Food Security and Dietary Diversity amongst Smallholder Farmers in Haiti

Jasmine A. Parent

260326840

School of Dietetics and Human Nutrition McGill University, Montreal

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ABSTRACT

As defined by the United Nations Food and Agriculture Organization, food security "exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life". The nature of food security is multi-faceted and therefore difficult to accurately measure. The Latin American and Caribbean Food Security Scale (ELCSA) is a tool that has been developed and validated to measure food security through the psychosocial experience of a household. Haiti, being the poorest country in the Western Hemisphere, is highly susceptible to poverty, malnutrition and food insecurity. It is estimated that over half of the population lives in extreme poverty (less than one US dollar a day). Since purchasing power for food is directly related to a household's consumption of food, dietary quantity and quality are greatly reduced in situations of extreme poverty and food insecurity. Dietary diversity has been shown to imply nutrition adequacy among populations and when compromised, results in poor health status. Food variety and dietary diversity scores have been traditionally used to assess dietary quality in developing countries. The primary objective of this study is to assess the relationship of food security with dietary diversity among small rural farming households in Haiti using a secondary data set analysis. Data are drawn from a quantitative cross sectional study including 500 households from 5 departments of rural Haiti that were surveyed by the Inter American Institute for Cooperation on Agriculture. Data were analyzed using IBM[®] SPSS[®] 2012 software for descriptive and inferential analyses. Results show that sixty-two percent of households were severely food insecure, with only 2.6 percent being food secure. Dietary Diversity Scores (DDS) were generated using the FAO's Household Dietary Diversity Index Guidelines. Results show that DDS decreased significantly from mild (11.0) to moderate (10.0) to severe (9.4) Food insecurity levels, after controlling for number of children in the household, gender of head of household, daily per capita income, education, number of animals and land size. Furthermore, the number of total food items consumed decreased significantly from the mildly (34.3) to the moderately (25.9) and severely (22.5) food insecure households after controlling for the same variables. The decrease affected staple foods, eggs, dairy, meat/fish, fruits and vegetables. Sugar consumption remained the same in all groups. When compared to all foods consumed, the proportion of animal source foods decreased from food secure households (18.6 percent) to severely food insecure households (11.6 percent) while the proportion of sugars and oils increased from food secure households (14.0 percent) to severely food insecure households (18.6 percent). The changes seen in consumption of low nutrient dense foods like sugars and oils implies greater access to foods that may provide calories but have little nutrient quality, therefore masking the achievement of food and nutrition security. Organizations, governmental and nongovernmental should be informed of these trends to better adapt existing and future intervention programs that aim to inversely improve access to energy and nutrient dense foods and decrease the access to empty calorie foods.

RESUME

La sécurité alimentaire telle que définie par l'ONU, existe quand tout le monde, en tout temps, a accès d'un point de vu physique, social et économique, à une alimentation nutritive, en quantité suffisante, de qualité adéquate, mais qui répond aussi aux besoins nutritionnels et aux préférences alimentaires d'une vie active et en santé. » La sécurité alimentaire est multi factorielle et conséquemment, difficile à mesurer de façon précise. L'échelle de sécurité alimentaire de l'Amérique latine et des Caraïbes (ELCSA) est un outil qui a été développé et validé pour mesurer la sécurité alimentaire à partir de l'expérience psychosociale d'individus. Haïti étant le pays le plus pauvre de l'hémisphère occidental, il est grandement exposé à la pauvreté, à la malnutrition et l'insécurité alimentaire. On estime que plus de la moitié de sa population vit dans des conditions d'extrême pauvreté (moins de 1 dollar américain par jour). La capacité à se procurer de la nourriture est directement liée à la consommation de nourriture. La quantité et qualité adéquates sont donc réduites sévèrement dans les situations d'extrême pauvreté et d'insécurité alimentaire. Il est démontré que la diversité nutritionnelle est nécessaire pour une alimentation adéquate et quand elle est compromise, il s'en résulte d'un piètre état de santé de ces populations. La variété des aliments et les résultats de la diversité de la diète ont été utilisés traditionnellement pour juger de la qualité de l'alimentation dans les pays en développement. L'objectif premier de ce projet est de démontrer la relation entre la sécurité alimentaire et la diversité diététique chez une petite population rurale et agricole en Haïti en utilisant une série de données secondaires d'analyse. Les données sont recueillies à partir d'une étude quantitative transversale incluant 500 foyers de 5 départements ruraux d'Haïti supervisés par l'Institut Inter Américain de coopération en agriculture. Les résultats démontrent que 62% des ménages vivaient une insécurité alimentaire sévère pour seulement 2,6% de ménages avec sécurité alimentaire. Les résultats démontrent, selon les lignes directrices de la FAO's Household Dietary Diversity, que la DDS décroit de façon significative de légère (11.0) à modérée (10.0) à sévère (9.4) selon le nombre d'enfants du ménage, le genre de la personne responsable du foyer, le revenu journalier par personne, l'éducation, le nombre d'animaux et la grandeur de la terre. Qui plus est, la sécurité alimentaire du nombre total de produits alimentaires consommés, décroît significativement de légère (34.3) à sévère (22.5) après avoir contrôlé les mêmes variables. La baisse affecte les aliments de base, les œufs, les produits laitiers, viandes et poissons, fruits et légumes. La consommation de sucre demeure la même dans tous les groupes. Quand elle est comparée à tous les aliments consommés, la proportion d'aliments de source animale décroît entre les ménages où la sécurité alimentaire est présente (18.6%) à (11.6%) dans ceux où il y a une insécurité alimentaire sévère. La proportion des gras et sucres consommés de (14%) dans les ménages où la sécurité alimentaire est présente, passe à (18.6%) dans ceux où l'insécurité est sévère. Les changements observés dans la consommation d'aliments à faible valeur nutritive, comme les sucres et les gras, impliquent que l'accès aux aliments qui fournissent des calories mais de faible qualité nutritionnelle camouffle le but ou la finalité de la sécurité alimentaire et nutritionnelle. Les organisations gouvernementales et non gouvernementales devraient être mises au courant de ces tendances, pour mieux ajuster leurs interventions, inverser cette tendance et améliorer l'accès à une nourriture avec une meilleure valeur nutritive et énergétique et de cette façon diminuer la consommation d'aliments à calories vides.

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CONTRIBUTION TO AUTHORS

As the first author of the manuscript, I was responsible for the gestation and development of the research questions, application for research ethics approval, analysis of the data, interpretation of findings and writing of the manuscript. Dr. Hugo Melgar-Quiñonez and Dr. Lea Berrang-Ford provided guidance, feedback and overall support throughout the dissertation. Diana Dallmann participated in the data entry and cleaning and played a major role as technical support for SPSS during the analysis phase. Kate Sinclair also participated in data entry and cleaning. Miguel Garcia, the director of agribusiness and trade at the Inter-American Institute for Cooperation of Agriculture, was responsible for the development of the survey and data collection

LIST OF TABLES

- Table 3.1ELCSA Scale questions
- Table 4.1Sample Characteristics
- Table 4.2Mean Number of Food Items consumed by Food Insecurity
- Table 4.3
 Percent of household consumption of one food item per food group by Food Insecurity
- Table 4.4
 Multiple Analysis of Variance and Regression for Total Food Items and Food Insecurity
- Table 4.5
 Multiple Analysis of Variance and Regression for Dietary Diversity Scores and Food

 Insecurity

LIST OF FIGURES

Figure 3.1 Haitian Departments

Figure 4.1 Proportion of principal food groups consumed by Food Insecurity Status

LIST OF ABREVIATIONS

ANOVA	Analysis of Variance
CARICOM	Caribbean Community
CIDA	Canadian International Development Agency
ELCSA	Escala Latinoamericana y Caribeña de Seguridad
	Alimentaria
EU	European Union
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization of the United
	Nations
FI	Food insecurity
FS	Food secure
GHI	Global Hunger Index
GDP	Gross domestic product
HDDS	Household Dietary Diversity Score
HDI	Human Development Index
HFIAS	Household Food Insecurity Access Scale
HFSSM	Us Household Food Security Survey
HH	Household
HTG	Haitian Gourdes
IICA	Inter-American Institute for Cooperation in
	Agriculture
IFAD	International Fund for Agriculture Development
IFPRI	International Food Policy Institute
PMA2	Prevention of Malnutrition Under 2 Approach
PNS	Programme de Nutrition Supplémentaire
SES	Socioeconomic Status
UN	United Nations
WHO	World Health Organization
no.	Number
р	p-value
SD/\pm	Standard deviation
SE	Standard error
USD	US dollars
yrs.	Years
y.o.	Years old
β	Beta

Table of Contents

ABSTRACT	2
RESUME	3
ACKNOWLEDGEMENTS	3
CONTRIBUTION TO AUTHORS	6
LIST OF TABLES	7
LIST OF FIGURES	7
LIST OF ABREVIATIONS	8
1. CHAPTER 1: GENERAL OVERVIEW	
1.1 Introduction	
1.2 Study Rationale	15
1.3 Objectives, Study Questions and Hypothesis	15
1.1.1 Objectives	15
1.1.2 Study Questions	15
1.1.3 Hypotheses	16
2. CHAPTER 2: LITERATURE REVIEW	
2.1 Food Security	
2.1.1 The Nature of Food Security	
2.1.2 Factors Affecting Food Security	22
2.1.3 Measuring Food Security	23
2.2 Haiti	24
2.2.1 Demographics	24
2.2.2 Background	24
2.2.3 Economy and Social Indicators	25
2.2.4 Current state of malnutrition	27
2.2.5 Typical Haitian Diet	
2.2.6 Current Food Aid Programmes	29
2.3 Dietary Diversity	
2.3.1 Definition	
2.3.2 Dietary Diversity as a measure of Nutrient Adequacy	
2.3.3 Measuring Dietary Diversity	

3.3.4 Dietary Diversity and Food Security	
3. CHAPTER 3: METHODOLOGY	
3.1 Research Design	
3.2 Study Site	
3.3 Sample Selection	
3.3.1 Department Selection	
3.3.2 Household Selection	
3.4 Development of the survey	
3.5 Data Collection	
3.5.1 Latin American and Caribb	ean household food security scale (ELCSA)43
3.5.2 Food Frequency Questionn	aire45
3.5.3 Socioeconomic an Demogr	aphic Characteristics46
3.6 Data Analysis	
3.6.1 Data Processing	
3.6.2 Variables of interest	
3.6.3 Statistical Analysis	
3.7 Ethical Considerations	
4. CHAPTER 4: MANUSCRIPT	50
4.1 Abstract	
4.2 Introduction	
4.3 Methodology	
4.3.1 Study Site	54
4.3.2 Sample Selection	54
4.3.3 Data Collection	54
4.3.4 Statistical Analysis	
4.4 Results	
4.4.1 Sample Characteristics	
4.4.2 Bivariate Analysis	
4.4.3 Multivariable Analysis	
4.5 Discussion	
4.5.1 Food Security	
4.5.2 Dietary Diversity and I	Food Security65

4.5.3 Limitations		
4.6 Conclusion76		
4.7 Tables77		
4.1 Sample Characteristics		
4.2Food Insecurity Status by Six Continuous Variables77		
4.3 Mean Number of Food Items consumed by FI Status78		
4.4 HH consumption of at least one food item per food group by FI Status79		
4.5 Regression Coefficients for Total Food Items by FI Status		
4.6 Regression Coefficients for Dietary Diversity Scores by FI Status		
4.7 Figures		
4.2 Food Insecurity by Six Independent Categorical Variables		
4.3 Proportion of Principal Food Groups by all Food Consumed and Household FI State82		
5. CHAPTER 5: FINAL CONCLUSIONS		
REFERENCES		
APENDICIES		
Appendix A		
Appendix B97		

1. CHAPTER 1: GENERAL OVERVIEW

1.1 Introduction

The 1948 Declaration of Human Rights states that, "Everybody has the right to a standard of living adequate for the health and well-being of himself and of his family, including food..." (Article 25 of the Universal Declaration of Human Rights: Adopted and proclaimed by General Assembly of the United Nations resolution 217 A (III) of 10 December, 1948) (Danieli, Stamatopoulou, & Dias, 1999). As food is one of the most basic of human needs, hunger in developing nations remains of great concern to world leaders. When addressing food insecurity, it must be noted that hunger is a key component, however, not the only contributing factor. Food insecurity is defined as the "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways" (Anderson, 1990). This phenomenon occurs when one or more of the pillars (availability, access, utilization and stability) to achieve food security are not being met.

Moreover, food security is defined as the state when "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (Food and Agriculture Organization of the United Nations, 1996). In 2011-2013, it was estimated that global food insecurity affects a total of 842 million people or one eighths of the world's population (Food and Agriculture Organization of the United Nations, 2013). Hunger trends differ across regions depending on a country's economic conditions, infrastructure, the organization of food production and political and institutional stability. This makes the complex nature of food insecurity very difficult to measure. Therefore, the prevalence of food insecurity, whether it is in the form of hunger or "hidden hunger" due to micronutrient deficiencies, may actually be higher than current estimations.

Since no one indicator is sufficient to measure all aspects of food insecurity, there is currently no gold standard tool in existence. The Latin American and Caribbean Food Security scale (Escala Latinoamericana y Caribena de Seguridad Alimentaria -ELCSA) is a tool that has been validated in several Latin American and Caribbean countries (Álvarez & Vélez, 2008; Melgar-Quiñonez et al., 2010; Munoz-Astudillo, Martinez, & Quintero, 2010; Perez-Escamilla, Dessalines, Finnigan, Hromi-Fiedler, & Pachón, 2009). The scale primarily considers the psychosocial experience of hunger as a reflection of food insecurity within a household. As the state of food insecurity worsens, worrying about food, portion cutting and meal skipping behaviours become more prevalent.

Food security is known to be related to many factors within a household including income (Agboola & Balcilar, 2012; Gebrehiwot & van der Veen, 2014; Zakari, Ying, & Song, 2014), education (Melgar-Quinonez & Hackett, 2008), household size (Zakari et al., 2014), gender (Felker-Kantor & Wood, 2012; Floro & Bali Swain, 2013) and food intake diversity (Hoddinott & Yohannes, 2002). However, many of these variables require further investigation to better understand what drives food security and in what global context does food insecurity occur.

Haiti, one of the poorest countries in the Western Hemisphere, is greatly affected by severe poverty, malnutrition and food insecurity. Poverty, corruption, vulnerability to natural disasters, and low levels of education put Haiti at a serious disadvantage when it comes to overcoming food insecurity. According to FAOSTAT, in 2013, 49.8percent (about 5 million

people) of Haiti's population was considered undernourished. Since 1992, Haiti's prevalence of under nutrition was steadily decreasing; however on January 12, 2010 the country was devastated by a massive 7.3 magnitude earthquake (OXFAM, 2014). This forced Haiti into a humanitarian crisis. In the progress of recovery, knowledge gaps exist on the state of food insecurity among the rural areas of Haiti. Gaining knowledge on the present situation regarding food security in Haiti is a crucial step towards the development of effective and sustainable intervention measures that target small rural Haitian farmers.

There has been some research done on the association between dietary diversity and food security, however these have not used ELCSA as the means of measuring food insecurity and never in Haiti. Assessing diet quality in relation to food security provides insight on the accessibility of nutrient dense foods among the poorest populations. In other developing countries around the world, many food assistance programmes have focused on increasing the intake of energy dense which have incidentally also been low nutrient dense foods. As a result, rates of obesity and non-communicable diseases have increased and rates of micronutrient deficiencies have remained the same. Assessing a population's diet offers an opportunity to focus on improving food assistance programmes relative to nutrition security, where the micronutrient content of food is considered as important as energy content. This will allow organizations to incorporate foods with higher nutrient content that may be currently inaccessible to rural populations, into food assistance programmes, ultimately improving the health and wellbeing of the most struggling populations.

1.2 Study Rationale

This study addresses the impact of food insecurity status on dietary diversity of smallholder farmers in Haiti. It explores the changes in food group consumption at different levels of food insecurity. Assessing the relationships between diet and food security supports the identification of high risk groups and their coping strategies for food consumption. This investigation contributes to the development of a better understanding of nutrition security as a part of food security. This information is of great importance to governmental and nongovernmental organizations in the development and evaluation of new and current food assistance programmes in Haiti to warrant more focus on diet quality.

1.3 Objectives, Study Questions and Hypothesis

1.1.1 Objectives

The primary objective of this study is to assess the prevalence and severity of food insecurity among smallholder rural Haitian farmers. The project also assesses the relationship between household eating patterns and food insecurity by addressing: total food count, food intake distribution among food groups, dietary diversity score (DDS) and the proportion of the foods in each food group relative to total food consumed in the last week.

1.1.2 Study Questions

This study aims to address the following questions:

- What is the prevalence of food security among smallholder farmers in Haiti?
- Is food insecurity statistically associated with the quantity of food consumed within a household?
- Is food insecurity statistically associated with the quality of food consumed within a household?

1.1.3 Hypotheses

This study hypothesizes:

- Food insecurity is prevalent among smallholder farmers in rural Haiti.
- Total number of foods consumed within a household will decrease as the state of food insecurity becomes more severe.
- Dietary diversity scores will decrease as the state of food insecurity becomes more severe.
- The distribution of food among food groups will change as the state of food insecurity becomes more severe;
 - Animal based protein foods and food groups such as eggs, dairy, meat and fish consumption will decrease.
 - Fruits and vegetable foods and food groups will decrease.
 - Staple foods and food groups will remain the same.

2. CHAPTER 2: LITERATURE REVIEW

2.1 Food Security

The concept of food security has been evolving for over half a century. Its definition has shifted from a narrow focus on global food availability to one that integrates access and utilization of food. The most widely accepted definition of food security is that of the United Nations Food and Agriculture Organization (FAO), which states that food security exists when "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (Food and Agriculture Organization of the United Nations, 1996). In the mid 70's, food security was defined as access by all people to a sufficient amount of food to maintain a healthy and productive life which was highly dependent on national and global food supplies (Maxwell & Smith, 1992). However, at the 1996 World Food Summit, increased emphasis on nutritive value and preferences were discussed. This transformed a basic definition into a more holistic understanding intended to incorporate all components appropriate across cultures including hunger, micronutrient malnutrition, and overall food sufficiency (Eisinger, 1998).

Despite a decrease in extreme poverty and food insecurity rates globally, the prevalence of food insecurity remains high and of continued global concern. More often than not, increased food production is thought to be the primary solution in the effort to improve global food security. However, it is known that enough food exists to feed all people in the world today and global net food production has successful kept ahead of the demand (Gebrehiwot & van der Veen, 2014; Misselhorn et al., 2012). This indicates a unequal distribution of the food produced, which in turn fails to meet the demands and needs of poorer regions and populations (food deficits) and overcompensates for the needs of richer regions and populations (food surpluses). Inhibiting peoples' access to food, poverty is still one of the main indicators of food insecurity and is a primary target for eradication as presented in The United Nation's Millennium Development Goals (World Health Organization, 2008).

Since 1947, prevalence of chronic undernourishment has decreased from 50 percent to about 15 percent of the global population (Food and Agriculture Organization of the United Nations, 2013). This is a remarkable achievement; however there still remain approximately 868 million people who are undernourished in terms of energy consumption and approximately 2 billion who suffer from at least one micronutrient deficiency (Food and Agriculture Organization of the United Nations, 2012). Moreover, according to the FAO's definition, the number of people who are affected by some form of food insecurity is over two billion. This confirms the continued challenge of food insecurity and emphasizes the importance of characterizing its causes, magnitude and outcomes among given populations.

In the context of food security, malnutrition has been often used interchangeably with undernutrition, however the two are not synonymous. Undernutrition occurs in the form of hunger which is defined by the FAO as "the uneasy or painful sensation caused by a lack of food" (Food and Agriculture Organization of the United Nations, 2003). Malnutrition can be undernutrition, overnutrition or both occurring simultaneously in an individual. It can be apparent throughout populations of all socioeconomic statuses. The simultaneous occurrence of both undernutrition and overnutrition is a phenomenon known as the double-burden of malnutrition or "hidden hunger" (Tanumihardjo et al., 2007). It occurs when a surplus of energy and a deficit of essential micronutrients are being consumed, usually due to increased access to cheap, non-diversified, energy dense and low nutritive value foods and decreased access to nutrient dense foods, like fruits and vegetables (Dalmiya & Schultink, 2003). Unfortunately, the

double burden of malnutrition has emerged in many developing countries and is of great concern. The consequences include the effects of micronutrient deficiencies as well as increased risk of non-communicable diseases associated with obesity (Tanumihardjo et al., 2007).

Malnutrition causes a direct and indirect financial burden on the society (Food and Agriculture Organization of the United Nations, 2013). This burden includes global losses in economic productivity that has been estimated to be approximately US\$ 1.4-2.1 trillion (Shekar, Heaver, & Lee, 2006). Other costs include direct medical costs such as physical and mental illness including increased rates of anxiety and depression. In total, the partial estimates of total economic losses due to malnutrition in all its forms are US\$ 2.8-3.5 trillion which is about 4 percent of global GDP (Food and Agriculture Organization of the United Nations, 2013). Food insecurity in some cases has also aggravated conflict and political instability within the communities and countries where it is experienced (Melgar-Quinonez & Hackett, 2008). Therefore, improvements not only benefit the individual experience, but populations more generally.

2.1.1 The Nature of Food Security

To acquire a better understanding of food security, its nature can be broken down into 4 main pillars; availability, access, utilization and stability of the first 3 pillars over time (Food and Agriculture Organization of the United Nations, 2013):

<u>Availability</u>: This component refers to the basic supply side of food where sufficient quantities of nutritionally adequate and safe foods are present over a continuous basis (Babu, Gajanan, & Sanyal, 2014a; Food and Agriculture Organization of the United Nations, 2008). The availability of food can be supplied through domestic production or imports (Food and Agriculture Organization of the United Nations, 2006). It is susceptible to environmental and climate changes, stock levels and overall net trade (Food and Agriculture Organization of the United Nations, 2008, 2013). However, availability of food to feed the world does not ensure equal distribution and access by all to the food that exists.

Access: This component encompasses having sufficient resources to have proper physical and economical access to the nutritious foods that are available (Food and Agriculture Organization of the United Nations, 2006; Melgar-Quinonez & Hackett, 2008; World Health Organization, 2014). Household purchasing power and food prices are the primary determinants of economic food security while infrastructure of roads and market outlets determine physical access. It must also be assured that the food is acquired in a socially acceptable way without scavenging, stealing or resorting to emergency food supplies (Babu et al., 2014a). Therefore, poverty is a major determinant of a population's access to nutritious food (Babu, Gajanan, & Sanyal, 2014b; Zezza & Tasciotti, 2010). This poverty refers to that within a household or a nation as whole.

<u>Utilization</u>: This pillar is understood by how the body makes use of the food and nutrients consumed for nutritional and health benefits (Food and Agriculture Organization of the United Nations, 2013). The quality and quantity of the food must be sufficient in energy and nutrients. Basic health status is an important determinant of good biological utilization of food (Food and Agriculture Organization of the United Nations, 2008). For example, chronic diarrhea can decrease the body's ability to absorb nutrients, therefore increasing a person's risk for malnutrition. General hygiene, sanitation and health practices, water quality, bioavailability of nutrients, food preparation methods, food safety and quality can all predict how the body utilizes food (Food and Agriculture Organization of the United Nations, 2006, 2013). Other non-food

inputs including inter-household distribution of food may also affect individual food security status (Pinstrup-Andersen, 2009).

Stability: This pillar reflects the stability of the other 3 pillars over time. To remain food secure, populations, households and individuals must have complete access to adequate, nutritious and safe food at all times (Food and Agriculture Organization of the United Nations, 2006). Adverse weather, political instability and/or economic factors including employment and food prices all affect the stability of a population or individual's food security status (Food and Agriculture Organization of the United Nations, 2008). Natural disasters, like the 2010 earthquake in Haiti and the onset of cholera, were both great shocks to a country already struggling to achieve food security. When stability is not maintained, and one of the three previous pillars is violated, food insecurity will occur and will last until all pillars are re-established.

Furthermore, food insecurity can occur as a chronic or transitory issue, varying from a lifelong condition to a short term experience (Food and Agriculture Organization of the United Nations, 2013).

<u>Chronic:</u> Chronic food insecurity occurs over a long-term and persistent time frame. Individuals are unable to meet minimum food requirements over a sustained period of time which may be a result of poverty, lack of assets and inadequate access to resources (Food and Agriculture Organization of the United Nations, 2008).

<u>**Transitory:**</u> Transitory food insecurity is temporary and experienced short-term. It occurs when there is a sudden decrease in production or access to adequate food. This phenomenon may be due to shocks and fluctuations of food access (changes in food prices or

household incomes) or domestic food production (environmental shocks) (Food and Agriculture Organization of the United Nations, 2008).

Different response measures must be taken into consideration when making the distinction between food insecurity duration periods. Haiti, for example, experiences high levels of chronic food insecurity as well as the additional weight of transitory acute food insecurity due to environmental shocks, i.e. earthquake in 2010 (Baro, 2002). In a transitory state of food insecurity, safety nets including feeding programmes, food-for-work programmes, and income-transfer programmes, may be useful measures to enhance and re-establish food security (Stamoulis & Zezza, 2003). In a state of chronic food insecurity, identifying the true nature of food insecurity and developing long term measures to address these issues is necessary to move forward with sustainable and attainable solutions to eradicate the problem.

2.1.2 Factors Affecting Food Security

Food security is known to be related to many factors within a household including income (Agboola & Balcilar, 2012; Zakari et al., 2014), education (Melgar-Quinonez & Hackett, 2008), household size (Zakari et al., 2014), gender of head of household (Felker-Kantor & Wood, 2012; Floro & Bali Swain, 2013) and food intake diversity (Hoddinott & Yohannes, 2002). The list of elements found to influence food security is not limited to what only affects the household. Variables affecting global food security should also be considered. Agriculture, for example, plays a large role in food supply and has been shown to be affected by climate change, water supplies and arable land (Bruinsma, 2003). More often than not, these global elements tend to affect the poorest populations firstly and most intensely. Smallholder rural farmers bear great burdens from the detrimental effects brought about by these factors. Within their own community, smallholder farmers may be affected by other variables including land ownership and livestock diversity (de Haan, 2001). Furthermore, it is evident that the list of factors that may affect food security at a household level or a global level is non-exhaustive. Without considering an integrative approach, fully eradicating the problem would not be possible.

2.1.3 Measuring Food Security

Measuring the prevalence and severity of food insecurity on a global scale is extremely difficult to administer, analyze and fund. Therefore, household-level indicators have become the primary means of measurement. Through the evolution of the current definition of food security, methods of measurement have changed as well. Since no single indicator can capture all dimensions of food insecurity, there are many accepted methods of measurement and no one indicator is considered the "gold standard". There is substantial variation in indicators, with some focusing on one dimension, others on the multi-dimensional nature; some are of a quantitative nature while others qualitative (Carletto, Zezza, & Banerjee, 2013). Traditional indicators that measure calorie adequacy and anthropometrics are expensive, time consuming and difficult to incorporate into monitoring and evaluation systems (Haddad, Kennedy, & Sullivan, 1994; Melgar-Quinonez & Hackett, 2008). Recent developments that include measuring income and expenditure on food have been shown to be one comprehensive method of measurement of food security (Melgar-Quinonez et al., 2006). The variety of indicators is non-exhaustive, however, what many fail to assess is the psychosocial experience of food insecurity. In the last few decades there have been efforts to develop a comprehensive, easy to use and affordable tool that accurately measures household food security through a household's experience. One of the first validated scales used to monitor food security was the US Household Food Security Survey (HFSSM). This included an 18 item survey addressing the behaviours and attitudes that differentiate the experience of different degrees of food insecurity along a spectrum of severity (Bickel, Nord, Price, Hamilton, & Cook, 2000; Melgar-Quinonez, Nord, PerezEscamilla, & Segall-Correa, 2007; Pérez-Escamilla et al., 2004). This indicator has been further adapted and validated to assess food insecurity in many countries including Latin America and the Caribbean. Among these is The Latin American and Caribbean Food Security Scale (Escala Latinoamericana y Caribena de Seguridad Alimentaria –ELCSA). This tool is now widely used by researchers and governmental organizations as a simple and low cost indicator for household food security (Ballard, Kepple, & Cafiero, 2013).

2.2 Haiti

2.2.1 Demographics

Occupying a total area 27 500 km², Haiti is located in the Caribbean region on the western third of the island La Hispaniola, neighbouring the Dominican Republic. The official languages are French and Haitian Creole. According to the World Bank, in 2012 Haiti's population was estimated to be 10.17 million inhabitants with a population density of about 364.8 people per square kilometer making it the most densely populated country in the Caribbean Community (CARICOM). According to the United Nations the population growth is about 1.3 percent with rural populations decreasing and urban populations growing (United Nations, 2014). In 2013, approximately 43 percent of its population lived in rural areas, which decreased from 51 percent in 2008 (Food and Agriculture Organization of the United Nations, 2011). Almost 60 percent of the population's labour force and 64 percent of the country's land is devoted to agriculture (Joseph, 2012).

2.2.2 Background

In 1492, Christopher Columbus arrived at the island of Hispaniola. In the early 17th century, the French established their presence on the island, claiming the western third portion, which later became known as Haiti (Fick, 1990). Forestry and sugar cane became the main industry, and with heavy African slave importation this French colony became one of the

wealthiest colonies in the Caribbean (Fick, 1990). However, as mass deforestation led to environmental degradation, Haiti's prosperity declined and in the late 18th century, nearly half a million slaves revolted under Toussaint L'Ouverture. Haiti was declared an independent state in 1804 (Baro, 2002; Fick, 1990). Following its independence, Haiti has experienced political instability and civil unrest due to corruption, injustice and poverty, which has made it very difficult for the country to prosper (Baro, 2002).

Since the agricultural trade liberalization, introduced in 1983 by former President Jean-Claude Duvalier, it has become increasingly difficult for Haitian farmers to earn a living. This act contributed to stagnant farm production, falling exports, increased food imports and reduced domestic food production which has resulted in reduced farmer productivity, national production and farm incomes (Joseph, 2012). Though important in Haiti's production sector, agriculture alone does not produce enough food to feed the country. Haiti has to import about 60 percent of the food needed, including about 80 percent of the rice consumed domestically (International Fund for Agricultural Development, 2008).

2.2.3 Economy and Social Indicators

Haiti's history of conflict and instability has left the country stigmatized as the Western Hemisphere's poorest country. In 2012 the United Nations Development Program ranks Haiti 161 of 186 on the Human Development Index (HDI). The HDI represents a measure of development by combining indicators of life expectancy, education attainment and income (United Nations Development Programme, 2013). Haiti is considered by the World Bank to be low income country with a Gross Domestic Product (GDP) of 8.5 billion US dollars and 1710 US dollars per capita in 2013. The average income is approximately 400 USD per year; onetenth of the average for Latin America (The World Bank, 2013). Over half of the entire population (The World Bank 2014) and 67 percent of rural residing residents (International Fund for Agricultural Development, 2008) live on less than 1 USD per day and in a state of extreme poverty. Approximately 80 percent of the population (The World Bank 2014), and 88 percent of rural residents (International Fund for Agricultural Development, 2008) live on less than 2 USD a day. The per capita income of rural people is about one third that of urban residents (International Fund for Agricultural Development, 2008). This places the country in a state of extreme poverty. Chronic food insecurity and hunger have been considered the norm.

Agriculture and commerce are the principal sources of income in Haiti, comprising 85 percent of the economy for rural residents (International Fund for Agricultural Development, 2008; United States Agency for International Development, 2010). Approximately one in every five farmers depend solely on raising crops and/or livestock as a source of income while the other 4 participate in other income-generating labours including wage labour, extraction, crafts and small scale trade (International Fund for Agricultural Development, 2008). A majority of the country, specifically rural areas, experience chronic states of food insecurity and malnutrition. Of the 10 departments, Nord-Est, Artibonite, Nord-Ouest and Centre experience the highest rates of poverty, malnutrition and disaster vulnerability leading to high levels of food insecurity (Glaeser, Horjus, & Strother, 2011; International Fund for Agricultural Development, 2008). Grande'Anse, Sud and Sud-Est are also highly vulnerable (Glaeser et al., 2011).

Due to high levels of importation, high poverty levels hinder Haitians abilities to purchase the required food to live a productive and healthy life. Increasing food prices have high consequences on vulnerable populations. For those who also rely on domestic agricultural production (namely smallholder rural farmers), climate change and environmental shocks including droughts, floods and hurricanes pose high threat on yield. In the past 12 years alone,

Haiti has experienced 34 major environmental shocks which have led to disease epidemics and further debilitated the country's economy and livelihood of the population (Glaeser et al., 2011). The country's low percentage of forested land further diminishes any possibility of protection against extreme weather events which occur frequently in the Caribbean region. Moreover, a combination of exogenous factors and Haiti's vulnerability and lack of resilience dramatically increases the population's risk of food insecurity. Farmers who do not have insurance, which is often the case, are extremely susceptible to these shocks which are therefore detrimental to their livelihood. For example, in the January 2010 earthquake, many of the irrigation systems were damaged, making harvests depend highly on rainfall (United States Agency for International Development, 2010). Many roads, warehouses, bakeries and shops were destroyed with substantial impacts on the integration of goods. Smallholder farmers lost access to income and food. Production yield was compromised, leaving farmers with less to sell and eat. Moreover, food security was greatly compromised for rural dwellers as a result of the 2010 earthquake and other environmental shocks that have followed.

2.2.4 Current state of malnutrition

In 2011, about 45 percent of the Haitian population was considered undernourished (Food and Agriculture Organization of the United Nations, 2011). According the World Food Programme, approximately 600,000 Haitians rely on external food assistance to survive (World Food Programme, 2014). One in five children suffer from chronic malnutrition (World Food Programme, 2014), 60 percent are reported anemic (Cayemittes M, 2007) and 59 percent suffer from iodine deficiency (World Food Programme, 2012). According to the World Health Organization, in 2012, 11.6 percent of children under 5 were underweight, 21.9 percent were stunted (chronic undernutrition) and 5.2 percent were wasted (acute undernutrition) (World Food Programme, 2014).

Proper nutrition is especially critical between the fetal stage and two years of age due to the highly rapid growth and development period (Glaeser et al., 2011). Long term consequences to stunting and wasting in children include impaired cognitive development, school achievement and economic productivity into adulthood (Dewey & Begum, 2011). Moreover, the importance of acknowledging these consequences to decrease the burden of disease and improve economic development in a country like Haiti is extreme. In order to foster proper development for improved long term productivity and livelihood, proper nutrition and improved food security are key factors to address.

Rice is considered a staple commodity available for consumption, followed by maize and sugar (Food and Agriculture Organization of the United Nations, 2011). White rice has a very low micronutrient value, therefore as a staple food greatly affects the micronutrient status of the population, especially those of lowest socioeconomic status who rely heavily on it for energy. The high consumption of rice not only has these primary effects on the diet, but also decreases fruit and vegetable consumption through secondary pathways. Smallholder farmers are able to sell their produce in markets immediately after harvest, however, have great difficulty competing to feed the growing population when relatively inexpensive cereals, like rice, are more economically accessible (United States Agency for International Development, 2010). This decreases the consumers and the farmer's economical access to food of higher nutrient density. Additionally, in these cases, smallholder farmers are less likely to eat the food they produce which often includes animal source food, fruits and vegetables, and sell them in markets to receive income for other necessities or for cheaper, energy dense foods.

2.2.5 Typical Haitian Diet

The consumption patterns of Haitians typically differ depending on regional production. People consume many roots and tubers in Grand'Anse and Nippes, maize and sorghum in the South, local rice in Artibonite and plantains and tubers in the Nord and Nord-Ouest departments (United States Agency for International Development, 2010). Rural areas tend to consume more rice, maize and sorghum. However sorghum is generally consumed by the poorest households (United States Agency for International Development, 2010). Butter and lard are the preferred cooking fats as they tend to be the most inexpensive.

In rural areas, approximately 68 percent of food consumed is purchased, meaning that most farms are unable to meet their dietary requirements through domestic production alone (International Fund for Agricultural Development, 2008). As previously stated, much of the food domestically produced, like green vegetables and tropical fruits, is sold before it is consumed. However, some fruits which are grown in abundance when in season are eaten extensively. These fruits include citrus, breadfruit, avocados and mangoes.

2.2.6 Current Food Aid Programmes

Currently food aid programs account for 5 percent of the country's intake. The United States, the Canadian International Development Agency (CIDA), the European Union (EU), the French Cooperation Mission and the World Food Programme account for Haiti's primary sources of food aid (Glaeser et al., 2011). The World Food Programme in collaboration with other non-governmental organizations (NGOs), including UNICEF, has led a number of programs aimed to improve food security and malnutrition in Haiti. Some of the programmes include:

Supplementary Feed Programme (PNS) and the Prevention of Malnutrition in Under Two Approach (PM2A) : These programs target pregnant and lactating mothers, and all children between the ages of 2 and 24 months (United States Agency for International Development, 2010).Under the direction of the Haitian Ministry of Health, management of moderate acute malnutrition is accomplished through food distribution and dietary supplements including fortified maize-soybean meal, oil, sugar and iodized salt for children and pregnant and nursing women (World Food Programme, 2012). The aim is to provide proper nutrition for development which presents opportunity for short, medium and long term improvement.

National School Feeding Programme (PNCS): These programs provide food and food supplements to school age children. This not only provides students with a free meal, but also promotes school attendance and creates an income transfer to parents potentially making it more reasonable to send a child to school (United States Agency for International Development, 2010; World Food Programme, 2012).

Food-For-Work (FFW): This programme is intended for "food-wage employment" of rural inhabitants during non-production and hunger seasons (United States Agency for International Development, 2010). The goal of this programme is to stabilize and improve food consumption and nutrition of rural households. The World Food Programme has a Cash and Food for Work project which uses 60 percent cash and 40 percent food wage for Haitian workers to participate in reconstruction projects (World Food Programme, 2012). These programmes were initiated after the 2010 earthquake to improve malnutrition and rebuild the countries infrastructure.

2.3 Dietary Diversity

2.3.1 Definition

With the exception of the first few months of life, the nutrients required by a human body cannot be found in one single food item but must be obtained through the consumption of a

variety of foods. Therefore, healthy diets are those that tend to be the most diverse (Burlingame, Charrondiere, & Halwart, 2006). The FAO estimates that billions around the world suffer from one or more micronutrient deficiencies, with more than half having adequate energy intakes (Food and Agriculture Organization of the United Nations, 2004). There has been great attention paid to the positive impacts of a balanced and diverse diet when preventing micronutrient deficiencies and their consequences to improving health, well-being and development. However, it is only recent that adequate micronutrient intake has been taken into consideration when evaluating food security. The term nutrition security is now more widely recognized as an evolved definition of food security, where micronutrient undernutrition is considered. Moreover, it is of great importance to assess dietary diversity within food insecure populations as a means of measuring food quality. These measures are vital in the development of food aid programmes that aim to improve the nutrition status and the health of vulnerable populations.

Dietary diversity is defined as the number of different foods or food groups consumed over a given reference period (Hatloy, Torheim, & Oshaug, 1998). It is internationally recognized as an indicator of a high quality diet as it likely ensures an adequate intake of essential nutrients and reduced intake of selected nutrients including fat, refined sugar and salt. In developing countries, a lack of nutrition diversity has become of increasing concern as the poorest populations tend to rely heavily on starchy staples, like rice and corn, and consume little to no animal products and fresh fruits and vegetables (Ruel, 2003). People living in rural areas tend to be the most exposed to high rates of poverty and poor infrastructure including roads, markets, storage facilities and communication services (Food and Agriculture Organization of the United Nations, 2004). Therefore, due to extremely limited access to a variety of foods, these populations are the most vulnerable to consuming a minimally diverse diet.

2.3.2 Dietary Diversity as a measure of Nutrient Adequacy

What is the most effective way to measure dietary diversity? In developed countries the resources and time are often available to measure nutrient adequacy, dietary diversity, proportionality and moderation. However, in developing countries, accurately quantifying food intake can be difficult. Simple food counts of food items or food groups eaten in the household over a period of time has been used to measure dietary diversity which has become the 'proxy' indicator to measure nutrition adequacy (Ruel, 2003). Therefore, food frequency questionnaires and indexes of dietary quality are often used to monitor populations' dietary intakes.

Before discussing specific indices, it is important to distinguish between nutrition adequacy, dietary diversity and dietary quality. However similar, they do not reflect the same constructs. Dietary diversity reflects the number of food items or food groups consumed while nutrition adequacy is the ratio of intake to recommended intake of energy and nutrients (Ruel, 2003). Dietary quality does not have any official definition, however is commonly perceived as a reflection of nutrient adequacy, proportionality and moderation of food intake (Food and Agriculture Organization of the United Nations/World Health Organization, 1998). It accounts for the achievement of an adequate diet that includes a balance of all essential micronutrients, avoiding deficiencies and excesses, which aims to reduce undernutrition as well as overnutrition. Dietary diversity can be considered a component of dietary quality, however, may not be the only element required to achieve all nutritional goals.

There are many studies carried out in developed (Foote, Murphy, Wilkens, Basiotis, & Carlson, 2004) and developing (Arimond & Ruel, 2004; Mirmiran, Azadbakht, & Azizi, 2006; Steyn, Nel, Nantel, Kennedy, & Labadarios, 2006a; Torheim et al., 2004) countries that indicate a measurement of dietary diversity is strongly associated with nutrient adequacy. Ruel (2003), summarized seven studies, five of which showed a significant relationship between dietary diversity and nutrient adequacy. The Food and Nutrition Technical Assistance (FANTA) programme, as a part of USAID, also carried out five studies which analyzed the relationship between simple indicators of dietary diversity and diet quality. The studies took place in rural areas of Mozambique and Bangladesh and urban areas of Burkina Faso, Mali and the Philippines. All sites reflected the relevant use of simple diversity indicators to reflect nutrient adequacy and ultimately dietary quality (Arimond et al., 2011).

2.3.3 Measuring Dietary Diversity

When assessing nutrient adequacy through dietary diversity, many studies have used a food variety score (FVS) and diet diversity score (DDS). Some of the first methods used to measure dietary diversity by Hatloy et al (1998) assessed whether these tools, represented as a simple count of food items and food groups, can actually predict the nutritional adequacy of the diet in developing countries. A FVS is measured as the mean number of different food items consumed from a possible of 75 food items as adapted from a previous study (Drewnowski, Renderson, Driscoll, & Rolls, 1997). The DDS is the mean number of food groups out of nine possible groups that was consumed over the last 24 hours (Kant, Block, Schatzkin, Ziegler, & Nestle, 1991). These 9 food groups were classified according to the FAO and include: (1) cereals, roots and tubers; (2) vitamin A fish foods and vegetables; (3) other fruit; (4) other vegetables; (5) legumes and nuts; (6) meat, poultry and fish; (7) fats and oils; (8) dairy; and (9) eggs. The DDS was shown to be more accurate. The FVS counts all food items eaten, including condiments used in sauces, which can therefore give false favorable impressions of dietary quality (Hatloy et al., 1998; Steyn, Nel, Nantel, Kennedy, & Labadarios, 2006b). In a regression model, the DDS contributed to a significantly better fit with the measure of nutrient adequacy than FVS. Additionally, estimating the DDS is easier to obtain than the FVS. The study

concluded that these food scores, especially if combined, can give fairly good assessments of dietary diversity and nutrient adequacy (Hatloy et al., 1998). A more recent study by Torheim et al (2004) also illustrates that dietary diversity is positively associated with nutrient adequacy in rural Mali. Rashid et al (2011) has also approved the use of FVS and DDS for predicting dietary quality in Bangladesh. These studies imply the efficacy of using these simple and inexpensive counts to measure dietary diversity and therefore nutrient adequacy in specific populations in developing countries.

In 2000, a diet quality index (DQI) was developed for China. This index was designed to detect micronutrient deficiency and overnutrition by calculating a sum of components and pattern scores from a 3 day diet record. Results showed that the total DQI score was significantly correlated with food and nutrient intakes, BMI and socio-demographic variables like income and urban dwelling (Stookey, Wang, Ge, Lin, & Popkin, 2000).

However, some limitations among these studies include possible inconsistency between countries. Especially for FVS, different studies have had different definitions of what a food item is. Some studies have food codes or use food ingredients. This makes the methodology of validating one index difficult. There have been other validated indices developed by researchers to overcome these limitations including the Healthy Eating Index and Dietary Quality Index (Drewnowski et al., 1996; Guenther, Reedy, & Krebs-Smith, 2008; Kennedy, Ohls, Carlson, & Fleming, 1995). However, these tools are more time consuming and more complex to administer which defeats the purpose for their use in developing countries (Steyn et al., 2006a). The use of a DDS is still favored despite its limitations as it has been consistent in showing a positive association with dietary diversity and nutrient adequacy making it a cheap, quick and efficient means to estimate dietary quality.

In 2011 the FAO released a report called *Guidelines for measuring household and* individual dietary diversity which provides a standardized questionnaire of universal applicability to assess nutrition diversity. The guidelines for measuring dietary diversity presented in this report intend to overcome many of the inconsistencies seen in the various indices used in previous studies. The questionnaire is not culture, population or location specific and should be adapted to the local context before using in the field. The FANTA Household Dietary Diversity Score Indicator Guide was used as a reference to generate FAO's Household Dietary Diversity Score (HDDS) (Swindale & Bilinsky, 2006). The dietary diversity score is calculated by summing the number of food groups consumed in a household in the last 24 hours (Kennedy, Ballard, & Dop, 2011). The foods recorded are then categorized into 16 standardized food groups. For obtaining a Household Dietary Diversity Score (HDDS), the 16 standardized food groups are condensed into 12. If at least one food item is consumed from a food group, that group is given a score of one. All positive scores are then added together to give the household a final HDDS of 0-12. Thus far, this index has shown to be standardized and universally applicable, making it a cheap, comprehensive and accessible way to measure dietary diversity within a household.

3.3.4 Dietary Diversity and Food Security

Food insecurity indicates a lack of access to sufficient and/or quality food to meet the requirements of a healthy and active lifestyle. It is therefore assumed that as food security diminishes within a household, the quality of the diet is compromised. As low dietary diversity has indicated poorer nutrition adequacy, which can result from a poor quality diet, it can be hypothesized that decreased dietary diversity is a result of food insecurity, or vice versa.

A few studies have demonstrated this association. Hoddinott and Yohannes (2002) explored the relationship between dietary diversity and household food security as a measure of household food access, drawing data from 10 countries including India, the Philippines, Mozambique, Mexico, Bangladesh, Egypt, Mali, Malawi, Ghana and Kenya. The study showed that, across the ten countries, the association between dietary diversity and household per capita caloric availability increases with the mean level of household per capita caloric availability. In other words, increased food access, which is a component of improved food security, is significantly associated with a higher diversity of the diet. Hoddinott & Yohannes suggest using the measure of dietary diversity as an indicator for food security, associating it with a number of improved health outcomes including birth weight, child anthropometric status and reduced risk of mortality. Furthermore, this study concluded that when resources and time are limited dietary diversity measurements are a promising means of measuring food security.

Hatloy et al. (2000) were the first to test the relationship between dietary diversity and socioeconomic status. The study showed that diversity increased with socioeconomic status (Hatløy, Hallund, Diarra, & Oshaug, 2000). Similarly, this was demonstrated in 2009 in South Africa by Faber, Schwabe and Drimie. Dietary diversity was analyzed, using the household DDS, as a measure of food security in relation to other validated food security indicators including living standards measure, months of food shortages and household food insecurity and access scale (HFIAS). Dietary diversity was the lowest in households with high poverty levels (Faber, Schwabe, & Drimie, 2009). This has also been demonstrated in previous studies (Savy, Martin-Prével, Traissac, & Delpeuch, 2007) indicating that DDS can be a useful indicator of a households economic access to food, decreasing their overall purchasing power. Moreover, this study also demonstrated that not being able to afford a fridge as a result of poverty, is an
important component affecting dietary diversity, availability and access to certain foods, including vegetables, fruits and foods from animal sources. Similarly, another study in South Africa showed increased stunting and underweight in children whose household did not own a fridge (Labadarios, Steyn, Maunder, MacIntyre, & Swart, 2001).

Hatloy et al. (2000) found a large difference in diversity between urban and rural households. Rural households had much lower dietary diversity than even the urban households with the lowest socioeconomic status (Hatløy et al., 2000). These findings further emphasize the lack of access rural dwellers have to most of the food that is available within a developing country. This relationship has also been demonstrated in previous research in the Southern Andes showing that rural households tended to have lower intakes of meat, dairy products and vegetables (Leatherman, 1994).

Using HDDS as a means to measure dietary diversity in a developing country has been shown to be valid, effective, cheap and rapid and will be used as a means to assess dietary quality in this project. Studies have shown that dietary diversity determined through simple counts of food groups and food items is positively associated with a state of food security. However, all studies addressing the dietary diversity and food security relationship, define food security in relation to food access, poverty or energy availability. Dietary diversity has never been analyzed in relation to household food security measurement scales like ELCSA and has never been assessed in Haiti. This study aims to assess the effect food security has on the dietary diversity of smallholder Haitian farming households.

3. CHAPTER 3: METHODOLOGY

3.1 Research Design

This study analyzes secondary quantitative data using a survey that was developed by the Inter American Institute for Cooperation in Agriculture and Haitian Ministry of Agriculture. It is a cross sectional study carried out in rural Haiti by in person interviews using a stratified random sample. The Latin American and Caribbean Food Security Scale (ELCSA) and a food frequency questionnaire in the survey were used to assess the relationship between food security and dietary diversity.

3.2 Study Site

The study took place in Haiti, a country located on the western third of the island Hispaniola in the Caribbean. It covers 27,650 square kilometers and is divided into 10 departments: Nord-Ouest, Nord, Nord-Est, Artibonite, Centre, Ouest, Sud-Est, Nippes, Sud and Grand'Anse. Refer to Figure 3.1 for a detailed map of these departments.

3.3 Sample Selection

3.3.1 Department Selection

The IICA and Haitian Ministry of Agriculture chose the departments and households to be surveyed. Five of the ten departments were chosen due to budget constraints. The departments were strategically selected based on similarities between the agricultural systems and ecosystems. The 5 departments chosen were selected based on their representation of Haiti's diverse population and agro-eco systems.

The Centre, Nord-Est and Nord-Ouest departments are very similar and consist largely of semi-arid ecosystems (800-1000m above sea level) and open rangelands which are very favorable for beef cattle, goats and horses. Two of three of these departments were chosen as representative. The Nord, Nippes, Grande L'Anse and Sud-Est departments consist mostly of

humid mountainous ecosystems (1500-2000m above sea level) which are favourable for growing coffee. Nord was chosen to represent this ecosystem. Artibonite was chosen to represent itself and the Ouest department which includes the valley and irrigation systems. Finally the Sud was chosen to represent the parts of the Sud -Est, Grande L'Anse and Sud areas that are associated with semi-humid mountainous, semi-arid and irrigated plains. See Figure 3.1 for more details on location.





Haitian Departments

3.3.2 Household Selection

The target population in this study includes smallholder rural farming households in Haiti. Given that 95 percent of Haitian farmers are smallholders and have very similar characteristics, including average plot sizes less than 1.5 hectares, the cut off points for the inclusion criteria for this study were not available (Glaeser et al., 2011). Therefore, only large scale farms were excluded. The objective of the study was to interview farmers with animals on their property who were willing to participate in the survey. The IICA team identified producers with the help of the Departmental Ministerial Office. As instructed by the Haitian Secretary of State for Animal Production, Michel Chancy, "Farmers Organization Lists" were used to identify rural farming households. Stratified random sampling techniques were then used to select households for participation. Finally, the survey assessed 500 households throughout 5 of the 10 departments with a target of 100 surveys per department.

3.4 Development of the survey

The survey was designed to assess the contribution of animal production to income and food security in family and smallholder farmers in various Latin American and Caribbean countries. It was developed using the "National Survey of Living Conditions – 2011" conducted by the National Statistics Institute of Guatemala as a reference. This survey is supported by international institutions such as the Inter-American Development Bank and the World Bank.

After completion, the survey was received in March 2012 by the IICA offices in Haiti, Dominican Republic, Paraguay and Uruguay. Exchanges of the survey were conducted via email and recommendations and changes to the original documents were discussed. A video conference with Miguel Garcia on Tuesday April 3, 2012 was carried out to incorporate suggested changes to the survey. A proposed work plan for implementing the training of the survey and interviewer teams in each country was sent on that date. This version of the survey was again shared with the 4 offices involved. On May 30, 2012 a version with the inclusion of these suggestions and a list of possible inclusion criteria for the households to be surveyed was presented to the group. A final version of the survey was reviewed and adapted in each country during the workshops to train the interviewers.

In reference to validation of the design, functionality and applicability of the survey, prior to implementation, questions and components of the surveys were discussed with officials from the IICA offices in participating countries and later in the training workshops with interviewers. This ensured the apparent validity of the instrument. The surveys were adjusted to the variability of each country especially with regard to the types of common animals, agricultural products, food and different traditions. See Appendix B Section 3, 4, 5, 6 and 9 for these details on the survey for Haiti.

An *Interviewer's Manual* was developed after feedback was given during workshops in each country. This helped improve the applicability of the survey and database obtained. The manual contains the definition of each variable used in the survey in addition to skills and knowledge used to carry out the surveys. This consultation document was to be available on site during the interviews.

3.5 Data Collection

Data collection methods included in person interviews with a member (assumed to be the head of household) living on the farm. The surveys were conducted in April and May 2013 by 5 trained employees chosen by the Ministry of Agriculture of Haiti. One supervisor was responsible for overseeing each survey in all of the 5 departments.

The terms of reference of the interviewers that were selected were based on these requirements:

1) Previous experience in similar work.

- University student with the last 2 years of study in economics, agronomy, veterinary science, statistics or nutrition.
- 3) Possess good knowledge and management of IT user-level tools.
- 4) Willingness to travel within the country as required.
- 5) Good verbal communication skills.
- 6) Capacity for teamwork.
- Physical fitness appropriate for the performance of their duties to fulfill required tasks.
- 8) Preferably resident or originally from the region where the surveys will be conducted.
- 9) Languages: knowledge of the local/rural language (i.e. in Haiti: French and Creole).

To ensure quality data, interviewers were trained throughout a 4 day workshop conducted between May 18 to 21 2013. Three masters' students from the IICA office in Haiti, the team of 5 surveyors (selected agronomists) and a supervisor attended the workshop. An interpreter for Spanish/Creole translation was also present. The training workshop included discussions related to the framework of food security, interviewer training (presentation to potential respondent, data confidentiality, listening skills, handling of sensitive or embarrassing questions, responses to "I don't know", recording of the data and editing of the questionnaire) and cultural and linguistic modifications of the survey.

Each interviewer was given the following materials for each household interview:

 A Consent Letter: The interviewers introduced themselves and the study participants with this letter. Through this, the consent of the participants to take the survey was obtained.

- Interviewer Manual: This is a consultation document including the definition of each variable included in the survey. It also included guidelines on how to conduct the interviews
- 3) Survey copy

Upon completion of 500 interviews, the surveys were sent to McGill University in Montreal, Canada in July and August 2013.

The surveys received in Montreal in August were transcribed using Epi InfoTM 7.1.2.0 from September to November 2013. The data were reviewed and outliers were identified. Each outlier was manually traced back to the original survey to ensure that it was properly entered onto the computer. If it was an error, the variable was corrected.

3.5.1 Latin American and Caribbean household food security scale (ELCSA)

Food security levels were assessed using the Latin American and Caribbean household food security scale (ELCSA). This scale has been validated in various Latin American and Caribbean Countries and has been shown to provide similar measurements across countries. ELCSA has been modified to ensure face validity and cultural acceptability (Perez-Escamilla et al., 2009). The scale was translated from Spanish to French and Creole by members of the Haitian IICA team.

The scale consists of 15 questions, 8 of which are relevant to adults and 7 of which are relevant to children. The questions assess the psycho-social experience of the household with regards to food in the last month. The questions are ordered with increasing severity. For example, the first questions address whether or not the household has worried about or been preoccupied with food supplies in the last month. The questions then assess the quality and

diversity of the food eaten within the household. The final questions assess cutting quantity of food portions and skipping meals or days of eating entirely.

The last seven questions are specifically targeted at children within the household. The scale assumes that children are protected and will be the last to experience the consequences of food insecurity. In a state of severe food insecurity, the adults of the household would be the first to experience a decrease in quality followed by quantity of food and children would be the last to experience a decrease in food quantity (Melgar-Quinonez & Hackett, 2008; Perez-Escamilla et al., 2009).

Table 3.1 ELCSA questions

Questions referring to respondent and/or other adults in the household: During the last month...

- 1. Were you worried about running out of food?
- 2. Did your home run out of food at any time?
- 3. Was your home unable to eat at any time the kind of foods that make up a healthy diet?
- 4. Did you or anybody in your home usually have to eat the same foods almost every day?
- 5. Was there any day that you or any other adult in your home skipped a meal because of lack of food?
- 6. Did any adult in your home eat less food than what they needed because there wasn't enough food?
- 7. Was there any day when you or any other adult in your home felt hungry but did not eat because there wasn't enough food?
- 8. Was there any day when you or any other adult in your home didn't eat for a whole day or just ate once during the day because there wasn't enough food?

Questions referring to children in the household: During the last month...

- 9. Were you unable to provide the children in your home with the kinds of foods they need to be healthy?
- 10. Did any children in your home usually have to eat the same foods almost every day?
- 11. Did any child in your home have to skip a meal?
- 12. Did any child in your home eat less food than what s/he needed because there wasn't enough food?
- 13. Did you have to serve less food to any child because there wasn't enough food?
- 14. Was there any day when any child in your home that felt hungry but could not be fed because there wasn't enough food?
- 15. Was there any day when any child in your home that didn't eat for a whole day or just ate once during the day because there wasn't enough food?

3.5.2 Food Frequency Questionnaire

A food frequency questionnaire which included a comprehensive list of 113 food items was included in the survey. The questionnaire asked if the food item was consumed within the household in the last month (yes or no). If yes, the household member was asked how frequently it was consumed (daily, weekly, a few times a month, or monthly). It was then asked how the food item was acquired (self-production, purchased, hunted/fished, received as a gift, traded, or through a food program). This allows for an assessment of food quantity, quality and any potential relationship between household acquisition of food and agricultural practices.

The analysis of dietary diversity was done using the FAO's (2013) *Guidelines for measuring household and individual dietary diversity* which was adapted from the Food and Nutrition Technical Assistance (FANTA) Project (Swindale & Bilinsky, 2006). The survey contained 12 food groups which included: Bread, flours and cereals (item 001 – 010); Meat, organs and sausages (011-025); Fish (026 – 028); Milk products (029 – 036); Eggs (037 – 042); Oils and fats (043 – 047); Leafy vegetables and other vegetables (048 – 063); Tubers (064 – 072); Pulses (073 - 082); Fruits (083 – 099); Sugars and additives (100 – 107); Infusions (108 – 113). For analysis, the original food groups were regrouped into 16 groups using the FAO guidelines for obtaining a Household Dietary Diversity Score. The new groups included: cereals, white tubers and roots, dark green leafy vegetables, vitamin A rich vegetables, other vegetables, vitamin A rich fruits, other fruits, organ meat, flesh meat, eggs, fish, pulses, milk, oils, sweets and others (Kennedy et al., 2011). For certain analyses, key food groups were used to simplify results. These groups included:

- Staples: cereals and tubers

- Animal Source Foods: flesh meat, organ meat, fish, dairy and eggs

- Meat and Fish: flesh meat, organ meat and fish

- Empty Calories: oil and sugar

- Vitamin A Rich Foods: vitamin A rich fruits and vitamin A rich vegetables

- Vitamin Rich Foods: other vegetables, vitamin A rich vegetables, green vegetables, other fruits and vitamin A rich fruits

- All Fruits

- All Vegetables

3.5.3 Socioeconomic and Demographic Characteristics

The survey included questions regarding characteristics of the household including number of people living in the household, ages of all members, literacy of all members, education levels of all members and professions of all members. It also included income of the household and land characteristics including size. Animal ownership, sales and values were also included in the survey but will not be used for the purpose of this study. All questions were adapted in reference to the National Survey of Living Conditions (2011) in Guatemala.

3.6 Data Analysis

3.6.1 Data Processing

3.6.1.1 ELCSA

Data collected were processed and analyzed based on research purposes. The 16 item ELSCA score was coded as follows: affirmative responses to items were coded as 1, while negative responses were coded as 0. A food security score was assigned to each household as the sum of all affirmative points. Food security was categorized into the following groups: food secure (score - 0), mildly food insecure (1-3 in households without children; 1-5 in households

with children), moderately food insecure (4-6 in households without children; 6-10 in households with children) and severely food insecure (7-9 in households without children; 11-15 in households with children).

3.6.1.2 Food Frequency Questionnaire

For total food item count, all foods that were consumed in the last 7 days were coded 1 for all affirmative responses. All affirmative responses were summed.

The food items were categorized into 16 groups according to the FAO's *Guidelines for measuring household and individual dietary diversity*. Using the HDDS, the groups were further condensed into 12 main food groups. A dietary diversity score was calculated by adding all food groups that had at least one food item consumed in the last week. A score of 0-12 was then obtained and compared by food insecurity state.

The proportion of food items within a food group relative to the total food items consumed was calculated. Five food groups that included all food items were used in this test. The 5 food groups were staples, pulses, vitamin rich food, animal source food and empty calories.

3.6.2 Variables of interest

- Food items: including total food items, food groups (12 groups in Food Frequency Questionnaire transformed into 16 groups used as per FAO recommendations) and individual food items that were consumed in the last 7 days.
- 2) Household food security status
- 3) Demographic and household controls: Age of head of household, gender of head of household, number of children in a household, education of head of household, household income, land size, number of animals, departments.

3.6.3 Statistical Analysis

The statistical analysis for this project was done using The Statistical Package for the Social Sciences (IBM[®] SPSS[®] Statistics Version 22: 64-bit) for Windows edition and STATA intercooled Version 11.0. Recommendations made by Lærd Statistics by Lund Research Ltd 2013© were used as a reference material.

Of the 500 households surveyed, 487 households were included in the analysis. The food secure group contained only 13 (2.6%) households which were excluded.

3.6.3.1 Data Description and Analysis

For description of the data, the mean was used to measure central tendency and standard deviation was used to measure the dispersion. For categorical variables, percentage and number of households were used.

The Chi-squared (χ^2) test was used to compare categorical variables in cases where it is assumed that all individual expected cell counts are greater than 1 and no more than 20 percent of the expected counts are under 5. To compare the mean of continuous variables between levels of food insecurity, the ANOVA test was used. The test was used in cases where the variables met the assumptions of homogeneity for variance and the distribution of data was normal. For multiple comparisons when ANOVA was statistically significant, the Bonferroni post-hoc analysis was used. For the comparison of two continuous variables, a Pearson's correlation coefficient was used. All analyses were considered statistically significant at the 95% confidence level.

A multiple analysis of variance (MANOVA) and regression were run using STATA intercooled version 11.0 to test the association between total numbers of food items consumed, total items per food group and dietary diversity scores with food insecurity. These tests

controlled for 6 independent variables including the number of children in the household, daily per capita income, total land size, total number of animals, gender of the head of household and education of the head of household (whether or not they finished primary school).

3.7 Ethical Considerations

This study used secondary data and analysis was approved by the McGill University Research Ethics Board (REB) for research involving human subjects. The IICA members in Haiti followed their organizations ethical guidelines during the process. The IICA and the Haitian Ministry of Agriculture provided McGill University with formal permission to use the data collected in the surveys for the purpose of this study.

4. CHAPTER 4: MANUSCRIPT

Food Security and Dietary Diversity among Smallholder Farmers in Haiti

Jasmine A. Parent¹, Diana Dallmann², Kate M. Sinclair¹, Miguel Garcia², Lea Berrang Ford³, Hugo Melgar-Quiñonez⁴

- 1. School of Dietetics and Human Nutrition, McGill University, Ste-Anne-de-Bellevue, Canada
- 2. Inter-American Institute for Cooperation in Agriculture, United States
- 3. Department of Geography. McGill University, Montreal, Canada
- 4. McGill Institute for Global Food Security, Ste-Anne-de-Bellevue, Canada

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4.1 Abstract

Introduction: Food Security is a multi-faceted phenomenon and therefore often difficult to accurately measure. Haiti, being the poorest country in the Western Hemisphere, has high levels of poverty, malnutrition and food insecurity. It is estimated that over half of the population lives in extreme poverty, on less than one US dollar a day. Since purchasing power for food is directly related to a households' consumption, dietary quantity and quality are greatly reduced in situations of extreme poverty and food insecurity. Dietary diversity has been shown to imply nutrient adequacy among populations and when compromised, results in poor health status. Fortunately, dietary diversity is relatively inexpensive and comprehensive to assess. Food variety and dietary diversity scores have been traditionally used to assess dietary quality in developing countries.

Objectives: 1) Determine the food security status of smallholder farmers in Haiti. 2) Assess the relationship between food security and dietary diversity.

<u>Methods</u>: This is a cross-sectional study of 500 surveyed households in Haiti. Data were analyzed using IBM statistic 22.0 © 2012 software. The Latin American and Caribbean Food Security scale (ELCSA) was used to measure food security. The Food and Agriculture Organization of the United Nations *Household Dietary Diversity Guidelines* were used to assess dietary diversity and diet quality.

<u>Results:</u> Results show that sixty-two percent of households were severely food insecure, with 2.6 percent being food secure. Dietary Diversity Scores (DDS) decreased significantly from mild (11.0) to moderate (10.0) to severe (9.4) food insecurity, after controlling for number of children, gender of head of household, daily per capita income, education, number of animals and land size. Furthermore, the number of total food items consumed decreased significantly from mild (34.3) to moderate (25.9) and severe (22.5) food insecurity after controlling for the same variables. The decrease affected staple foods, eggs, dairy, meat/fish, fruits and vegetables. Sugar consumption remained the same in all groups. When compared to all foods consumed, the proportion of animal source foods decreased from food secure (18.6%) to severely food insecure households (11.6%) while the proportion of sugars and oils increased from food secure (14.0%) to severely food insecure households (18.6%).

<u>Conclusions</u>: Being severely food insecure significantly decreased a households total food consumption and their intake of many nutrient dense foods. However, the minimal changes in consumption of low nutrient dense foods like sugars and oils implies greater access to foods with calories but little micronutrient value. Future intervention programs should aim to inversely improve access to energy and nutrient dense foods and decrease the access to empty calorie foods to reduce the consequence of hidden hunger.

4.2 Introduction

The 1948 Declaration of Human Rights states that, "Everybody has the right to a standard of living adequate for the health and well-being of himself and of his family, inducing food..." (Article 25 of the Universal Declaration of Human Rights: Adopted and proclaimed by General Assembly of the United Nations resolution 217 A (III) of 10 December 1948) (Danieli et al., 1999). As food is one of the most basic of human needs, hunger in developing nations remains of great concern to world leaders. Moreover, food security is defined as the state when "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (Food and Agriculture Organization of the United Nations, 1996, 2013). In 2011-2013, the estimated prevalence of global food insecurity affects a total of 842 million people or one eighths of the world's population (Food and Agriculture Organization of the United Nations, 2013). Hunger trends differ across regions depending on a country's economic conditions, infrastructure, the organization of food production and political and institutional stability. This makes the complex nature of food insecurity very difficult to measure. Therefore, the prevalence of food insecurity, whether it is in the form of hunger or nutrient deficiencies, may actually be higher than current estimations.

Haiti, one of the poorest countries in the Western Hemisphere, is greatly affected by severe poverty, malnutrition and food insecurity. Poverty, corruption, vulnerability to natural disasters and low levels of education has put Haiti at a serious disadvantage when it comes to overcoming food insecurity. According to FAOSTAT, in 2013, 49.8percent (about 5 million people) of Haiti's population was considered undernourished. Food insecurity is known to be correlated with a number of negative health and nutrition status outcomes including

micronutrient deficiencies, poor development and quality of life. Since 1992, Haiti's prevalence of under nutrition was steadily decreasing; however on January 12, 2010 the country was devastated by a massive 7.3 magnitude earthquake (OXFAM, 2014). This forced Haiti into a massive humanitarian crisis. In the progress of recovery, knowledge gaps exist on the state of food insecurity among the rural areas of Haiti. Gaining knowledge on the present situation regarding food security in Haiti is a crucial step towards the development of effective and sustainable intervention measures that target smallholder rural Haitian farmers.

This study addresses the impact food insecurity has on dietary diversity. It explores the changes in food groups' consumption at different levels of food insecurity. There has been little prior research carried out on the association between dietary diversity and food security. Understanding this association supports the identification of high risk groups and their coping strategies for food consumption. This investigation contributes to the development of a better understanding of nutrition security as a part of food security. Finally, this information is of great importance to governmental and non-governmental organizations in the development and evaluation new and current food aid programmes in Haiti to warrant more focus on dietary quality.

4.3 Methodology

This study analyzes secondary quantitative data using a survey that was resourced by the IICA and Haitian Ministry of Agriculture. It is a cross sectional study carried out in rural Haiti by in person interviews using a stratified random sample. The Latin American and Caribbean Food Security Scale (ELCSA) and a food frequency questionnaire in the survey were used to analyze food security and dietary diversity.

4.3.1 Study Site

The study took place in Haiti, a country located on the western third of the island Hispaniola in the Caribbean. It covers 27,650 square kilometers and is divided into 10 departments: Nord-Ouest, Nord, Nord-Est, Artibonite, Centre, Ouest, Sud-Est, Nippes, Sud and Grand'Anse. Randomly selected households were chosen from five of the ten departments. Those chosen departments included: Nord, Nord-Ouest, Sud, Artibonite and Centre.

4.3.2 Sample Selection

The IICA and Haitian Ministry of Agriculture chose the departments and households to be surveyed. The departments were strategically selected based on similarities between the agricultural systems and ecosystems. The 5 departments chosen were selected to best represent the country's farming population and diverse agro-eco systems of Haiti. The target population in this study is smallholder rural farming households in Haiti. Given that 95 percent of Haitian farmers are smallholders and have very similar characteristics including plot sizes less than 1.5 hectares, the cut off points for the inclusion criteria for this study were not available (Glaeser et al., 2011). The objective of the study was to interview farmers with animals on their property who were willing to participate in the survey. The IICA team identified producers with the help of the departmental ministerial office. As instructed by the Haitian Secretary of State for Animal Production, "Farmers Organization Lists" were used to identify rural farming households. Stratified random sampling techniques were then used to select households for participation. Finally, the survey assessed 500 households throughout 5 of the 10 departments with a target of 100 surveys per department.

4.3.3 Data Collection

Data collection methods included in person interviews with a member (assumed to be the head of household) living on the farm. The surveys were conducted in June and July 2013 by 5

trained employees chosen by the Ministry of Agriculture of Haiti. One supervisor was responsible for overseeing each survey in all of the 5 departments.

Food security levels were assessed using the Latin American and Caribbean household food security scale (ELCSA). This scale has been validated in various Latin American and Caribbean Countries and has been shown to provide similar measurements across countries. ELCSA has been modified to ensure face validity and cultural acceptability (Perez-Escamilla et al., 2009). The scale was translated from Spanish to French and Creole by members of the Haitian IICA team. The scale consists of 15 questions, 8 of which are relevant to adults and 7 of which are relevant to children. The questions assess the psycho-social experience of the household with regards to food in the last month. The questions are ordered with increasing severity. Food security was categorized into the following groups: food secure (score - 0), mildly food insecure (1-3 in households without children; 1-5 in households with children), moderately food insecure (4-6 in households without children; 6-10 in households with children) and severely food insecure (7-9 in households without children; 11-15 in households with children).

A food frequency questionnaire which included a comprehensive list of 113 food items was included in the survey. The questionnaire asked if the food item was consumed within the household in the last month (yes or no). If yes, the household member was asked how frequently it was consumed (daily, weekly, a few times a month, or monthly). They were then asked how the food item was acquired (self-production, purchased, hunted/fished, received as a gift, traded, or through a food program). This allows for an assessment of food quantity, quality and any potential relationship between household acquisition of food and agricultural practices.

And finally, the survey included questions regarding characteristics of the household including number of people living in the household, ages of all members, literacy of all members, education levels of all members and professions of all members. It also included income of the household and agricultural characteristics including land size. Animal ownership, sales, value...etc. were also included in the survey but will not be used for the purpose of this study. All questions were adjusted in reference to the National Survey of Living Conditions (2011) in Guatemala.

4.3.4 Statistical Analysis

Due to an extremely high prevalence of severe food insecurity (n=312, 62.4%) and such a small prevalence of food security (n=13, 2.6%), the food secure category was excluded in bivariate and multivariable analyses Therefore, the total number of households included for the majority of the analyses was 487.

4.3.5.1 Descriptive and Inferential Analysis

The Chi-squared (χ^2) test was used to compare categorical variables in cases where it is assumed that all individual expected cell counts are greater than 1 and no more than 20 percent of the expected counts are under 5. To compare the mean of continuous variables between levels of food insecurity, the ANOVA test was used. The test was used in cases where the variables met the assumptions of homogeneity for variance and the distribution of data was normal. For multiple comparisons when ANOVA was statistically significant, the Bonferroni and Kruskal-Wallis post-hoc analysis was used. For the comparison of two continuous variables, a Pearson's correlation coefficient was used. All analyses were considered statistically significant at the 95% confidence level.

4.3.5.3 Multivariate Analysis

A multiple analysis of variance (MANOVA) and regression were run using STATA intercooled version 11.0 to test the association between total number of food items consumed, total items per food group and dietary diversity scores with three levels of food insecurity (mild, moderate and severe). These tests controlled for 6 independent variables including the number of children in the household, daily per capita income, total land size, total number of animals, gender of the head of household and education of the head of household (whether or not they completed primary school). A statistical significance of p<0.05 was used.

Ethical Considerations

McGill Ethic's approval was obtained from the Research Ethics Board of the Faculty of Agriculture and Environmental Sciences at McGill University on the Ethical Conduct of Research Involving Human Subjects, the Research Ethics Board guidelines, and the Ethical Conduct for Research Involving Humans.

4.4 Results

4.4.1 Sample Characteristics

A total of 500 households were included in the study. Table 4.1 provides a summary of key descriptive characteristics of the sample.

The age of the head of household ranged from 20 to 86 with a mean of 49 years. Most head of households were married with only 15 percent being single. The household size ranged from 1 to 18 people with an average of 6.2 members per household. The number of children per household ranged from 0 to 11 with an average of 3.15 children under the age of 18 per household.

Over half (66%) of the head of households did not complete primary school. Only 8 percent (n = 19) of head of households completed high school and 1.6 percent (n = 8) had a university degree.

Annual incomes ranged greatly from 88.83 USD to 16, 732 USD with an average of 2,550 USD ($\pm 2,567.7$). The mean daily per capita income was 1.2 (± 1.2) USD, signifying that even the average daily income remains under the poverty line (2 USD/day). Almost 60 percent of households were living under 1 USD/day which is considered extreme poverty.

The average land owned per household was $1.6 (\pm 1.2)$ carreaus which is equivalent to 2.1 hectares. The land sizes ranged from 0.1 to 8.5 carreaus.

See Figure 4.1 for the prevalence of food insecurity.

4.4.2 Bivariate Analysis

4.4.2.1 Food Security and Related Variables

Chi-square tests used to assess the relationship between food insecurity and several independent categorical variables including head of household gender, literacy of household head and spouse, marital status of household head, education and households living in extreme poverty can be found in figure 4.2 for details. Finally, there was no significant trend seen between the 5 departments and food insecurity. However, Nord-Ouest tended to have the highest proportion of severe food insecurity. The other 4 departments were similarly distributed.

One way ANOVA tests were used to test the association between food insecurity and several independent continuous variables including head of household age, household size, number of children, number of livestock, and land size. See table 4.2 for details.

4.4.2.2 Food Insecurity and Food consumption

The number of total food items consumed in the last week decreased from the mild (34.3 ± 8.8) to moderate 25.9 ± 7.6) to severe (22.5 ± 7.3) food insecurity, in that order. The decrease in total food item consumption in the household was statistically different between different levels of food insecurity. Games-Howell post-hoc analysis revealed that increases from mild to moderate food insecurity (8.48, 95% CI (5.11 to 11.86), p<0.00)), from moderate to severe (3.312, 95% CI (1.47 to 5.16), p<0.00)) and from mild to severe (11.80, 95% CI (8.62 to 14.98), p<0.00)) were significant.

Table 4.3 summarizes the results of the one-way ANOVA bivariate analysis of the mean number of foods consumed per group in the last week by food insecurity. The mean consumption of all foods per food group, with the exception of sugar and organ meat, decreased as food insecurity increased.

Table 4.4 summarizes the results for the chi-square bivariate analysis of the proportion of households who consumed at least one item from a food group by food insecurity. As food insecurity becomes more severe, food groups including flesh meat, fish, dairy, eggs, other vegetables, vitamin A rich vegetables, green vegetables, other fruits, animal sourced foods and meat & fish tended to decrease in consumption. In other words, mildly food insecure households were more likely to consume at least one food from these food groups when compared to moderately and severely food insecure households. At least one item from cereals, empty calories, vitamin rich and staple food groups were consumed by all households, regardless of food insecurity.

When the Vitamin A rich fruit group was reanalyzed excluding mango, the mean intake decreased from the mild (0.5 ± 0.5) to moderate (0.2 ± 0.4) to severe (0.3 ± 0.4) food insecurity,

in that order. The decrease in vitamin A rich fruits, excluding mango, consumption in the household was statistically different between mild and moderate food insecurity, (p <0.01). Games-Howell post-hoc analysis revealed that the decrease from mild to moderate food insecurity (0.26, 95% CI (0.06 to 0.45), p<0.00) and mild to severe food insecurity (0.24, 95% CI (0.05 to 0.42), p<0.01) was significant. No significant difference was seen between moderate and severe food insecure households (p = 1.00).

The dietary diversity scores were calculated using the FAO's guidelines for measuring Dietary Diversity. The mean scores decreased from mild (11.0 ± 1.0) to moderate (10.1 ± 1.4) to severe (9.4 ± 1.5) food insecurity, in that order. The decrease was significant between all levels of food insecurity (p<0.00). Games-Howell post-hoc analysis revealed that the decrease from mild to moderate food insecurity (0.88, 95% CI (0.02 to 1.52), p<0.01) and moderate to severe (0.65, 95% CI (0.93 to 2.14), p<0.00). The chi-square tests for the association between dietary diversity scores and food insecurity were also significant; χ^2 (14) = 52.23, p<0.00. This test showed that the majority (n=25) of mildly food insecure households showed a score of at least 11 with no household scoring below 8. The majority (n=63) of moderately food insecure households had scored between 10 and 11 with no household scoring under 7. The majority (n=200) of severely food insecure households scored between 8 and 10, 22 households scored 7 and 5 households scored less than 6.

The scores of each food group were summarized by mild, moderate and severe food insecurity to obtain the total dietary diversity scores. All households consumed at least one item from the groups' cereals and others (giving them a score of 1). Groups including oil, pulses, sugar, vegetables and fruits fluctuated very slightly (a max decrease of 0.03) from mild to severe food insecurity. The mean score of tubers decrease from mild (0.83) to moderate (0.69) to severe

(0.60). Flesh meat decreased from mild (0.86) to moderate (0.71) to severe (0.53). Fish decreased from mild (0.63) to moderate (0.53) to severe (0.50). Dairy decreased from mild (0.94) to moderate (0.71) to severe (0.56). Eggs decreased from mils (0.69) to moderate (0.50) to severe (0.35).

Food items were grouped into the following principal categories: staples = (tubers + cereals), pulses, animal source = (meat + fish + dairy + eggs), vitamin rich = (vegetables other + vitamin A rich vegetables + green vegetables + other fruits + vitamin A rich fruits), and empty calories = (sugar + oil). Figure 4.3 summarizes the proportion of these food groups with the total number of foods consumed by household food security. There was a significant decrease in the proportion of animal source foods with increasing food insecurity, $\chi^2(4) = 23.55$ (p<0.00). There was also significant increase in the proportion sugar and oil foods consumed as food insecurity increased, $\chi^2(4) = 24.77$ (p<0.00).

4.4.2.3 Variables related to food consumption

Dietary diversity scores significantly changed when tested with a variety of independent variables. Literacy and education of the head of household significantly increased a household's dietary diversity score. Households living in extreme poverty tended to have lower scores. There were significant positive relationships between number of livestock and land size. There were no relationships observed between dietary diversity scores and gender of the head of household, literacy of spouse, marital status, household size and department.

Literacy of the head of household and/or spouse and education of the head of household (completion of primary school) significantly increased the total food consumption, the mean number of animal source foods, staples and vitamin rich foods including vegetables. Literacy and education also affected the proportion of households who consumed from these same food groups. This trend was not seen for sugars, vitamin a rich fruits or oils.

There were no statistically significant relationships found between the gender, marital status of the head of household and household size with the proportion of households who ate at least one item from each food group or the mean number of food items consumed per group.

There was a negative correlation between age and all mean number of food items per groups except pulses, other fruits and total fruits. These relationships were significant for total food items, animal source foods, all vegetables and vitamin rich foods. Older heads of households were less likely to eat from all food groups except oil, pulses, vitamin A rich fruits and sugar.

Households living in extreme poverty significantly decreased mean consumption of all food items, all animal source foods, all vegetables, pulses and vitamin rich foods. This trend was not seen for oils and sugars. The proportion of households who ate an item from each food group tended to decrease as extreme poverty increased for all groups except oil. These trends were significant for total vegetables, meat and fish.

Similarly, daily per capita income significantly increased the mean intake of food items for all food groups except tubers and sugar. The proportion of households with higher incomes tended to eat at least one item from all food groups, except for oil. This trend was significant all animal source foods and green vegetables. A lower daily income significantly increased consumption from the oil group.

The number animals on a farm significantly increased the mean intake of food items for all food groups except tubers, oil, green vegetables, vitamin A rich fruits and other fruits. A

larger number of animals on the farm significantly increased the proportion of households who ate from all animal source food groups.

Increased land size increased the mean intake for food items for all food groups except green vegetables, sugar and other fruits. The proportion of households who ate an item from all food groups, tended to increase with increased land size, with the exception of oil where smaller land sizes significantly more oil.

4.4.3 Multivariable Analysis

Table 4.4 and 4.5 summarize the results for the multiple ANOVA regression analysis for total food items and dietary diversity scores respectively and food insecurity. Adjusting for total number of children, daily per capita income, land size, total animals, gender of head of household and education of head of household, there was a statistically significant relationship between total food item intake and food insecurity ($R^2 = 0.22$, p<0.00). A regression was run on the MANOVA to generate coefficients for each of the food insecurity categories. A coefficient of -5.75 for moderate food insecurity indicates that for a decrease from a state of mild to moderate food insecurity, there was a decrease of 5.75 of total food items within a household. From mild to severe food insecurity, there was a decrease in 8.76 food items.

Adjusting for 6 independent variables, there was a statistically significant relationship between dietary diversity scores and food insecurity ($R^2 = 0.14$, p <0.00). A coefficient of -0.56 for a decrease in mild to moderate food insecurity indicates a decrease in 0.56 of a score. From mild to severe food insecurity, there was a decrease in 1.12 of a dietary diversity score. The same test was done for animal source foods, vitamin rich, staples and empty calories. For animal source foods, adjusting for the 6 independent variables, the analysis was statistically significant for all food insecure categories, p<0.05, $R^2 = 0.20$. For vitamin rich foods, the analysis was statistically significant for all food insecure categories, p<0.05, $R^2 = 0.13$. For staples, the analysis was statistically significant for all food insecure categories, p<0.05, $R^2 = 0.17$. And for empty calories there was no statistical significance, $R^2 = 0.05$, between mild and moderate (p = 0.10), moderate and severe (p = 0.28) and mild and severe (p = 0.24).

4.5 Discussion

4.5.1 Food Security

Due to the country's state of extreme poverty, food insecurity rates were expected to be high. As such, these predictions were true with 62 percent of households living in states of severe food insecurity and only 2.6 percent in a state of food security. These findings are comparable to those found by Pérez-Escamilla et al. (2009) using similar methods including ELCSA to evaluate food insecurity in Haiti. The CNSA-led National Food Security Survey (NFSS) with a sample size of 3,557 households, found contradicting results showing only 2.1 percent of the Haitian population being in a state of severe food insecurity and 21 percent being highly food secure. The majority of the population, however, (76.8%) was shown to be living in some state of food insecurity ranging from highly food insecure to moderately food secure (Coordination Nationale de la Sécurité Alimentaire, 2011). The differences in results may be attributed the inclusion of urban and rural populations, as opposed to only rural populations for this study. Urban areas tend to be more food secure than rural, therefore it is expected that there be a higher level of food security overall. Another cause may be the different methods used to measure food insecurity. The NFSS used an index that combined a Food Consumption Score, a Dietary Diversity Score and a Hunger score. These indices measure a completely different aspect of food insecurity as compared to ELCSA. Moreover, the lack of a gold standard for measuring food insecurity due to its multifaceted nature may render variations in results that are intended to measure the same thing.

4.5.2 Dietary Diversity and Food Security

The key purpose of this study was to assess the relationship between food security and dietary diversity, assuming that as food insecurity becomes more severe, the diversity of a household's diet would also diminish. This relationship was found to be significant with the loss of an entire food group for each state of food insecurity. This relationship has been shown in a number of studies, giving the measurement of dietary diversity the potential to be an indicator for food insecurity. Hoddinott and Yohannes (2002), were one of the first to address this relationship, showing a positive association between dietary diversity, per capita consumption and energy availability. Using more comparable methods, other studies have shown the same trend, finding that certain food groups, like starches, tend to have higher elasticity during different states of severe food insecurity (Faber et al., 2009). This study has shown that cereals, oils and sugars tended to be the most elastic. As the intake of animal sources decreased, pulses became the primary source of protein. However, in severely food insecure states, the only food group to have the highest proportion of consumption was sugars.

Similarly, it was the most impoverished households that had the lowest food insecurity and dietary diversity scores. Those living in poverty or extreme poverty have limited purchasing power, directly affecting their ability to buy a variety of foods. It has been demonstrated that as income rises, households tend to diversify their diets, in turn increasing their micronutrient intakes and improving their nutrient adequacy (Hatløy et al., 2000). Furthermore, rural areas tend to have lower dietary diversity than urban areas (Leatherman, 1994). Not only do rural areas tend to be poorer, but they also have limited physical access to markets. In Haiti, infrastructure is poor, and rural dwellers often do not have access to roads that lead to urban centers. Therefore, for those living in extreme poverty, the ability to acquire a variety of foods, unless self-produced, is extremely difficult.

Dietary diversity has also been demonstrated as food variety (the total number of food items consumed within a household). This study has shown that food variety tended to decrease significantly as food insecurity worsened. As recognized in ELCSA, an increasing state of food insecurity increases the likelihood of household members to skip meals or entire days of eating, which is evidently related to the total number of items consumed in a week. The MANOVA regression analysis demonstrated that even after controlling for other independent variables like number of children and income, the total number of food items still tended to decrease. Food quantity provides energy to household members and so it is evident that severe food insecurity is likely to result in undernutrition and hunger.

The variety of items consumed in all food groups tended to significantly decrease, with the exception of organ meat and sugar, as food insecurity became more severe. Due to only one item existing in the organ meat group, this trend contributes little to the diversity of the diet. Groups that decreased among all food insecurity states were staples, meats, dairy products and vitamin rich foods. Similarly, Leatherman (1994) found that poorer, rural areas have significantly lower intakes of meat, dairy products and vegetables. One might think that farmers should have access to nutrient rich foods that are part of their agricultural production. However, even if poor farmers appear to have access to these foods, it is very common for households to sell their production before consuming it. Some food groups only showed significant decreases between mild and moderate states of food insecurity including tubers, oil, pulses, fruits, and vitamin A rich foods. Staples (rice), pulses (beans), tubers, sugars and cooking oils tend to be the most easily accessible foods for poor households, therefore remaining in relatively constant consumption. As the intake of nutrient rich foods decrease, households tend to replace their consumption with these cheaper and high energy foods to reduce the effects of hunger as much as possible.

This study showed that as the state of food insecurity increased, entire food groups were eliminated from the household's diets. These food groups included flesh meat, fish, dairy, eggs, vegetable and some fruits. Only 35 percent of severely food insecure households consumed eggs and less than half consumed green vegetables, flesh meat and dairy. Every household consumed at least one staple, one sugar and oil and one vitamin rich food. The majority of food consumed by the vitamin rich food group came from other vegetables which included onions, cauliflower, peas and cabbage. Of the vitamin rich foods, these are considered to have the lowest nutrient density, including energy. It is therefore evident that besides vitamin A rich foods and pulses, sources for micronutrients become extremely limited in severely food insecure states.

It was noted that the proportion of households who consumed Vitamin A rich fruits and foods did not decrease significantly with food insecurity. In Haiti and other Caribbean countries, peak mango season generally occurs between May and September (Hrapsky, Weber, & Riley, 1985). Mangos are one of Haiti's most cultivated and consumed foods by small holder farmers (Central Intelligence Agency, 2013-2014). Their high nutrient content provides Haitian's with an opportunity to increase their vitamin A consumption. Without mango consumption, there would be significantly lower access to vitamin A rich foods.

Sugar intake did not change with food insecurity. Nearly every single household consumed from the sugar food group. In the survey, this food group included cream sugar, refined sugar, jams and jellies, syrup, powdered juices, candies and rapadura (unrefined whole cane sugar). This trend indicates that these foods are easily accessible, even by the poorest households. Not only does high sugar intake have negative effects on nutrition status, one study showed the effect of high sugar consumption in rural Haiti on dental carries in children (Psoter, Gebrian, & Katz, 2008). Furthermore, for households where energy consumption may be adequate but access to

nutrient rich foods, including animal source and vitamin rich foods are limited, the potential for hidden hunger is amplified.

Regarding the proportion of food groups relative to all foods consumed, as food insecurity became more severe, the proportion of staples and pulses tended to increase (not significantly). This was expected since rice and beans are the most consumed foods in Haiti. The proportion of vitamin rich foods tended to decrease, especially in severe food insecurity (not significantly). A decrease in animal source food consumption significantly decreased as sugar and oil consumption increased. Poorer households tend to substitute animal products with pulses as a source of protein because pulses are cheaper. Although many may argue that a diet low in animal source foods can be nutritionally adequate, in situations where food access is generally limited, it becomes very challenging for households and individuals to acquire adequate nutrition on a plant based diet. Negative health outcomes associated with improperly balanced plant based diets include anemia, poor growth, rickets, impaired cognitive function, blindness, neuromuscular deficits and death (Murphy & Allen, 2003). The literature has shown that a diet including animal and plant based foods is likely to provide all essential macro and micro nutrients (Murphy & Allen, 2003; Neumann et al., 2003). Since protein-energy-malnutrition and anemia are common in developing countries (Neumann, Harris, & Rogers, 2002), including Haiti (Russell, Psoter, Jean-Charles, Prophte, & Gebrian, 2010), consuming a diet with adequate protein is important especially for child development and maternal health.

Although this study did not assess BMI, it is important to mention the incidence of obesity in Haiti. According to the literature, households with adults or children who tended to be overweight or obese were of higher socioeconomic status when compared to households with lowers BMIs (Raphaël, Delisle, & Vilgrain, 2005). Poorer families are more likely to suffer from

hunger and malnutrition. However, relatively speaking, families with higher socioeconomic status in Haiti, when compared to a highly developed country like the United States, are still considered to be of lower SES. These families have a higher economic access to food which tends to be cheaper, high calorie, low nutrient dense foods. In a country heavily impacted by extreme poverty, the psychology towards food is to intake as much energy as is available or accessible. Overweight or obesity may be seen as protective of hunger and undernutrition, and seen as a healthier alternative.

As much of the developing world is seeing a nutrition transition from patterns of famine, undernutrition and infectious diseases to one with a higher prevalence of nutrition-related noncommunicable diseases and hidden hunger (Popkin, 2003), Haiti still remains predominantly experiencing the former. As for many other countries including Mexico, Brazil, Chili and China, a shift towards diets high in saturated fats, sugars and processed foods, often referred to as the "Western diet", has been the product of urbanization, economic growth and changes in technologies (Popkin, Adair, & Ng, 2012). As shown in this study, the household consumption of oils and sugars tended to remain unchanged at all levels of food insecurity and the proportion of consumption relative to total food intake tended to increase. This indicates a shift towards the nutrition transition mentioned above. Presently, Haiti remains the Latin and Caribbean country to have the lowest incidence of obesity and lowest caloric intake (Kain, Vio, & Albala, 2003). It is therefore crucial that programs created to improve this situation are aware of the possible risks of driving a population from a state of malnutrition and famine to one of malnutrition and obesity. For example, the Supplementary Feed Programme (PNS) and the Prevention of Malnutrition in Under Two Approach (PM2A) in Haiti, distribute foods that include fortified maize-soybean meal, oil, sugar and iodized salt to mothers and children to reduce the effects of hunger and

malnutrition (United States Agency for International Development, 2010). As experienced in countries like Mexico and Brazil, some of the traditional methods associated with feeding programs and reducing poverty have had unanticipated consequences including a higher incidence of the double burden of malnutrition and hidden hunger (Popkin et al., 2012; Rivera, Barquera, González-Cossío, Olaiz, & Sepúlveda, 2004). Evidence from this study gives indication that some food programs should reconsider their methods and quality of food distribution to avoid potential consequences that are difficult to reverse.

4.5.2.1 Departments

Although there were no statistical differences between departments and food insecurity, Nord-Ouest had the highest proportion of individuals, 72 percent, living in a state of severe food insecurity. The NFSS has also found that more than half of the locals living in the Nord-Ouest are food insecure (Coordination Nationale de la Sécurité Alimentaire, 2011). This particular area is highly prone to food insecurity due to low productive resources, high frequency and susceptibility to tropical storms and hurricanes, soil erosion and limited resource access due to high poverty rates (Baro, 2002).

4.5.2.2 Gender and Marital Status

There was no observed relationship between gender of the head of household and the state of food insecurity within the household. There were also no relationships seen with gender and consumption of food groups. In the literature, female headed households tend to be more food insecure than male headed households (Felker-Kantor & Wood, 2012; Floro & Bali Swain, 2013; Zakari et al., 2014). This may result from the possibility that if a woman is the head of the household, she is likely to be single, without the support of a spouse. Furthermore, a female headed household must take on the responsibilities of the agricultural labor force as well as

cooking, cleaning, food preparation activities, transporting and marketing produce and caring for children (Hyder et al., 2007). Male headed households are assumed to be better positioned to execute heavy labor activities and have better access to agricultural resources (Gebrehiwot & van der Veen, 2014). The lack of a statistically significant trend observed in this study may be due to the small percentage (10.8%) of households that were headed by a female.

4.5.2.3 Age

There was no statistically significant trend found for the age of head of household and food insecurity. The literature has presented arguments for both possible trends. Some believe that as a head of household ages, they acquire more experience, knowledge and assets which may positively contribute to food security (Hofferth, 2004). However, significant decreases in the consumption of most major food groups as founded in this study implies that older heads of households may have limited access to a more diverse diet. Sugar, oil, pulses and vitamin A rich fruits were consumed more and animal sources consumed less by older heads of households. This was trend was similar to the number of animals on the farm. Efficiency in carrying out demanding farm activities may be limited, including animal care, causing lower production and productivity levels (Gebrehiwot & van der Veen, 2014). Furthermore, an older head of household is more likely to have more children than a younger head of household who is just starting a family. A larger household size may also negatively impact access to a variety of foods.

4.5.2.3 Household Size

Households with larger families tended to be more food insecure; however, these results were not significant. Other studies have shown this trend to be significant (Zakari et al., 2014), indicating that larger households require more resources and have higher food demands than

smaller households. In some cases, one might argue that larger households have more members that are capable of working in the labour force or on the farm, therefore implying more resources. Moreover, this study found that households with a higher number of children under the age of 18, tended to be significantly more food insecure. This is a result of increasing the dependency ratio, meaning that these members are at a non-productive age and are a high liability for the family to feed. These results are comparable to others found in the literature (Babatunde, Omotesho, & Sholotan, 2007; Gebrehiwot & van der Veen, 2014)

4.5.2.6 Education

Education of the head of household was shown to be negatively correlated with food insecurity; meaning if the head of household completed at least primary school, the state of food insecurity was likely to improve. Education promotes literacy, which increases a household access to public information which benefits health, nutrition and hygiene (Mukudi, 2003). Education may also improve a farmer's knowledge which is likely to improve farming techniques and productivity which positively impacts food security. Education of the head of households also increased a household's dietary diversity by increasing the consumption of animal source foods, fruits and vegetables. The consumption of sugar tended to decrease in households with an educated head of household. This may be due to increased knowledge on the importance of nutrient dense foods and a prioritization of nutrition and health of the family. Improving nutrition has direct impacts on development and productivity of household members, which increases the likelihood of future generations to also attend primary school (Hanjra, Ferede, & Gutta, 2009).

4.5.2.4 Poverty
The characteristics assessed in this project are similar to those assessed in "Enquête nationale sur la sécurité alimentaire", a national survey designed to determine the prevalence of food insecurity in rural and urban areas. The average household size, number of children, literacy, head of household gender and poverty rates presented in the national survey were all similar to those found in this study (Coordination Nationale de la Sécurité Alimentaire, 2011). The average daily income was found to be 1.2 USD/day with 86 percent of the sample living in poverty (2 USD/day). About 59 percent of households were considered to be living in extreme poverty (living on less than 1 USD/day) which was similar to results published by USAID in 2011 stating that 56 percent of the population was considered extremely poor. Since poverty levels tend to higher in rural areas, it is accepted that the Haitian population as a whole would have slightly lower extreme poverty rates than those described in this study.

It is a well-established fact that poverty is directly related to food insecurity. Households living in extreme poverty (<1 USD/day) were significantly more likely to be living in a state of severe food insecurity. About 98 percent of individuals living under extreme poverty were living in a state of moderate - severe food insecurity. Poverty considerably limits a household's access to food quantity and food quality. Severely intercepting a household's ability to escape food insecurity, the negative health outcomes associated with hunger and malnutrition increases the likelihood of a household being trapped in poverty and food insecurity (Strauss, 1986). Furthermore, it is not surprising that households that were living in extreme poverty were significantly more likely to be less food insecure and consume a less diverse diet.

The mean number of food items consumed as a whole and within all food groups increased, except sugar and oil, when income increased. The proportion of households who consumed at least one item from a food group dramatically decreased as a result of extreme poverty. The consumption of animal source foods, fruits and vegetables were mainly affected, once again emphasizing the difficulty a household may have to achieve better health and improved production levels to alleviate extreme poverty levels. A better income is usually correlated with a better education; increasing a household's opportunity to buy more livestock and more land which have shown to also be related to an increase in consumption of animal sources, fruit and vegetables and a better dietary diversity.

4.5.2.5 Land ownership and livestock

The average land size was determined to be 1.60 carreau which is equal to 2.06 hectares. According a report from the IFAD in 2008, the average land holding for a smallholder farmer is actually less than one hectare. Due to high rates of environmental degradation it is unclear whether or not the land reported in the surveys is suitable for agricultural activities therefore inferring that farmers may over report lands sizes. Another study that took place in Haiti demonstrated that owned farmland tended to be smaller than reported by the head of household (Smucker, White, & Bannister, 2000).

Land size and number of animals were positively associated with food security. In other words, a household living on a larger piece of land with more animals was more likely to be more food secure than a household with little land and fewer animals. More land gives opportunity for increased food production (Najafi, 2003). Land size and number of livestock also affected dietary diversity by increasing the intake of all food items and all food items within groups containing animal sources and most vegetables. Furthermore, it is important to note that land size alone is not likely to be the result of an improved state of food security. Farmers with bigger land will most likely have more livestock, which is a source of greater income, increasing their access to a more diverse diet and better food security.

4.5.3 Limitations

Some limitations that must be addressed when considering this study include the unknown nature of the household member participating in the interview. There was no specific protocol for choosing a respondent. It is assumed to be the head of household; however this was not confirmed which may be a source for variation in survey responses.

Furthermore, this study is cross-sectional, which cannot track long term changes in household circumstances. Changes in household food security due to seasonal elements could not be analyzed, including variations in vitamin A consumption due to mango season. However, the surveys were conducted in the season prior to harvest which is assumed to be the time of highest food insecurity.

In terms of food intake analysis, the surveys do not include portion sizes. Whether or not the food was consumed in the last week was only considered, therefore it is unknown if the amount of food items differ among households. Further analysis on food portions would be beneficial to assess if quantities of food change even more dramatically than assessed in this study. Similarly, the dietary diversity score, the number of foods per group was not taken into account. If a household ate 5 items or 1 item per group, the score would be 1. This limits the ability to see smaller changes in intake between households and levels of food insecurity.

Inter-household distribution of food items was not considered in this project. Studies have shown that women tend to experience the most severe food insecurity within households (Hyder et al., 2007). Therefore, some members of the household may actually be more or less food secure than others. Finally, the food frequency questionnaire relies on the memory of the household member being interviewed. Remembering what food was consumed within the household in the last month may be difficult for some. This is why only foods consumed in the last week were considered.

4.6 Conclusion

This study draws attention to the high prevalence of severe food insecurity among smallholder farmers in Haiti. The multifaceted and synergistic relationship between food security, poverty, dietary diversity, education, land ownership and livestock shows the complexity of current crisis. Furthermore, this study highlights the need for increased emphasis on dietary diversity and food quality for all food insecure households. The lack of animal sources, fruits and vegetables and high proportion of intake of sugar and oils in the diets of the poorest households is of great concern for development and productivity rural dwelling Haitians. These trends suggest a movement towards a future struggle involving hidden hunger. Current and future food aid programmes should incorporate methods to improve energy intake and dietary diversity of struggling households to better ensure a state of nutrition security.

4.7 Tables

4.1 Sample Characteristics (N=500)

Characteristic	
Head of HH gender (% male), %(m)	89.2 (446)
Age of head of HH (yrs), %(n)	49.2 (±12.0)
Marital status of HH	
Married, %(n)	85.8 (429)
Household size, mean(±sd)	6.2 (±2.6)
Children per household, mean (±sd)	3.2±2.11
Education of head of HH	
< primary school, %(n)	66.0 (330)
Illiterate, %(n)	35.2 (176)
Food Security status, %(n)	
Food secure	2.6 (13)
Mild food insecurity	7.2 (36)
Moderate food insecurity	27.8 (139)
Severe food insecurity	62.4 (312)
Daily per capita income, mean(±sd)	1.2 (±1.3)
Households living in extreme poverty (<1	59.0 (295)
USD/day), %(n)	
Total land (carreau), mean(±sd)	1.6 (±3.0)

Continuous data is presented as mean (\pm standard deviation); categorical data is present as % (n)

4.2Food Insecurity Status by Six Continuous Variables

• •				
	Mild	Moderate	Severe	P value
Age of household head (years)	49.72 ^a	48.58 ^a	49.52 ^a	0.722
Household size (# of people)	5.64 ^a	6.15 ^a	6.30 ^a	0.331
Number of children	3.17 ^{a,b}	2.62 ^b	3,32 ^a	0.020*
Number of livestock	25.31 ^a	17.31 ^a	15.24 ^b	0.000**
Land size (carreau)	2.51 ^a	1.53 ^b	1.50 ^b	0.000**
Daily per capita income	2.20^{a}	1.15 ^b	0.95 ^b	0.000**
(USD)				

These tests are based on ANOVA and Kruskal-Wallis post-hoc analyses; ^{a,b,c} Different superscripts indicate a statistically significant differences at p<0.05 as calculated in post-hoc analysis; ** indicates statistical significance of one-way ANOVA at p<0.00; * indicates statistical significance at p<0.05

	Food Insecurity Status									
Food Group	Mild FI	Moderate FI	Severe FI	P value						
Tubers	2.1 ± 1.5^{a}	1.3 ± 1.2^{b}	1.0 ± 1.1^{b}	< 0.00**						
Cereals	$5.4\pm1.3^{\rm a}$	4.6 ± 1.3^{b}	4.0 ± 1.2^{c}	< 0.00**						
Flesh Meat	1.8 ± 1.1^{a}	$1.2\pm1.0^{\rm b}$	$0.8 \pm 1.0^{\circ}$	< 0.00**						
Organ Meat	0.2 ± 0.4^{a}	$0.1\pm0.3^{\mathrm{a}}$	0.1 ± 0.3^{a}	0.120						
Fish	1.0 ± 0.9^{a}	$0.7\pm0.7^{\rm b}$	0.5 ± 0.6^{b}	< 0.00**						
Dairy	1.6 ± 0.9^{a}	$0.9\pm0.7^{\rm b}$	0.7 ± 0.7^{c}	< 0.00**						
Eggs	$0.8\pm0.6^{\rm a}$	$0.5\pm0.5^{\mathrm{a}}$	0.4 ± 0.5^{b}	< 0.00**						
Oil	2.4 ± 0.7^{a}	2.0 ± 0.4^{b}	2.0 ± 0.5^{b}	< 0.00**						
Vegetables - Other	4.6 ± 1.6^{a}	4.0 ± 1.5^{a}	3.1 ± 1.6^{b}	< 0.00**						
Vegetables – Vit A Rich	1.8 ± 0.9^{a}	$1.1\pm0.9^{\rm b}$	$0.8\pm0.8^{\circ}$	< 0.00**						
Vegetables - Green	$0.8\pm0.6^{\rm a}$	$0.7\pm0.5^{\rm a,b}$	0.6 ± 0.5^{b}	< 0.05*						
Vegetables Total	$7.2\pm2.3^{\rm a}$	5.8 ± 2.4^{b}	4.5 ± 2.4^{c}	< 0.00**						
Pulses	2.8 ± 0.9^{a}	2.2 ± 0.9^{b}	2.1 ± 0.9^{b}	< 0.00**						
Fruits - Other	$2.7\pm1.9^{\mathrm{a}}$	$1.4 \pm 1.4^{\rm b}$	1.2 ± 1.2^{b}	< 0.00**						
Fruits – Vit A Rich	$1.6\pm0.6^{\rm a}$	$1.2\pm0.4^{\rm b}$	$1.3\pm0.5^{\text{b}}$	< 0.00**						
Fruits Total	$4.3\pm2.3^{\mathrm{a}}$	2.6 ± 1.5^{b}	2.4 ± 1.5^{b}	< 0.00**						
Sugar	2.0 ± 0.9^{a}	$1.8\pm0.9^{\mathrm{a}}$	1.9 ± 0.9^{a}	0.422						
Staples	$8.4\pm2.2^{\rm a}$	6.6 ± 2.4^{b}	$5.7 \pm 2.0^{\circ}$	< 0.00**						
Animal Source	$5.3\pm2.5^{\mathrm{a}}$	3.3 ± 2.0^{b}	2.4 ± 1.8^{b}	< 0.00**						
Vitamin Rich	11.4 ± 4.0^{a}	$8.4\pm3.3^{\rm b}$	$7.0\pm3.3^{\circ}$	< 0.00**						
Vit A Rich	3.3 ± 1.2^{a}	$2.3\pm1.1^{\text{b}}$	2.0 ± 1.1^{b}	< 0.00**						
Empty Calories	4.4 ± 1.8^{a}	3.8 ± 1.0^{b}	4.0 ± 1.1^{b}	< 0.05*						

4.3 Mean Number of Food Items consumed by FI Status

These tests are based on ANOVA and Kruskal-Wallis post-hoc analyses; ^{a,b,c} Different superscripts indicate a statistically significant differences at p<0.05 as calculated in post-hoc analysis; ** indicates statistical significance of one-way ANOVA at p<0.00; * indicates statistical significance at p<0.05

Food Insecurity Status									
Food GroupMild FIModerate FISevere FIP value									
Tubers	83.3	69.1	59.9	0.08					
Cereals	100.0	100.0	100.0	1.0					
Flesh Meat	86.1	71.2	53.5	<0.05*					
Organ Meat	16.7	7.2	7.1	0.12					
Fish	63.9	53.2	44.9	<0.05*					
Dairy	94.4	70.5	56.4	<0.05*					
Eggs	69.4	50.4	35.3	<0.05*					
Oil	100.0	100.0	99.7	0.75					
Vegetables – Other	100.0	100.0	96.2	<0.05*					
Vegetables – Vit A	88.9	69.8	53.5	<0.05*					
Rich									
Vegetables – Green	69.4	63.3	53.2	<0.05*					
Vegetables Total	100.0	100.0	97.4	0.102					
Pulses	100.0	97.1	98.4	0.451					
Fruits – Other	86.1	69.1	63.1	<0.05*					
Fruits – Vit A Rich	100.0	97.8	98.1	0.683					
Fruits Total	100.0	99.3	99.0	0.822					
Sugar	100.0	98.6	99.4	0.585					
Staples	100.0	100.0	100.0	1.0					
Animal Source	100.0	96.4	86.9	<0.05*					
Vit A Rich	100.0	99.3	98.4	0.577					
Vitamin Rich	100.0	100.0	100.0	1.0					
Empty Calories	100.0	100.0	100.0	1.0					

4.4 HH consumption of at least one food item per food group by FI Status (%)

These tests are based on chi-square analysis;* Indicates a significant relationship at p<0.05

	В	SEB	P value	95% Confidence Interval	
				Lower Bound	Higher Bound
Moderate FI	-5.75	1.47	0.000*	-8.63	-2.87
Severe FI	-8.76	1.41	0.000*	-11.53	-5.99
Total # of Children	0.43	0.18	0.014*	0.09	0.78
Daily per capita	0.85	0.30	0.005*	0.26	1.44
income (USD)					
Land size (carreau)	0.78	0.30	0.010*	0.19	1.38
Total # of animals	0.05	0.02	0.063	-0.00	0.09
Gender of HH	-1.51	1.07	0.158	-3.62	0.59
(male)					
Education of HH	2.20	0.72	0.002*	0.78	3.62
(completed					
primary school)					

4.5 Regression Coefficients for Total Food Items by FI Status

Mild FI is reference category for Moderate and Severe FI; $SE_B = Standard Error of B$; *Indicates statistical significance at p<0.05

no Regression court	The regression coefficients for Dreakly Diversity Scores by Treateds									
	B	SEB	P value	95% Confider	ice Interval					
				Lower Bound	Higher Bound					
Moderate FI	-0.56	0.28	0.049*	-1.12	-0.00					
Severe FI	-1.12	0.27	0.000*	-1.66	-0.59					
Total # of Children	0.02	0.03	0.609	-0.05	0.08					
Daily per capita	0.83	0.05	0.153	-0.03	0.20					
income (USD)										
Land size (carreau)	0.08	0.06	0.161	-0.03	0.20					
Total # of animals	0.01	0.01	0.026*	0.00	0.02					
Gender of HH	0.02	0.21	0.914	-0.38	0.43					
(male)										
Education of HH	0.44	0.14	0.002*	0.16	0.71					
(completed										
primary school)										

4.6 Regression Coefficients for Dietary Diversity Scores by FI Status

Mild FI is reference category for Moderate and Severe FI; $SE_B = Standard Error of B$; *Indicates statistical significance at p<0.05

4.7 Figures4.1 Food Security of Smallholder Farmers in Haiti



4.2 Chi Square Analysis of Food Insecurity by Six Independent Categorical Variables



*** indicates a significant relationship at p<0.00; y = yes



4.3 Chi Square Analysis of the Proportion of Principal Food Groups by all Food Consumed and Household FI

FI = Food Insecurity; * Indicates significant decrease (p<0.00)

5. CHAPTER 5: FINAL CONCLUSIONS

As the global concern for food security is becoming more evident, a greater understanding of its complexity and relationship will other independent environmental factors like poverty, is critical. The present study addresses some of these relationships but primarily the impact food insecurity has on the diets of one of the poorest populations in the world, rural Haitian farmers.

Unfortunately, Haiti's past and present circumstances have made it exceptionally difficult for the country to prosper. High poverty rates keep the majority of households trapped in states of malnutrition and food insecurity. With over 60 percent of smallholder farmers living in a state of severe food insecurity, this study has addressed the difficulties of maintaining diverse diets that provide adequate nutrition to household members. After adjusting for other independent variables, food security was shown to be a positive predictor of total food intake and dietary diversity.

Reduced intakes of animal source foods by moderate and severely food insecure households, implies the potential for high rates of macro and micronutrient deficiencies including protein and iron. Fruits and vegetable intake was also negatively affected, especially those with highest micronutrient value; dark leafy greens and vitamin A rich foods. However, as micronutrient dense foods tended to decrease in intake, an increase in low nutrient, high energy dense foods was observed. An increase in the proportion of sugars, oils and starches indicate a high accessibility to these foods for the lowest income households.

Possible future interventions may include increasing the purchasing power of farmers through poverty reduction strategies. This will increase the economic accessibility of a diverse diet including animal source foods and vitamin rich foods. Increasing dietary diversity by

83

increasing production strategies of farmers through competitive and sustainable agricultural practices provided by the IICA, as seen in other countries, might be a promising intervention approach. Under many circumstances, small holder farmers sell their production before consuming most of it. Encouraging farmers to keep and consume more of their produce may improve the nutrient intake within households. As was seen with the higher mango consumption during mango season, acknowledging and incorporating the seasonality of certain produce into intervention strategies may help increase the intake of certain foods among small farming households.

Other potential strategies may include the revaluation of current food aid programmes in Haiti, incorporating more nutrient dense foods and less high energy low nutrient dense foods into their frameworks. School feeding programs which provide a nutritious meal to students may not only provide energy and nutrients to the students, improving their scholastic performance and motivation, but may also increase school enrollment as it alleviates some financial pressure from households of the children. This could improve education levels of rural dwellers. More research on these types of strategies are necessary.

Other strategies could include the use of biotechnology to improve the nutritional value of staple foods including rice and maize. However, more research is necessary to develop and implement potential strategies involving biotechnology into the Haitian culture.

Overall, more research in needed on potential interventions to improve the intake of nutrient dense foods including animal source foods and fruits and vegetables of smallholder farmers in Haiti. Strategies to decrease poverty, increase education and improve food security through increasing dietary diversity must be implemented to synergistically improve the overall wellbeing of these rural populations.

Moreover, the observations made in this study present a state of urgency for evaluation and revaluation of current and future aid programs working to reduce hunger and poverty in Haiti. It is evident that overall food consumption is problematically low among the most severely food insecure populations, however, dietary diversification should be considered a vital component for achieving a state food security. Appropriate interventions must be considered at all levels. Finally, this study demonstrates the importance of considering nutrition security as a more evolved definition of food security, where the importance of dietary quality is as relevant as quantity.

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APENDICIES

Appendix A

Consentement éclairé 1. **Institution et But**

Bonjour, mon nom est :...., Je travaille pour le Ministère de l'Agriculture, des Ressources Naturelles et du Développement Rural (MARNDR) de la République d'Haïti. Le Ministère travaille en collaboration avec l'Institut Interaméricain de Coopération pour l'Agriculture (IICA), qui a des bureaux dans 34 pays de l'Amérique et l'Université McGill du Canada. Nous faisons une enquête auprès des agriculteurs dans les différents départements d'Haïti, afin de mieux comprendre quel type d'animaux ils possèdent, ils produisent, et aussi quel type d'aliments ils consomment.

2. Informateur

Afin de faire cette enquête, j'ai besoin de parler à la personne de votre famille qui a la capacité de me donner des informations sur la production agricole au sein de votre famille et également sur les aliments que vous consommez. Peut-être aurai-je besoin de parler avec plus d'une personne qui pourraient être le chef de famille ou la patronne de votre foyer.

3. **Avantages** Je tiens à dire que nous ne percevons pas cette information pour aucun programme du gouvernement ou aucune agence de développement ou de support. Ce que nous voulons, c'est de mieux connaitre cette zone et la façon dont vous travaillez les champs ici et ce que les gens mangent. Donc, les informations que vous pourrez me donner n'affecteront en aucune manière les avantages que vous pourriez recevoir d'un programme ou d'une assistance quelconque ou que vous seriez susceptible de recevoir. Le seul avantage que vous tirerez de cette enquête est que la région dans laquelle vous vivez sera mieux connue, ce qui est important pour son développement futur.

4. **Confidentialité** Je voudrais vous dire également que tous les renseignements que vous me fournirez seront confidentiels. Cela signifie que, à aucun moment, on ne va utiliser votre nom dans aucun rapport. Je vais vous demander vos renseignements seulement pour pouvoir entrer en communication avec vous, au cas où je devrais revenir poser une question quelconque que j'aurais oublié de vous poser aujourd'hui. Mais tant votre nom que vos données sont strictement confidentiels et ne seront pas partagés avec qui que ce soit, ni avec aucune institution. Si vous me permettez de vous poser quelques questions et acceptez de participer à cette enquête, je vous remercierai beaucoup.

84

5. Vos Droits

Bien sûr, si vous ne voulez pas participer à cette enquête, je le comprends. Je le répète, si vous y participez, cela ne déterminera aucun avantage additionnel ou assistance d'un quelconque programme dont vous êtes déjà bénéficiaire ou êtes susceptible de bénéficier dans le futur. Vous pouvez donc décider de participer ou non à cette enquête. Enfin, je tiens à vous dire que j'aurai besoin de plus ou moins deux (2) heures de votre temps pour remplir ce questionnaire. Si vous êtes d'accord et pouvez me donner ce temps, je vous serai très reconnaissant.

Appendix **B**

SECTION 1. DONNÉES GÉNÉRALES A. IDENTIFICATION CARTOGRAPHIQUE ET LOCALISATION DE L'EXPLOITATION AGRICOLE 01. Province: 01. Province: 02. Commune: 03. Section: 04. Adresse de l'exploitation agricole: 05. Téléphone: 06. Codes d'Identification et/ou de Signalisation: 05. Téléphone: 06. Codes d'Identification et/ou de Signalisation: 04. Entretien complété lors de la visite 01. Date de la visite 02. Heure Début 04. Entretien complété lors de la visite N°: 05. Nom et Signature Visite N°: 05. Nom et Signature 2° Dimetric de la visite 1 2° Dimetric de la visite 1 2° Dimetric de la visite 05. Nom et Signature 2° Dimetric de la visite 1 2° Dimetric de la visite 1 2 b. Superviseur 02. Combien de menages (un préparent leurs aliments de manière séparée? 01 01. Est-ce que, dans cette exploitation agricole vivent des groupes de personnes (un de menages)	Numéro de Fo	Numéro de Formulaire: ()Numéro de menage:								
A. IDENTIFICATION CARTOGRAPHIQUE ET LOCALISATION DE L'EXPLOITATION AGRICOLE 01. Province: 02. Commune: 03. Section: 04. Adresse de l'exploitation agricole: 05. Téléphone: 06. Codes d'Identification et/ou de Signalisation: 05. Téléphone: 06. Codes d'Identification et/ou de Signalisation: 03. 01. Date de la visite 03. Début Heure Fin Complété lors de la visite N°: de la visite N°: 05. Nom et Signature 1° Image: Signalisation: 2° Image: Signalisation: 3. Superviseur 2° Image: Signalisation: 4. Agreeue 2° Image: Signalisation: 3. Superviseur 2. Superviseur C. MENAGES VIVANT DANS L'EXPLOITATION AGRICOLE	SECTION 1	. DONNÉE	S GÉNÉ	RALES			1			
01. Province: 02. Commune: 03. Section: 04. Adresse de l'exploitation agricole: 05. Téléphone: 06. Codes d'Identification et/ou de Signalisation: B. B. DONNÉES DE CONTRÔLE 04. Entretien complété lors de la visite Identification 01. Date de la visite 02. Heure Début 04. Entretien complété lors de la visite Identification 1º Début Heure Min Identification 05. Nom et Signature 1º Image: Debut Min Image: Debut Min Image: Debut Min Image: Debut Min 1º Image: Debut Min 1º Image: Debut Min	A. IDENTIFICATION CARTOGRAPHIQUE ET LOCALISATION DE L'EXPLOITATION AGRICOLE									
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04. Adresse de l'exploitation agricole: 05. Téléphone: 06. Codes d'Identification et/ou de Signalisation: B. DONNÉES DE CONTRÔLE 01. Date de la visite 02. Heure Début 03. Heure Fin 04. Entretien complété lors de la visite Visite Jour Heure Min O4. Entretien complété lors de la visite ldentification Visite Jour Heure Min N°: 05. Nom et Signature 1° Image: Image	03. Section:									
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2° Description Description Description Description Superviseur C. MENAGES VIVANT DANS L'EXPLOITATION AGRICOLE 01. Est-ce que, dans cette exploitation agricole vivent des groupes de personnes (menages) qui préparent leurs aliments de manière séparée? OUI NON SI LA RÉPONSE EST "NON", PASSEZ A LA QUESTION N° 03. SI Outer menages) (ou de menages) y a t'il dans cette Description SI LA RÉPONSE EST "OUI", ENTREZ LE NUMÉRO DE LA MENAGE VISITÉE, A COTE DU NUMÉRO DU FORMULAIRE, EN HAUT A DROITE ET LA QUANTITÉ DE Va t'il dans cette Description O3. Combien de gens personnes mangent et dorment régulièrement dans cette menage, qu'elles soient liés ou non du chef ou de la patronne de la menage, y compris les nouveau-nés, les enfants, les personnes âgées, etc., à l'exclusion des personnes qui, pour diverses raisons, se trouvent absentes de la menage pendant 9 Mois consécutifs ou plus.	1°] [] 1	a. Enquêteur					
C. MENAGES VIVANT DANS L'EXPLOITATION AGRICOLE 01. Est-ce que, dans cette exploitation agricole vivent des groupes de personnes (menages) qui préparent leurs aliments de manière séparée? OUI NON SI LA RÉPONSE EST "NON", PASSEZ A LA QUESTION N° 03. 02. Combien de menages (ou de menages) y a t'il dans cette SI LA RÉPONSE EST "OUI", ENTREZ LE NUMÉRO DE LA MENAGE VISITÉE, A COTE DU NUMÉRO DU FORMULAIRE, EN HAUT A DROITE ET LA QUANTITÉ DE MENAGES DANS LA QUESTION N° 02. 02. Combien de menages (ou de menages) y a t'il dans cette 03. Combien de gens personnes mangent et dorment régulièrement dans cette menage, qu'elles soient liés ou non du chef ou de la patronne de la menage, y compris les nouveau-nés, les enfants, les personnes âgées, etc., 1 à l'exclusion des personnes qui, pour diverses raisons, se trouvent absentes de la menage pendant 9 Mois consécutifs ou plus. 9	2°				b. Superviseur					
 01. Est-ce que, dans cette exploitation agricole vivent des groupes de personnes (menages) qui préparent leurs aliments de manière séparée? OUI NON SI LA RÉPONSE EST "NON", PASSEZ A LA QUESTION N° 03. SI LA RÉPONSE EST "OUI", ENTREZ LE NUMÉRO DE LA MENAGE VISITÉE, A COTE DU NUMÉRO DU FORMULAIRE, EN HAUT A DROITE ET LA QUANTITÉ DE COTE DU NUMÉRO DU FORMULAIRE, EN HAUT A DROITE ET LA QUANTITÉ DE 03. Combien de gens personnes mangent et dorment régulièrement dans cette menage, qu'elles soient liés ou non du chef ou de la patronne de la menage, y compris les nouveau-nés, les enfants, les personnes âgées, etc., i à l'exclusion des personnes qui, pour diverses raisons, se trouvent absentes de la menage pendant 9 Mois consécutifs ou plus. 	C. MENAGES	S VIVANT I	DANS L'E	XPLOITATION	AGRICOL	Æ				
03. Combien de gens personnes mangent et dorment régulièrement dans cette menage, qu'elles soient liés ou non du chef ou de la patronne de la menage, y compris les nouveau-nés, les enfants, les personnes âgées, etc., à l'exclusion des personnes qui, pour diverses raisons, se trouvent absentes de la menage pendant 9 Mois consécutifs ou plus.	01. Est-ce que, dans cette exploitation agricole vivent des groupes de personnes (menages) qui préparent leurs aliments de manière séparée? OUI □ NON □ SI LA RÉPONSE EST "NON", PASSEZ A LA QUESTION N° 03. 02. Combien de menages (ou de menages) y a t'il dans cette □ □ y a t'il dans cette □ □ exploitation agricole? SI LA RÉPONSE EST "OUI", ENTREZ LE NUMÉRO DE LA MENAGE VISITÉE, A COTE DU NUMÉRO DU FORMULAIRE, EN HAUT A DROITE ET LA QUANTITÉ DE 02. Combien de menages (ou de menages) y a t'il dans cette □ □ exploitation agricole?									
du chef ou de la patronne de la menage, y compris les nouveau-nés, les enfants, les personnes âgées, etc., à l'exclusion des personnes qui, pour diverses raisons, se trouvent absentes de la menage pendant 9 Mois consécutifs ou plus.	03. Combien d	e gens pers	onnes mai	ngent et dormen	t régulièrem	nent dans o	cette mena	ge, qu'elles soient liés ou non		
à l'exclusion des personnes qui, pour diverses raisons, se trouvent absentes de la menage pendant 9 Mois consécutifs ou plus.	du chet ou de	la patronne	de la men	age, y compris les	s nouveau-n	és, les enf	ants, les p	ersonnes âgées, etc.,		
	à l'exclusion (consécutifs of	des personr u plus.	nes qui, p	our diverses rai	sons, se tro	ouvent abs	sentes de	la menage pendant 9 Mois		
Monsieur (ou Madame) J'ai besoin de préparer une liste avec les noms et prénoms de chacune des personnes qui	Monsieur (ou	Madame) J'a	ai besoin d	e préparer une lis	ste avec les 1	noms et pr	énoms de c	chacune des personnes qui		
mangent et dorment régulièrement dans cette menage à l'exclusion de ceux qui préparent leurs aliments a part.	mangent et de	orment régu	ilièrement	t dans cette menagi	ge à l'exclus	ion de ceu	x qui prépa	arent leurs aliments a part.		

INSCRIVEZ CES DONNÉES SUR LA PAGE SUIVANTE. N'OUBLIEZ PAS D'ENREGISTRER LES PERSONNES QUI SONT TEMPORAIREMENT ABSENTES, LES NOUVEAU-NÉS ET LE PERSONNEL DOMESTIQUE DE MENAGE ET EXCLURE LES PERSONNES QUI, POUR QUELCONQUE RAISON, SE TROUVENT HORS DE LA MENAGE POUR UNE PÉRIODE DE 9 MOIS CONSÉCUTIFS OU PLUS.

naissance, la langue principale, l'occupation principale, entre autres.

S'il y a des personnes qui ne sont pas des parents du chef ou de la patronne de la famille qui mangent et dorment régulièrement dans cette menage pour une période de trois mois ou plus, incluez les, s'il vous plait.

S'il y a des personnes qui sont membres de cette menage mais ne sont pas présents, pour raisons de vacances, du travail, de leurs études, ou pour des raisons de santé, indiquez moi leurs noms et prénoms, s'il vous plaît (tant qu'ils sont définis «membre de cette menage").

N'oubliez pas d'inclure les enfants, les personnes âgées et les handicapés, s'il y en a dans l'exploitation agricole.

- 1. Indiquez-moi, le nom et prénom de la personne que les membres de ce menage reconnaissent comme chef ou patronne de cette menage, qui mange et dort régulièrement dans cette menage (*NOTEZ SON NOME ET PRÉNOMS DANS LA FILE 01 DE LA QUESTION N° 1 DE LA PROCHAINE PAGE*),
- 2. Maintenant, indiquez-moi le nom de l'époux ou de l'épouse ou du compagnon ou de la compagne qui mange ou dort habituellement dans cette menage,
- 3. Indiquez-moi le nom et prénom de chacun des fils ou des filles, beau-fils ou belles-filles, célibataires et sans enfants qui vivent habituellement dans cette menage (y compris les enfants nouveau-nés et tous les enfants mineurs),
- 4. Indiquez-moi les noms et prénoms de chacun des fils ou filles, beau-fils ou belles filles mariés ou vivant en union libre qui résident habituellement dans cette menage,

ainsi que celui de leurs époux ou épouses, de leurs fils ou de leurs filles, en notant en suite, au conjoint et à ses enfants.

- 5. Indiquez-moi les noms et prénoms de chacun des fils ou filles, beau-fils ou belles filles divorcés, séparés ou dont le conjoint est décédé et dont les enfants, fils ou filles, vivent avec eux, en notant ensuite chacun de ces enfants.
- 6. Indiquez-moi les noms et prénoms des autres parents du chef ou de la patronne de la menage ou de son compagnon ou compagne, qui mangent et dorment régulièrement dans cette menage.
- 7. Indiquez-moi les noms et prénoms des employés de menage des deux sexes et de leurs parents qui mangent et dorment régulièrement dans cette menage.
- 8. Indiquez-moi les noms et prénoms des personnes qui ne sont pas des membres de la famille, mais qui sont des membres réguliers de cette menage.

SECTION 2. CARACTÉRISTIQUES DE LA POPULATION (1 - 15)

ode	POUR TOUS LES MEMBRES DE LA MEN	AGE							
Ŭ					ME ANS	MBF S OU	RES DU MENA PLUS	AGE QUI ONT U	JN ÂGE DE 5
	01. Nom et prénoms.	02. Quelle relation	03.	04. Quel est l'âge					
		de parenté	Se	de [NOM]en					
	ENREGISTREZ LE PREMIER NOM ET LES PREMIERS	a.[NOM] avec le	-xe	années, mois ou	05.	06.	07. Quel est le niveau	08. S'il vous plait,	COMPLÉTEZ LA

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PRÉNOMS SELON L'ARRANGEMENT SUIVANT:	Chef ou la		jours vécus?	Sait	Sait	d'éducation atteint	informez-moi à propos de	QUESTION SUIVANTE
	patronne du		·	lire	écrir	par/NOMI?	la profession principale	SEULEMENT POUR
a Chef ou natronne du menage	Menage?		SELONIA		0	F	de INOMI ?	LES PERSONNES OUI
a. Chej ou puronne au menage	Wienage :	nin	SITUATION .					ONT UN EMPLOI
	<i></i>	mi	SITUATION :		INO			ONT UN EMPLOI
b. Epoux ou epouse, compagnon ou compagne du chef	Chef ou	Fé			M]	Aucun0		COMME OCCUPATION
de menage)	patronne1		annéesa	INO	?		Agriculteur1	PRINCIPALE
				M12				
c. Fils ou Filles, beau-fils ou belles filles – célibataires	Époux(se) ou		<i>ex.: 30 années =</i>	<i>wi</i> j.:				
sans descendance (garcons ou filles)	compagnon(e) 2		30 a			Kindergarten1		
sans descendance (gai çons où juies)	compagnon(c)2		000				Marchant2	09. Quelle est la
- File Filler hans file haller filler			*ft- \$t 1-					catégorie ou position
e. Fus ou Flues, beau-jus ou belles jules – celibalaires	Fus(le)3		<u>*enfants ages de</u>					que <i>[NOM]</i> exerce
avec enfants			moins de 2			Alphabétisation2		dans cette occupation?
	Beau-fils(fille)4		années: moism				•xclusivement aux travaux	unio cono occupationi
f. Fils ou Filles, beau-fils ou belles filles – marié(e)s							de menage3	
avec ou sans enfants	Gendre ou Bru5		<i>Ex.: 1 année + 5</i>				U U	
			mois=		Oui	Primaire incomplete.3		Travailleur indépendant.1
a Autros nonorte	Detit fla(la)		mons-		Oui			1
g. Autres parents	rem jus(ie)0		1 5	Oui	1		Il est	
			1a 5 m,	1		Drimaina Complète	étudiant4	
h. Autres non parents	Père ou Mère7					Primaire Complete4		Employé/ouvrier public2
			$ou \ 3 \ mois = 3 \ m$					
i. Employés(ées) de menage	Beau-père ou							
	Relle-mère 8		*enfants âgés de			Secondaire	Il vit de ses rentes5	
	Dene merennin		moine d'1 moie:			incomplète 5		Employé/ouvrier privé3
			inoms a r mois.		NON			
	Frere ou sœur9		joursd			Secondaire		
				NON	0	Complète6	Il est retraité ou	
	Beau-frère ou		<i>Ex.: 15 jours =15</i>	0			pensionnaire6	Employeur ou patron4
	belle-sœur10		d				*	
						<i>4 - - -</i>		
	Autro parent 11					Ecole Prof.		<i>T C I</i>
	nune purcha					Incomp7	Il est âgé ou invalide7	I ravailleur Jamulai non
								rémunéré5
	Autre non							Travailleur familial
	parent12					<i>4</i> . 5 . 6		rémunéré6
						Ecole Prof. Comp8	Il cherche du travail8	
	Personnel							
	Domestique ou							
	lour famillo 13					Étudos Unin	Il act un min aun 0	Employé domestique7
	ieur jumilie15					Etuaes Univ.	It est un mineur9	
						incomp9		
							Autre (à snécifier)	
						Étudos Unin Com- 10	func (a specifier)	
						Eiuaes Univ. Comp.10		
							Ex.: mécanicien:	
						Ne sait nas 00	secrétaire cordonnier	
						1.c. sun pus	ata	
							eu.	
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01					
02					
03					
04					
05					
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14					
15					

SECTION 2. CARACTÉRISTIQUES DE LA POPULATION (16 – 28)

ode	POUR TOUS LES MEMBRES DE LA MENAGE	
C		MEMBRES DU MENAGE QUI ONT UN ÂGE DE 5
		ANS OU PLUS

								0
01. Nom et prénoms.	02. Quelle relation	03.	04. Quel est l'âge					
	de parenté	Se	de [NOM]en					
ENREGISTREZ LE PREMIER NOM ET LES PREMIERS	a.[NOM] avec le	-xe	années, mois ou	05.	06.	07. Quel est le niveau	08. S'il vous plait,	COMPLÉTEZ LA
							-	

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PRÉNOMS SELON L'ARRANGEMENT SUIVANT:	Chef ou la		jours vécus?	Sait	Sait	d'éducation atteint	informez-moi à propos de	QUESTION SUIVANTE
	patronne du		, in the second s	lire	écrir	par/NOMI?	la profession principale	SEULEMENT POUR
a Chef ou patronne du menage	Menage?		SELONIA		0	Fine only one from	de INOMI ?	I ES PERSONNES OUI
u. eneg ou puronne uu menuge	Wienage :	nin	SITUATION .					ONT UN FMPLOI
	~	im	SITUATION :		INO			ONT UN EMPLOI
b. Epoux ou epouse, compagnon ou compagne du chef	Chef ou	Fό			M]	Aucun0		COMME OCCUPATION
de menage)	patronne1		annéesa	INO	?		Agriculteur1	PRINCIPALE
				M12				
c. Fils ou Filles, beau-fils ou belles filles – célibataires	Époux(se) ou		ex.: 30 années =	<i>wij.:</i>				
sans descendance (garcons ou filles)	compagnon(e) 2		30 a			Kindergarten1		
sans aescentance (garçons ou juies)	compagnon(c)2		200				Marchant2	09. Quelle est la
Eile an Eiller hann file an haller filler silik stainer			*ft- 2t 1-					catégorie ou position
e. Fus ou Fuies, beau-jus ou beues juies – ceubalaires	Fils(le)3		<u>*enfants ages de</u>					que <i>[NOM]</i> exerce
avec enfants			moins de 2			Alphabétisation2		dans cette occupation?
	Beau-fils(fille)4		années: moism				•xclusivement aux travaux	unis cette occupation?
f. Fils ou Filles, beau-fils ou belles filles – marié(e)s							de menage3	
avec ou sans enfants	Gendre ou Bru5		<i>Ex.: 1 année + 5</i>			D · · · D · 2	0	
aree ou sans enjands	Contaite our Drante		mois-		0:	Primaire incomplete.3		Travailleur indépendant. I
			mois-		Oui			The and the second s
g. Autres parents	Petit fils(le)6			Oui	1		Il est	
			1a 5 m,	1		During commellity (étudiant4	
h. Autres non parents	Père ou Mère7					Primaire Complete4		Employé/ouvrier public2
			ou 3 mois = 3 m					1 2 1
i. Employés(ées) de menage	Beau-père ou							
I i j i i i i i i i i i i i i i i i i i	Rollo màra 8		*enfants âgés de			Sacondaire	Il vit de ses rentes5	
	Delle-mere0		<u>emants ages de</u>			Secondative		Employé/ouvrier privé3
			moins d 1 mois:		NON	incomplete5		
	Frère ou sœur9		joursd		NON	Secondaire		
				NON	0	<i>Complète</i> 6	Il est retraité ou	
	Beau-frère ou		<i>Ex.:</i> 15 <i>jours</i> =15	0		*	pensionnaire	Employeur ou patron4
	belle-sœur10		d				Pensionnaite	
			a					
	A					École Prof.		
	Autre parent11					Incomp7	Il est âgé ou invalide7	Travailleur familial non
						-	0	rémunéré5
	Autre non							Travailleur familial
	parent12							rómunóró 6
						École Prof. Comp8	Il cherche du travail8	<i>remaner</i> ections
	Personnel							
	Domestique ou							
	Domestique ou					,		Emplové domestique7
	leur famille13					Etudes Univ.	Il est un mineur9	1 2 1
						incomp9		
						-		
						,	Autre (à spècifier)	
						Etudes Univ. Comp.10		
							Ex. mágguigion.	
						NY 1/ 00	Ex., mecanicien;	
						<i>Ne sait pas99</i>	secretaire; cordonnier;	
							etc.	

16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					

10. Pourriez-vous m'indiquer s'il vous plait combien de personnes du menage se dédient à des activités agricoles?

<u>SECTION 3. TYPE DE TENURE DES TERRES ET DE L'UNITÉ DE PRODUCTION:</u>

01. Pourriez-vous m'indiquer, s'il vous plait, quelle quantité de terres travaillez-vous en tout? *SPÉCIFIEZ L'UNITÉ DE MESURE UTILISÉE*

02. De la superficie que vous travaillez, Combien vous Appartient en Propre? Combien est Prêtée ou louée , …? *COMPLÉTEZ LA VALEUR QUI CORRESPOND A CHAQUE TYPE DE TENURE, SI VOUS N'AVEZ PAS DE TERRE, ÉCRIVEZ "0"*)

UM	01	Propriétaire	
	02	Usufruit	
	03	Fermage	
	04	Métayage	
/	05	Indivision	

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		Institut de Seburite Ainn	entane ofobale – offiverate megin
03. Utilisez-vous une partie de cette terre pour des activités	disposez-vous de	disposez-vous d'équipements	disposez-vous
d'élevage?	machineries)?	de traction animale?	d'infrastructures de gestion
OUI 🗌 NON 🗌 SI LA RÉPONSE EST "N O N", PASSEZ À LA			
QUESTION 4			
	SI LA RÉPONSE EST	SI LA RÉPONSE EST	SI LA RÉPONSE EST
03a. Quelle quantité de la terre totale destinez-vous aux activités	"NON", PASSEZ À LA	"NON", PASSEZ A LA	"NON", PASSEZ A LA
d'élevage?	QUESTION 8	QUESTION 09	SECTION 4
	07a. Pourriez-vous	8a. De Combien	09a. De combien
04. Utilisez-vous une partie de cette terre pour des activités	m'indiquer, s'il vous plait, de	d'équipements de traction	d'infrastructures de gestion
agricoles?	combien de machineries	animale disposez-vous en	disposez-vous en total?
OUI NON SI LA RÉPONSE EST "NON". PASSEZ A LA	disposez-vous en total?	total?	COMPLÉTEZ LA
OUFSTION 5	COMPLÉTEZ LA	COMPLÉTEZ LA PREMIÈRE	PREMIÈRE RANGÉE
QUESTION'S	PREMIÈRE RANGÉE	RANGÉE	09b. De ces infrastructures
049 Quelle quantité de la terre totale est destinée à des activités	07b. De ces machineries dont	8b. De ces équipements de	de gestion dont vous
ora. Quene quantité de la terre totale est destinée à des activités	vous disposez, Combien sont	traction animale dont vous	disposez, Combien sont
agricoles?	votre Propriété? Combien	disposez, Combien sont votre	votre Propriété? Combien
	sont Prêtées?	Propriété?; Combien sont	sont Prêtées,?
	CONTINUEZ A	Prêtés?	CONTINUEZ A
AVANT DE PASSER A LA QUESTION SUIVANTE, CONFIRMEZ QUE LES	COMPLÉTER LA TABLE	CONTINUEZ A	COMPLÉTER LA TABLE
UNITÉS DE MESURE SOIENT COMPLÈTES POUR TOUTES LAS		COMPLÉTER LA TABLE	
SUPERFICIES.	01 TOTAL		
05. Au cas où vous avez loué la terre d'autres personnes, combien vous avez			
payé pour le loyer au cours des derniers 12 mois (\$):	_ 02 Propre		
	03 Prôtáo		
06. Au cas où vous louez la terre à d'autres personnes, combien vous avez	03 Helee		
reçu pour le loyer au cours des 12 derniers mois (\$):	04 Louée		

07. Pour l'activité agricole, **08.** Pour l'activité agricole, **09.** Pour l'activité agricole,

UNITÉS DE MESURE. UTILISEZ LA CODIFICATION SUIVANTE POUR LES UNITÉS DE MESURE TOUT AU LONG DE CETTE ENQUÊTE.

1. SUPERFICIE (ÉTENDUE)	2. POIDS	3. VOLUME (LIQUIDES)	4. QUANTITÉ (UNITÉS)
Hectares10	Quintal20	Litres (1000ml)	Unité41
Carreau11	Arroba21	Bouteille de rhum (350 ml)31	Douzaine
Pied carré12	Livres	Bouteille de bière (720 ml)32	Milliers44
Mètre carré13	Kilogrammes23	Coqn33	
Fanegada14			
Acres15	Fanega24	*Pour les abeilles	

	Ruches	
	Barrique*35	

SECTION 4. REVENUS ÉCONOMIQUES DU MENAGE

Pourriez-vous m'indiquer, s'il vous plait, quelles ont été toutes les sources de revenus de votre menage au cours des 12 derniers mois?

01. Au cours des 12 derniers mois, le revenu du menage a été fourni par? <i>COMPLÉTEZ LA COLONNE SUIVANTE. SIL</i> <i>N Y A PAS EU DE SOURCE DE REVENUS,</i> <i>NOTEZ "0"</i>		Оиі1 Non0	02. Quel a été le revenu total au cours des derniers12 mois en provenance de? \$ COMPLÉTEZ POUR CHAQUE SOURCE DE REVENU MARQUÉE "OUI" (1)	01. Au cours des 12 derniers mois, le revenu du menage a été fourni par? <i>COMPLÉTEZ LA COLONNE SUIVANTE. SIL</i> <i>N Y A PAS EU DE SOURCE DE REVENUS,</i> <i>NOTEZ "0"</i>			Non0	02. Quel a été le revenu total au cours des derniers12 mois en provenance de? \$ <i>COMPLÉTEZ POUR</i> <i>CHAQUE SOURCE DE</i> <i>REVENU MARQUÉE</i> "OUI" (1)
01	Salaire (ouvrier, journalier, etc.)			08	Location de terres			
02	Services professionnels			09	Vente de terres			
03	Entreprises non agricoles			10	Autres revenus (spécifiez):			
04	Aide familiale de l'extérieur			10				
05	Aide familiale du pays			ТО	TAL (ADDITIONNEZ de 1 A 10)			
06	Retraite ou Pension (vieillesse, incapacité)			10				
07	Aide du gouvernement / Revenus de l'État							

SECTION 5: ANIMAUX ET PRODUCTION ANIMALE

Est-ce que vous me donneriez la permission, s'il vous plait, d'observer vos animaux et les installations dans lesquelles ils se trouvent?

OBSERVEZ L'ÉTAT SANITAIRE ET LA COMPOSITION CORPORELLE DES ANIMAUX. OBSERVEZ LA CONDITION DES INSTALLATIONS.

01. En général, comment se trouve l'état sanitaire et la	02.	03. Commentaires de l'enquêteur
condition corporelle des animaux et des installations?	Qualification	
01 État sanitaire des animaux*		
02 Condition corporelle des animaux**		
03 Condition des installations***		

*0 = on n'a pas pu l'observer; 1 = en mauvais état; 2 = régulier; 3 =bon

**0 = on n'a pas pu l'observer; 1 = maigre, 2 = régulier (limite), 3 = optimal (bon), 4 = obèse (gros)

***0 = on n'a pas pu l'observer; 1 = sales, 2 = régulières; 3 =propres et adéquates

Ensuite, je vais vous demander des informations à propos des animaux que vous avez élevés au cours des 12 derniers mois.

SECTION 5. ANIMAUX ET PRODUCTION ANIMALE (cont.) – ÉLEVAGE DES ANIMAUX I (1 - 16)

Code	01. Pourriez-vous m'indiquer, s'il vous plait si vous avez fait l'élevage, au cours des derniers 12 mois [ANIMAL]? NOTEZ 1 OU 0 DANS LA COLONNE SUIVANTE, SELON LES NÉCESSITES	0ui1 Non0	02. Combien d' [ANIMAU X]avez- vous actuelleme nt? INDIQUE Z LA QUANTIT É TOTALE	03. Si vous deviez vendre tous vos [ANIMAU X] aujourd'hu i, combien cela vous rapportera it-il en tout? \$ INDIQUE Z LE MONTAN T TOTAL	04. Au cours a mois, avez-vou des animaux? SI []; NO [REPONSE ES PASSER à LA 04a. Combien d' [ANIMAUX] avez-vous acheté en total, au cours des derniers12 mois? INDIQUEZ LA QUANTITÉ TOTALE	des derniers12 us acheté un ou (SI LA T "NON", Q. 05) 04b. Combien avez-vous payé en total pour tous les [ANIMAUX] que vous avez acheté au cours des derniers12 mois? \$ INDIQUEZ LE MONTANT TOTAL	 05. Au cours d vendu ou donn SI N (SI LA REPON Q. 06) 05a. Combien d' [ANIMAUX] avez vous vendu en total au cours des derniers12 mois? INDIQUEZ LA QUANTITÉ TOTALE 	es derniers12 m é un animal que O NSE EST "NON OSb. Combien avez-vous reçu en total pour la vente des [ANIMAUX] au cours des derniers 12 mois ? \$ INDIQUEZ LE MONTANT TOTAL	vois, avez-vous elconque? ", PASSER à LA OSc. Combien d' [ANIMAUX] avez-vous donné en total, au cours des derniers 12 mois? INDIQUEZ LA QUANTITÉ TOTALE	06. Si quelqu'u n a volé leurs animaux au cours des 12 derniers mois, porriez- vous m'indiqu er, combien il a été volé au total?	07. Quel est l'usage principal que vous faites des [ANIMAUX] que vous possédez actuellement? l'alimentation familiale1 Vente2 Travail de champ3 Traite4 Combat5 Reproduction6 pour une autre personne7 Donne des animaux à élever à d'autres personnes pour lui8 Autres (spécifiez) Ex.: cadeau; laine
01	Veau / Veaux										
02	Jeune taureaux										
03	Taureaux										
04	Taureaux combat										
05	Génisses										
-----	-----------------	----------------	----------	--	------------------------	-----------	---------------	--	--		
06	Vache										
07	Moutons										
08	Brebis										
09	Chèvres										
10	Agneau/ agnelle										
11	Verrat										
12	Truies										
13	Coqs										
14	Coqs de combat										
15	Poules										
16	Dindes										
and		T T T 7	DT DDODI		$)$ $\hat{\mathbf{n}}$	DEC AND A	TIN/ TT (18 A				

SECTION 5. ANIMAUX ET PRODUCTION ANIMALE (cont.) – ÉLEVAGE DES ANIMAUX II (17 - 27)

le	01. Pourriez-vous		02.	03. Si	04. Au cours des derniers12	05. Au cours des derniers12 mois, avez-vous	06. Si	07. Quel est l'usage
Ď	m'indiquer, s'il	0.	Combien	vous deviez	mois, avez-vous acheté un ou	vendu ou donné un animal quelconque?	quelqu'u	principal que vous
Γ	vous plait si vous		ď	vendre	des animaux? SI 📋; NO 🗌	$SI \square NO \square$	n a volé	faites des [ANIMAUX]
	avez fait	Von	[ANIMAU	tous vos	(SI LA REPONSE EST	(SI LA REPONSE EST "NON", PASSER à LA	leurs	que vous possédez
	l'élevage, au		X]avez-	[ANIMAU	"NON", PASSER à LA Q. 05)	Q. 06)	animaux	

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				r		1	r	Institut de Securit	e Allmentaire	Globale – Universite Mcgill
	cours des derniers	vous	X]	<i>04a</i> .	04b. Combien	05a.	05b.	05c.	au cours	actuellement?
	12 mois	actuelleme	aujourd'hu	Combien d'	avez-vous	Combien d'	Combien	Combien d'	des 12	7. 7.
	[ANIMAL]?	nt?	i, combien	[ANIMAUX]	payé en total	[ANIMAUX]	avez-vous	[ANIMAUX]	derniers	l'alimentation
	NOTEZ 1 OU 0	INDIQUE	cela vous	avez-vous	pour tous les	avez vous	reçu en total	avez-vous	mois,	familiale1
	DANS LA	Z LA	rapportera	acheté en	[ANIMAUX]	vendu en	pour la vente	donné en total,	porriez-	Vanta 2
	COLONNE	QUANTIT	it-il en	total, au	que vous avez	total au	des	au cours des	vous	<i>v</i> enie2
	SUIVANTE,	É TOTALE	tout? \$	cours des	acheté au	cours des	[ANIMAUX]	derniers 12	m'indiqu	Travail de champ 3
	SELON LES		INDIQUE	derniers12	cours des	derniers12	au cours des	mois?	er,	Travaa ac enamp
	NÉCESSITES		ZLE	mois?	derniers12	mois?	derniers 12	INDIQUEZ	combien	Traite4
			MONTAN	INDIOUEZ	mois? \$		mois ? \$	LA	il a été	
			T TOTAL	LA	INDIOUEZ	INDIQUEZ		OUANTITÉ	volé au	<i>Combat</i> 5
				OUANTITÉ	LE	LA	INDIQUEZ	TOTALE	total?	
				TOTALE	MONTANT	QUANTITÉ	LE	-		Reproduction6
				1011111	TOTAL	TOTALE	MONTANT			
					101112		TOTAL			pour une autre
										personne7
										Donne des animaux à
										Sonne des animaas a
										elever u u unires
										personnes pour iuio
										Autres (snécifiez)
										Thur es (specificz)
										Ex.: cadeau; laine
17	Pintade									
18	Canard									
	Autres oiseaux									
10	(préciser):									
19										
20	Lapins									
21	Poissons									

										¥
22	Cochons d'Inde									
23	Pigeon									
24	Abeilles et ruches									
25	Boeufs Charrue									
26	Chevaux									
27	Ânes									
28	Mules									
29	Autre (préciser):									
27										
08.7	Avez-vous abattu d'ar		x au cours d	es derniers 12	mois? OUI	(SI LA RÉPON	ISE EST "NON	" PASSER A LA	SECTION 06	5
50.1	roc rous usund u u	uu/	a au cours u	05 acrimero 12				,		1

SECTION 5. ANIMAUX ET PRODUCTION ANIMALE (cont.) – ABATTAGE D'ANIMAUX

02	Jeune taureaux				
03	Taureaux				
04	Génisses				
05	Vache				
06	Moutons				
07	Brebis				
08	Chèvres				
09	Agneau/ agnelle				
10	Verrat				
11	Truies				
12	Coqs				
13	Poules				
14	Dindes				
15	Pintade				
16	Canard				
18	Lapins				
19	Poissons				
20	Cochons d'Inde				
21	Pigeon				
22	Chevaux				

	Autre (préciser):				
23					

SECTION 6. SOUS-PRODUITS DE L'ÉLEVAGE ET DES ŒUFS

roae	01. Pourriez-vous m'indiquer, s'il vous plait si vous avez élaboré ou produit, au cours des		02. Combien avez-vous produit de [PRODUIT] au total au	U M	03. Combien Avez-vous vendu, au total, du [PRODUIT] au cours des	U M	04. Quel revenu avez-vous obtenu, en total, de la	05. Combien avez-vous consommé, en total, du [PRODUIT], au cours des derniers12 mois? INDIOUEZ LE POIDS	U M	06. Si vous avez consommé toute ou une partie de[PRODUIT], à combien estimez-	07. Si vous n'avez ni vendu, ni consommé une partie des produits, qu'en avez-vous fait ? Don 1
	derniers12 mois les [PRODUITS]? NOTEZ 1 OU 0 DANS LA COLONNE SUIVANTE, SELON LA SITUATION	Oui1; Non0	cours, des derniers12 mois? INDIQUEZ LE POIDS, LE VOLUME OU LA QUANTITÉ TOTALE ET ENSUITE L'UNITÉ DE		derniers12 mois? INDIQUEZ LE POIDS , LE VOLUME OU LA QUANTITÉ TOTALE ET ENSUITE L'UNITÉ DE MESURE (UM)		vente de [PRODUIT] au cours des derniers12 mois? \$ INDIQUEZ LE MONTAN T TOTAL	LE VOLUME OU LA QUANTITÉ TOTALE ET ENSUITE L'UNITÉ DE MESURE(UM)		vous sa valeur? \$ INDIQUEZ LE MONTANT TOTAL	Perte2 Vols3 Autres (spécifiez)
01	Le lait de vache		MESURE UM								
01	Lait de chèvre										
02											
03	Fromage de vache										
04	Yaourt de vache										
05	Beurre										
06	Dulce de leche										
07	Poulet frit										
08	Viande de boeuf séchée										
09	Lait caillee										
10	Soupoudre										

11	Enduis					
12	Les œufs de poulet					
13	Les œufs de canard					
14	Œufs d'autres spèces					
15	Miel d'Abeille					
16	Cire d abeille					
17	Graisse					
18	Peau/Cuir					
	Autre (précisez)					
19						

SECTION 7. DONNÉES DE PRODUCTION AGRICOLE

01. Au cours des derniers12 mois, avez-vous récolté quelconque produits agricoles, soit pour la consommation propre, la vente et/ou la transformation?

OUI	NON SI LA RÉPONSE E	ST	"NON", PASSEZ	A LA SECTION 8		
Code	02. Pourriez-vous m'indiquer, s'il vous plait si vous avez récolté, au cours des derniers12 mois, soit pour l'autoconsommation, la vente, et/ou la transformation [CULTURE]? NOTEZ 1 OU 0 DANS LA SUIVANTE COLONNE, SELON CORRESPOND	Oui1 Non0	03. Au cours des derniers12 mois, en total, combien de fois avez-vous récolté [CULTURE]? INDIQUEZ LA QUANTITÉ DE FOIS	04. Au cours des derniers12 mois, quel a été l'usage principal que vous avez donné à la [CULTURE] ? Consommation familiale1 Consommation animale2 Vente3 Transformation4 Autres (spécifiez)	05. Au cours des derniers12 mois, quel a été le deuxième objectif de l'usage que vous avez donné à la [CULTURE] ? Consommation familiale1 Consommation animale2 Vente	 06. Au cours des 12 derniers mois, avez-vous vendu une partie de la récolte d'une culture donnée? OUI
01	Musáceas					
02	Les racines et tubercules					
03	Plantez les bulbes et tubercules					
04	Céréales					
05	Légumineuses					
06	Oléagineux					
07	Les légumes à feuilles					
08	Les légumes qui portent leurs fruits					
09	cannes à sucre					
10	Snuff					
11	Fibres					

12	Les résidus de tonte			
14	Fruits tropicaux et subtropicaux			
15	Agrumes			
16	Fruits à pépins et fruits à noyau			
13	Cépages			
17	Autres fruits et aux noix			
18	Fruits oléagineux			
19	Plantes pour boissons			
20	Les plantes aromatiques et médicinales			
21	Autre (précisez)			

SECCIÓN 8. SEGURIDAD ALIMENTARIA DEL HOGAR

ESCALA LATINOAMERICANA Y CARIBEÑA DE SEGURIDAD ALIMENTARIA – ELCSA

	COMPLÉTEZ LAS QUESTIONS DE 1 A 9 DANS TOUS LES MENAGES. EN CAS DE MENAGE OU SE TROUVENT DES	Oui1 Non0			saine et nutritive?	
	MINEURS DE 18 ANNÉES OU MOINS, CONTINUER JUSQU'A LA QUESTION NUMÉRO 16.	NS .09	(04	Vous ou l'un des adultes dans votre menage avez eu une alimentation basée sur des aliments peu variés?	
Code	Lors du dernier mois, par manque d'argent ou d'autres ressources, quelquefois	NR. 99	(05	Vous ou l'un des adultes dans votre menage a cessé de prendre le petit déjeuner, le déjeuner ou le souper?	
01	Vous êtes-vous préoccupé que les aliments pourraient être épuisés dans votre menage?		(06	Vous ou l'un des adultes dans votre menage a moins mangé que ce qu'il devrait manger?	
02	êtes vous restés sans aliments dans votre menage?		(07	Vous ou l'un des adultes dans votre menage a ressenti de la faim mais n'a pas pu manger?	
03	dans votre menage, avez-vous cessé d'avoir une alimentation					

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	······································				
08	Vous ou l'un des adultes dans votre menage avez mangé seulement une fois par jour ou a passé une journée entière sans manger?		12	Un jeune âgé de 18 ans ou moins dans votre menage à cesser de prendre le petit déjeuner, le déjeuner ou de diner?	
09	Dans votre menage est-ce que vivent des personnes âgées de moins de années? OUI (CONTINUER AVEC LE QUESTIONNAIRE) NON (PASSER A LA SECTION 9)	18 N 🗌	13	Un jeune âgé de 18 ans ou moins dans votre menage a mangé moins que ce qu'il devrait?	
	COMPLÉTEZ LAS QUESTIONS DE 1 A 9 DANS TOUS LES MENAGES. EN CAS DE MENAGE OU SE TROUVENT DES	Oui1 Non0	14	Un jeune âgé de 18 ans ou moins dans votre menage a du diminuer la quantité d'aliments servie aux repas?	
	MINEURS DE 18 ANNÉES OU MOINS, CONTINUER JUSQU'A LA QUESTION NUMÉRO 16.	NS .09	15	Un jeune âgé de 18 ans ou moins dans votre menage a ressenti de la faim mais n'a pas pu manger?	
Code	Lors du dernier mois, par manque d'argent ou d'autres ressources, quelquefois	NR. 99	16	Un jeune âgé de 18 ans ou moins dans votre menage a mangé seulement une fois par jour ou a passé une journée entière sans manger?	
10	Un jeune âgé de 18 ans ou moins dans votre menage, a cessé d'avoir une alimentation saine et nutritive?				
11	Un jeune âgé de 18 ans ou moins dans votre menage avez eu une alimentation basée sur des aliments peu variés?				

* NS: Ne sait pas; NR: N'a pas répondu

SECTION 9. ALIMENTS ET COMBUSTIBLES POUR LE MENAGE

•	01. Au cours des 12 derniers mois, est-ce qu'un membre quelconque de votre menage a reçu une assistance du gouvernement ou d'une autre institution? <i>OUI NON</i>									
(02. Au cas où la réponse est affirmative, dans quel type de programme est enrôlée cette personne? (spécifiez)									
	03. Généralement, à quelle fréquence, sortez-vous acheter des aliments pour votre menage? CHOISISSEZ UNE SEULE RÉPONSE									
	a. Tous les jours b. Chaque semaine c. Deux fois par mois d. Une fois par mois									
	04. Généralement, à quelle fréquence sortez-vous, vo	us ou votre famille manger hors de chez vous?	CHOISISSEZ UNE SEULE RÉPONSE							
	a. Jamais ou moins de 1 fois par semaine	b. 1-2 fois par semaine	c. 3-5 fois par semaine							
	d. 6 à 8 fois par semaine 🗌	e. 9 à 11 fois par semaine 🗌	f. 12 ou plusieurs fois par semaine							

TOUS LE JOUR: 4 FOIS OU PLUS PAR SEMAINE / CHAQUE SEMAINE: 1-3 FOIS PAR SEMAINE OU 4 FOIS PAR MOIS / QUINZAINE: 2 OU 3 FOIS PAR MOIS / MENSUELLE: 1 FOIS PAR MOIS

Ensuite Je vous demanderai des informations à propos des aliments consommés dans le menage. S'il vous plait, incluez les aliments sylvestres collectés au champ, chassés ou pêchés; Non seulement les produits achetés ou produits par le menage.

de	05. Pourriez-vous m'informer si	0.	06. Principalement,	07. Lors du	004	Farine ou d'amidon (blé, maïs et			
Co	pendant le dernier mois, votre	п	comment avez-vous	dernier mois,	004	/ ou manioc)			
	famille et vous avez mangé	No	obtenu le	avec quelle					
	des [ALIMENT]?		[ALIMENT] que vous	fréquence a	005	Maïs en grain			
		1	avez consommé?	consommé votre		6.0			
	AU CAS QUI N'A PAS ETE			famille, le	006	Bonhon sucre et sale			
	CONSOMME L'ALIMENT,	Jui.	Autoproduction1	[ALIMENTS]?		Bondon sucre et sale			
	NOTEZ 0 DANS LA COLONNE	0			007				
	SUIVANTE ET 2 ET 3 POUR		Achat2	tous les jours1	007	Pain			
	L'ALIMENT		Chasse/eugillette 3						
	CORRESPONDENT.		Chasse/cueillelle5	semaine2	008	Avoine			
			Don4	quinzaine3					
				mensuelle4	Aut	res céréales comme: flocons, etc. (
			Échange5						
					009				
			Prog. Alimentaire.6						
					010				
PAN	I, FARINES Y CEREALES								
					VIANDE, ABATS Y SAUCISSES				
001	Riz					·			
					011	Viande de Poulet			
002	Maïs moulue					viande de l'outer			
					012				
003	Spaghatti ou autra Pâtas				012	Viande de Pintade			
	spagnetti ou autre r ates								
					013	Viande de Porc			

014	Viande de Mouton				Autres viandes comme: viande salée y séchée, lapin, etc. (spécifier)				
015	Viande de chèvre ou de cabri				023				
016	Viande de bœuf (avec / sans os, moulue, os seulement)				024				
017	Viande de lapin; dindon, canard				025				
	1 ' '				POI	SSONS			
018	Cochon d'Inde				026	Poisson en boite (sardines, etc)			
019	Lambi				027	Sea Fresh Fish			
020	Charcuterie (saucisson)				028	Poisson d eau douce			
Code	05. Pourriez-vous m'informer si pendant le dernier mois, votre	ui1 Non0	06. Principalement, comment avez-vous	07. Lors du dernier mois, avec quelle fréquence a consommé votre famille, le [ALIMENTS]? tous les jours1 semaine2 quinzaine 3	PRODUITS LAITIERS				
	famille et vous avez mange des [ALIMENT]? AU CAS QUI N'A PAS ETE CONSOMME L'ALIMENT, NOTEZ 0 DANS LA COLONNE SUIVANTE ET 2 ET 3 POUR L'ALIMENT CORRESPONDENT.		[ALIMENT] que vous		029	Lait			
			Autoproduction1		030	Lait en poudre			
		0	Achat2		031	Lait de chèvre liquide			
			Chasse/cueillette3		032	Fromage			
			Don4	mensuelle4	033	Yogourt			
			Prog. Alimentaire.6		Autres produits laitiers comme lait fermenté, lait caillé, etc. (spécifier)				
					034				
021	Abats (foie, ris de veau, etc)				035				
022	Beef seché								

036 043 Huile comestible ŒUFS 044 Appât Les œufs de poule 037 045 Beurre 038 Les œufs de canard Autres graisses (spécifier) 046 039 Les œufs de pintade 06. Principalement, **05.** Pourriez-vous m'informer si **07.** Lors du Non...0 Code 047 pendant le dernier mois, votre comment avez-vous dernier mois, famille et vous avez mangé obtenu le .. avec quelle LÉGUMES FEUILLES ET AUTRES LÉGUMES [ALIMENT] que vous des.. [ALIMENT]? fréquence a avez consommé? consommé votre 048 Poivrons ou piment doux 0ui....1 AU CAS QUI N'A PAS ETE famille, le... CONSOMME L'ALIMENT, Autoproduction....1 [ALIMENTS]? 049 Piment NOTEZ 0 DANS LA COLONNE Achat.....2 SUIVANTE ET 2 ET 3 POUR tous les jours...1 Les petit pois ou pois france 050 L'ALIMENT Chasse/cueillette...3 semaine2 CORRESPONDENT. 051 Aubergines, concombres quinzaine3 Don.....4 mensuelle.....4 052 Oignons Échange5 053 **Prog.** Alimentaire.6 Chou, chou-fleur, brocolis 040 054 Épinards ou lalo Oeufs de dinde Autres œufs (spécifier) 055 Laitue 041 056 Tomate crue 042 057 Carotte, potiron (Bangana) **HUILES Y GRAISSES**

058 066 Gombo Pommes de terre 059 067 Taro Giraumont **05.** Pourriez-vous m'informer si **06.** Principalement, **07.** Lors du Code Non...0 068 Igname pendant le dernier mois, votre dernier mois, comment avez-vous famille et vous avez mangé avec quelle obtenu le .. Autres racines (spécifier) des.. [ALIMENT]? [ALIMENT] que vous fréquence a avez consommé? consommé votre 069 0ui...1 AU CAS QUI N'A PAS ETE famille. le... CONSOMME L'ALIMENT, Autoproduction....1 [ALIMENTS]? 070 NOTEZ 0 DANS LA COLONNE Achat.....2 tous les jours...1 SUIVANTE ET 2 ET 3 POUR 071 L'ALIMENT Chasse/cueillette..3 *semaine*2 CORRESPONDENT. quinzaine3 072 Don.....4 mensuelle.....4 LÉGUMINEUSES Échange5 **Prog.** Alimentaire.6 Pois congo, pois inconnu, pois 073 souche, pois boukousou, Autres légumes feuilles frais (spécifier) 074 Haricots 060 075 Pistache 061 076 Avocat 062 077 Amandes, noisettes 063 078 Caimite TUBERCULES Arbre a pain\ arbre veritable 079 064 La patate douce 065 Manioc

ode	05. Pourriez-vous m'informer si	0	06. Principalement,	07. Lors du	088	Mangue			
0	famille et vous avez mangé	Non.	obtenu le	avec quelle	089	Pomme poire			
	des [ALIMENT]?	[ALIMENT] que vous avez consommé?	[ALIMENT] que vous avez consommé?	fréquence a consommé votre		Tomme, pone			
	AU CAS QUI N'A PAS ETE CONSOMME L'ALIMENT		famille, le	090	Melon				
	NOTEZ 0 DANS LA COLONNE	01		[ALIMENTS]?	091	Orange, pamplemousse,			
	SUIVANTE ET 2 ET 3 POUR L'ALIMENT		Achat2	tous les jours1		mandarine, citron			
	CORRESPONDENT.		Chasse/cueillette3	semaine2 auinzaine 3	092	Ananas			
			Don4	mensuelle4	093	Banane, figue banane			
			Échange5						
			Prog. Alimentaire.6		094	Melon d'eau			
Aut	res légumineuses (spécifier)			095	Raisin				
080					096	Abricot			
081					ode	05. Pourriez-vous m'informer si	0	06. Principalement,	07. Lors du
082						famille et vous avez mangé	Non.	obtenu le	avec quelle
EDI	urrs				-	des [ALIMENT]?		[ALIMENT] que vous avez consommé?	fréquence a consommé votre
r K (115					AU CAS QUI N'A PAS ETE	i1	Autoproduction 1	famille, le
083	Cerises, prunes, noix de cajou					NOTEZ 0 DANS LA COLONNE	0n	Autoproduction1	[ALIMENTS]?
084	Cocoyer					SUIVANTE ET 2 ET 3 POUR L'ALIMENT		Achat2	tous les jours1
095						CORRESPONDENT.		Chasse/cueillette3	semaine2
085	Fraises							Don4	quinzaine3 mensuelle4
086	Goayave							Échange5	
087	Papaye, quenepe							Prog. Alimentaire.6	

Autres fruits frais (spécifier)			110	Thés					
097					QUELQUE AUTRE ALIMENT NON MENTIONNE PLUS HAUT				
098					111				
099					112				
SUC	CRE ET ADOUCISSANTS				113				
100	Sucre crème								
101	Sucre raffiné								
102	Marmelades et gelées								
103	Sirop de canne (mélasse) et miel d'abeille								
104	Jus en poudre et friandises en poudre								
105	Rapadour		1						
Aut	res adoucissants (saccharine, stev	ia, et	tc.)		-				
105									
106									
107									
INFUSIONS									
108	Café								
109	Cacao, poudre de chocolat								