. Sardina en lata

1= Si
2= No → ***Pasar a ix***

Anotar en los recuadros el número que la persona entrevistada declaró que consumieron en la familia, con 0.5 de precisión

Cantidad de kilogramos: ,

Cantidad de tazas: ,

ix. Atún en lata

1= Si
2= No → ***Pasar a x***

Anotar en los recuadros el número que la persona entrevistada declaró que consumieron en la familia, con 0.5 de precisión

Cantidad de kilogramos: ,

Cantidad de tazas: ,

x. Pescado congelado (del mar)

1= Si
2= No → ***Pasar a xi***

Anotar en los recuadros el número que la persona entrevistada declaró que consumieron en la familia, con 0.5 de precisión

Cantidad de kilogramos: ,

Cantidad de tazas: ,

xi. Pescado amazónico

1= Si → ***Pasar a P100***
2= No

Anotar en los recuadros el número que la persona entrevistada declaró que consumieron en la familia, con 0.5 de precisión

Cantidad de kilogramos: ,

Cantidad de tazas: ,

RECORDATORIO DE ÚLTIMAS 24 HORAS CONSUMO DE PESCADO: FAMILIA

(Si no comieron pescado amazónico preguntar la 99 y si comieron pasar a la P100)

99. Si no se comió pescado ayer, ¿Por qué no?

1= No es época de pescado
2= No teníamos dinero para comprar pescado
3=No teníamos acceso a la laguna/río
4= No me gusta
5= Ya comimos pescado los anteriores días
6= Nunca comemos pescado
7= Otro, (especificar):_____

-Pasar a la P 108 ☐

	100.	**101.**	**102.**	**103.**	**104.**	**105.**	**106.**
N°	**¿Qué especie de pescado comieron ayer?**	**¿Cómo estaba preparado el pescado?** 1= Sopa 2=Sudado 3=Asado al horno 4=Asado a la parrilla 5= Ahumado, 6=Frito 7=Dunucuavi 8=Desmenuzado 9=Tacuara 10=Otros	**¿Qué partes del pescado fueron utilizadas para preparar la comida?** 1=Entero (cabeza y tripas) 2=Destripado (con cabeza y destripado) 3=Pedazo/Filete	*(Mostrar la taza)* **¿Puede calcular cuantas tazas de (ESPECIE) prepararon ayer?**	**¿Cuántos kilogramos de (ESPECIE) prepararon ayer?**	*(Preguntar solo si anotaron 1 o 2 en la P102)* **¿Cuántos individuos de (ESPECIE) prepararon ayer?**	*(Preguntar solo si anotaron 1 o 2 en la P102)* **¿De qué tamaño eran los individuos de (ESPECIE) preparados ayer?**
	(Obligatoria)	*(Obligatoria)*	*(Obligatoria)*	*(Obligatoria)*	*(Obligatoria)*	*(Opcional)*	*(Opcional)*
1							
2							
3							
4							
5							
6							
7							

(Indagar respuestas, no leer opciones listadas)

107.¿Dónde se consumió el pescado comido ayer?

1=Hogar/casa
2=Restaurant
3=Otro (especificar):

_____ ☐

(Indagar respuestas, no leer opciones listadas)

108.¿Usualmente de dónde proviene el pescado que consume su hogar?

(Marcar todas las casillas, incluida otros)
1=Si / 2=No

1= Capturado por un miembro de la familia..... ☐
2= Comprado directamente a un pescador..…..... ☐
3= Comprado a un intermediario…..... ☐
4= Comprado en el Mercado Abastos
San José. ..... ☐
5= Comprado en el Mercado Central..…..... ☐
6= Comprado en una venta/tienda..…..... ..... ☐
7= Comprado en Almacén..…..... ☐
8= Intercambiado/Truequeado..…..... ☐
9= Otro (especificar)

_____. ☐

(Indagar respuestas, no leer opciones listadas)

109. Generalmente el pescado llega a su hogar:

1=fresco
2=semi-congelado
3=congelado
4= charque
5=ahumado
6=otro (especificar):

_____ ☐

(Indagar respuestas, no leer opciones listadas)

110.¿En qué estado de conservación llega el pescado a su hogar?

1=Siempre en buen estado
2=De vez en cuando en mal estado
3=Siempre en mal estado ☐

111.¿Conservan el pescado en su hogar?

1=Si
2=A veces
3= No ➔ ***Pasar a P113*** ☐

(Indagar respuesta, no leer opciones listadas)

112.¿Cómo se conserva el pescado en el hogar?

(Marcar todas las casillas, incluida otros)
1=Si / 2=No

1=en frío (hielo, refrigerador) ….…..... ….…..... ☐
2=charque..…..... ….…..... ….…..... ☐
3=ahumado, ….…..... ….…..... ….…..... ☐
4=Tapado con un trapo..….…..... ….…..... ☐
5=otro (especificar):

_____. ☐

(Indagar respuesta, si es necesario leer las respuestas)

113.¿Consumir pescado es?

1= Muy saludable
2= Poco saludable
3= Neutral
4= No muy saludable
5= No es saludable ☐

(Indagar respuesta, si es necesario leer las respuestas)

114.¿El pescado contribuye a la salud de la mujer?

1= Contribuye mucho
2= Contribuye algo
3= Neutral
4= Contribuye poco
5= No contribuye ☐

(Indagar respuesta, si es necesario leer las respuestas)

115.¿El pescado contribuye a la salud de los niños(as)?

1= Contribuye mucho
2= Contribuye algo
3= Neutral
4= Contribuye poco
5= No contribuye

☐

((Indagar respuesta, si es necesario leer las respuestas)

116.¿El pescado es importante para el crecimiento de los niños?

1= Muy importante
2= Poco importante
3= Neutral
4= No muy importante
5= Nada importante

☐

MODULO 6: SEGURIDAD ALIMENTARIA EN EL HOGAR

Ahora le voy a preguntar sobre los alimentos producidos y/o consumidos en su hogar durante el último año (12 meses)

117.En el último año ¿Cultivaron algún producto para el consumo propio de su hogar?

1= Si
2 = No → ***Pasar a la P121***

☐

	118.	**119.**	**120.**
Cultivar	**En el último año ¿cultivaron (CULTIVAR-*leer de la lista*)?** 1= Si 2 = No → ***Pasar al siguiente CULTIVAR de la lista***	**En el último año ¿El (CULTIVAR -*leer de la lista*)? abasteció la demanda de consumo de la familia?** 1= Si → ***Pasar al siguiente CULTIVAR de la lista*** 2 = No	**En el último año ¿Compraron (CULTIVAR -*leer de la lista*)??** 1= Si 2 = No
Arroz			
Yuca			
Maíz			
Plátano			
Frijol			
Hortaliza			

121.En el último año ¿Criaron animales para el consumo familiar?

1= Si
2 = No → ***Pasar a la P124***

122. ¿Qué animales que criaron comieron?

(Marcar todas las casillas, incluida otros)
1=Si / 2=No

1= Bovinos (Vacas//toro/Cebú/etc.) .....
2= Ovinos (ovejas) .....
3= Porcinos (cerdos) .....
4= Aves de corral (Gallina, pato, pavo) .....
5= Otro (especificar):

_____

123. En el último año ¿Qué productos derivados de los animales que crían se consumieron dentro el hogar?

1= Huevo
2= Leche
3=Otro (especificar):

_____

124. En el último año ¿consumieron carne de animales silvestres proveniente del bosque cazados por algún miembro de su hogar?

1= Si
2 = No

125. En el último año ¿consumieron en el hogar algún alimento que algún miembro de la familia recolectó del bosque (frutas, almendra, etc.)?

1= Si
2 = No

MODULO 6: SEGURIDAD ALIMENTARIA EN EL HOGAR

Ahora vamos a hablar sobre asistencia alimentaria y las necesidades alimentarias de su hogar.

126. En los últimos 12 meses ¿Algún miembro de la familia recibió algún tipo de comida o asistencia alimentaria?

1= Si
2 = No → ***Pasar a P129***

127. ¿Cómo se distribuyó la comida entre los miembros de la familia?

1= Compartida entre los miembros del hogar
2= No compartida con algunos miembros de la familia
3= Compartida con todos los miembros de la familia
4= Otra, (especificar):

_____

(Indagar la respuesta no leer las opciones listadas)

128. ¿De qué fuente recibió la comida o la asistencia alimentaria?

(Marcar todas las casillas, incluida la casilla "Otra")
1=Si / 2=No

1= Trabajo (Subsidio familiar) .....
2= Bonos sociales promovidos por el estado.....
3= Raciones para llevar a casa. .....
4= Dinero para comprar comida.....
5= Banco o cocina comunal….....
6= Programa escolar (desayuno escolar).....
7= Otra (especificar):

_____

129. En los últimos 30 días, ¿Le preocupó que en su hogar no hubiera suficiente alimento?

1 = Si
2 = No → ***Pasar a la P131***

130. Sí responde si, ¿Cuán seguido le ha pasado?

1= Raramente (una a dos veces en los ultimos 30 días)
2= Algunas veces (3-10 veces en los ultimos 30 días)
3= Frecuentemente (mas de10 veces en los ultimos 30 días)

131. En los últimos 30 días, ¿Usted o alguien de su familia no pudo comer los tipos de alimentos preferidos debido a que usted no pudo comprar o cosechar suficiente de estas comidas?

(Indagar mencionando comidas que podrían ser las preferidas como chancho, pollo, vaca, leche, etc.)

1 = Si
2 = No → ***Pasar a la P133***

132. Sí responde si, ¿Cuán seguido le ha pasado?

1= Raramente (una a dos veces en los ultimos 30 días)
2= Algunas veces (3-10 veces en los ultimos 30 días)
3= Frecuentemente (mas de10 veces en los ultimos 30 días)

133. En los últimos 30 días, ¿Usted o alguien de su familia tuvo que comer una variedad limitada de alimentos debido a que usted no pudo comprar o cosechar suficiente de estas comidas?

(Indagar mencionando comidas que podrían mostrar poca variedad en la dieta como arroz, yuca, plátano, etc.)

1 = Si
2 = No → ***Pasar a la P135***

134.Sí responde si, ¿Cuán seguido le ha pasado?

1= Raramente (una a dos veces en los ultimos 30 días)
2= Algunas veces (3-10 veces en los ultimos 30 días)
3= Frecuentemente (mas de10 veces en los ultimos 30 días)

135.En los últimos 30 días, ¿Usted o alguien de la familia tuvo que comer alimentos que realmente no deseaba comer, debido a que usted no pudo comprar u obtener suficiente de estas comidas?

(Indagar mencionando comidas que podrían ser no deseadas como pescado en mal estado, cabeza de pescado, verduras, etc.)

1 = Si
2 = No → ***Pasar a la P137***

136.Sí responde si, ¿Cuán seguido le ha pasado?

1= Raramente (una a dos veces en los ultimos 30 días)
2= Algunas veces (3-10 veces en los ultimos 30 días)
3= Frecuentemente (mas de10 veces en los ultimos 30 días)

137.En los últimos 30 días, ¿Usted o alguien de su familia tuvo que comer menos de lo que sentía que necesitaba, debido a que no había suficiente comida?

(Indagar mencionando que pudo comer poco durante desayuno, meriendas, almuerzo y cena)

1 = Si
2 = No → ***Pasar a la P139***

138.Sí responde si, ¿Cuán seguido le ha pasado?

1= Raramente (una a dos veces en los ultimos 30 días)
2= Algunas veces (3-10 veces en los ultimos 30 días)
3= Frecuentemente (mas de10 veces en los ultimos 30 días)

139.En los últimos 30 días, ¿Usted o alguien de su familia tuvo que comer menos comidas diarias debido a que no había suficiente comida?

(Indagar mencionando las comidas que podrían haberse saltado como desayuno, meriendas, almuerzo y cena)

1 = Si
2 = No → ***Pasar a la P141***

140.Sí responde si, ¿Cuán seguido le ha pasado?

1= Raramente (una a dos veces en los ultimos 30 días)
2= Algunas veces (3-10 veces en los ultimos 30 días)
3= Frecuentemente (mas de10 veces en los ultimos 30 días)

141.En los últimos 30 días ¿alguna vez no hubo absolutamente ningún alimento que comer en su hogar debido a la falta de recursos para adquirirlos?

1 = Si
2 = No → ***Pasar a la P143***

142.Sí responde si, ¿Cuán seguido le ha pasado?

1= Raramente (una a dos veces en los ultimos 30 días)
2= Algunas veces (3-10 veces en los ultimos 30 días)
3= Frecuentemente (mas de10 veces en los ultimos 30 días)

143.En los últimos 30 días ¿Usted o alguien de su familia se fue a dormir por la noche con hambre debido a que no había suficiente comida?

1 = Si
2 = No → ***Pasar a la P145***

144.Sí responde si, ¿Cuán seguido le ha pasado?

1= Raramente (una a dos veces en los ultimos 30 días)
2= Algunas veces (3-10 veces en los ultimos 30 días)
3= Frecuentemente (mas de10 veces en los ultimos 30 días)

145.En los últimos 30 días ¿Usted o alguien de su familia se pasó todo el día (día y noche) sin comer nada debido a que no había suficiente comida?

1 = Si
2 = No → ***Pasar al MODULO 7***

146. Sí responde si, ¿Cuán seguido le ha pasado?

1= Raramente (una a dos veces en los ultimos 30 días)
2= Algunas veces (3-10 veces en los ultimos 30 días)
3= Frecuentemente (mas de10 veces en los ultimos 30 días)

MODULO 7: ACTITUDES Y CONOCIMIENTO MATERNAL
(solo diagnóstico)

(Esta sección es solamente para madres y mujeres embarazadas/ No realizar a mujeres que no sean madres y/o no estén embarazadas)

Si la mujer entrevistada no es madre, ni está embarazada ***→ Pasar a la MODULO 8***

147. ¿En el último mes usted ha recibido consejos de salud?

1= Si
2= No → ***Pasar a la P149***

☐

(Leer las opciones listadas)

148. ¿De cuáles de las siguientes fuentes usted recibió los consejos?

(Marcar todas las casillas, incluida otros)
1=Si / 2=No

1= Radio..... ☐
2= Televisión..... ☐
3= Periódico..... ☐
4= Banner/Poster..... ☐
5= Amigos/vecinos..... ☐
6= Familiar (Madre/suegra) ..... ☐
7= Doctor..... ☐
8= Enfermera ..... ☐
9= Médico naturista..... ☐
10= Otro (especificar):

_____ ☐

149. ¿Usted busco o busca consejos sobre beneficios y dificultades de la lactancia?

1= Si
2= No → ***Pasar a la P151***

☐

(Leer las opciones listadas)

150. ¿En dónde o de quien recibió consejos?

(Marcar todas las casillas, incluida otros)
1=Si / 2=No

1= Hospital/seguro..... ☐
2= Clínica privada..... ☐
3= Partera..... ☐
4= Medico tradicional..... ☐
5= Amigos/Vecino..... ☐
6= Familiar (Madre/suegra..... ☐
7= Otro (especificar):

_____ ☐

(Leer las opciones listadas)

151. ¿Cómo considera usted que se debe dar de lactar a un niño menor de 24 meses que tiene diarrea?

1= Menos que lo usual
2= La misma cantidad
3= Más que lo usual

☐

(Indagar respuestas. No leer opciones listadas)

152. ¿Cuáles cree usted que son las características que debe tener un niño saludable?

(Marcar todas las casillas, incluida otros)
1=Si / 2=No

1= Buen apetito ..... ☐
2= Son activos..... ☐
3= Lucen saludables (no son ni muy gordos ni muy flacos) ..... ☐
4= Crecen bien ..... ☐
5= Otros (especificar):

_____.. ☐

153. Sin contar la leche materna o la leche para bebes recién nacidos ¿Cuantas veces se debería alimentar a los niños en el día?

1. <u>De 6-12 meses</u>:

a. # veces/día: ☐☐

2. <u>De 12-24 meses</u>:

a. # veces/día: ☐☐

154.¿Alguna vez usted escucho sobre la anemia o la deficiencia de hierro?

1= Si
2= No
3= No lo se

155.¿Usted considera que el pescado es una comida importante para su salud?

1= Si
2= No → ***Pasar al MODULO 8***

(Indagar las respuestas, no leer las opciones listadas)

156. ¿Por qué?

(Se puede marcar de una casilla)

1. Porque es una buena fuente de energía.....
2. Porque es importante para la salud de las mujeres….....
3. Porque es importante para el crecimiento y desarrollo de los niños.....
4. Otro (especificar):

_____

MODULO 8: PERCEPCIÓN (PREGUNTAS ABIERTAS)

Ahora me interesa saber su opinión sobre algunos temas generales

157.¿Cuál es la especie de pescado que usted prefiere consumir?

_____

158.¿Cuál es la forma de preparación del pescado que usted prefiere para su consumo?

1= Sopa.... ..... ☐
2=Sudado..... ☐
3=Asado al horno..... ☐
4=Asado a la parrilla..... ☐
5= Ahumado..... ☐
6=Frito..... ☐
7=Dunucuavi..... ..... ☐
8=Desmenuzado..... ☐
9=Tacuara..... ☐
10=Otros (especificar)

_____ ☐

159.¿Qué opinas acerca la calidad de la carne de pescado que se come en su casa?

_____

_____

_____

160.¿Qué opina acerca de la calidad de la carne del paiche?

_____

_____

_____

161. Alguien del hogar forma parte de una organización, asociación, comité, grupo deportista, etc.?

1= Si
2= No → ***Pasar a la P 165*** ☐

	162.	163.	164.
VER NOMBRES ANOTADOS EN LA SOLAPA	*(Indagar la respuesta, no leer las opciones listadas)* **¿A qué tipo de organización pertenece (NOMBRE)?** 1= Agricultores 2= Pescadores 3= Comité Cívico 4= ONG 5= Grupo cultural 5= Grupo de jóvenes 6= Organización de mujeres 7= Comité de escuela/colegio 8= Asociación de deportistas 9= OTB 10= Otros	**¿Cuál es el nombre de la asociación en la que (NOMBRE) participa?**	**¿Cuál es el nivel de participación de (NOMBRE) en la organización?** 1= Líder 2=Muy activo 3=Mas o menos activo 4=Poco activo
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

165. Si tuviera un problema que afecta a toda la comunidad/barrio (p.e. plagas en cultivos o violencia en el barrio), quien se encargaría de resolverlo?

1=Cada familia por su propia cuenta
2=Gobierno municipal
3=Dirigentes
4=OTB
5=Líderes políticos
6=Miembros de todas las familias
7=ONG
8= Asociaciones comunitarias
9= Comité cívico
10=Otros: (especificar)

_____ ☐

166. ¿Qué es lo que más le preocupa en su barrio o comunidad en cuanto a salud, nutrición y seguridad alimentaria?

_____

_____

_____

_____

167. ¿Qué es lo que más le gusta de su barrio o comunidad?

_____

_____

_____

_____

_____

_____

MODULO 9: MEDIDAS ANTROPOMÉTICAS
(Dos medidas de tamaño y peso serán tomadas a la madre y los hijos. Si entre medidas hay una diferencia mayor a 0.5 cm o 0.25 kg, se tomará una tercera medida).

Madre (Talla y peso)

Año de nacimiento: _____

Peso (kg) 1ra medida	Peso (kg) 2da medida	Peso (kg) 3ra medida *(Solo si es necesario)*	Talla (cm) 1ra medida	Talla (cm) 2da medida	Talla (cm) 3ra medida *(Solo si es necesario)*

Niño (a)(s) (menores a 5 años de edad) (Solo talla, peso y diámetro del antebrazo):

Nombre Niño	Fecha de nacimiento dd/mm/aa	Peso (kg) 1ra medida	Peso (kg) 2ra medida	Peso (kg) 3ra medida *(Solo si es necesario)*	Talla (cm) 1ra medida	Talla (cm) 2da medida	Talla (cm) 3ra medida *(Solo si es necesario)*	Diámetro del brazo (cm) 1ra medida	Diámetro del brazo (cm) 2ra medida	Diámetro del brazo (cm) 3ra medida *(Solo si es necesario)*