

Fall 9-16-2014

Bridging the Food Gap: Addressing the feasibility and applicability of three key traditionally Western food preservation techniques to improving household food security and reducing malnutrition in Uganda.

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Bridging the Food Gap:

Addressing the feasibility and applicability of three key traditionally Western food preservation techniques to improving household food security and reducing malnutrition in Uganda.

Eva Baguma

SDDC 2013/14

CAPSTONE PAPER

**A Capstone Paper submitted in partial fulfillment of the requirements for a Masters of
Arts in Sustainable Development: International Policy and Management
at SIT Graduate Institute in Washington DC, USA.**

August 8, 2014

Advisor: Kanthie Athukorala

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ABBREVIATIONS AND ACRONYMS

CSFVA Comprehensive Food Security and Vulnerability Analysis

FAO Food and Agriculture Organization

HIV/AIDS Human Immuno Virus/ Acquired Immune Deficiency Syndrome

IFAD International Fund for Agricultural Development

MDGS Millennium Development Goals

SDDC Sustainable Development (District of Colombia)

SIT School for International Training

UN United Nations

UNDP United Nations Development Program

UNEP United Nations Environment Program

USDA United States Department of Agriculture

WB World Bank

WHO World Health Organization

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ABSTRACT

Food wastage is the leading cause of food insecurity and malnutrition in the world today. A huge amount of food gets wasted along the food supply chain from the time it is harvested to the time it gets to our plates. A significant amount of the food wasted happens in the home as well as on farms, in restaurants and supermarkets across the globe.

In Sub-Saharan Africa, many families and communities are facing severe food shortages due to lack of electricity for refrigeration, poor storage facilities and limited access to markets.

However for many centuries, different cultures around the world have devised ways to preserve food and make it available for longer periods of time and in times of need. These techniques have helped sustain many communities through wars, droughts and periods of scarcity, while at the same time providing much needed nutrients for a healthy diet throughout the year as well as providing a source of income.

The purpose of this research is to demonstrate the feasibility and applicability of three key traditionally Western food preservation techniques, i.e canning, pickling and fermenting, which if applied in the Ugandan context can significantly reduce food wastage and help improve household food security, nutrition, health and income.

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I. INTRODUCTION

Food security approaches in recent years have been dominated by discussions around food production at the global and national level. Today, we are seeing the failure of these approaches in really addressing why individuals and households are unable to access enough food for a healthy and productive life. With the frequently changing dynamics today, like rapid urbanization and increasing natural disasters as a result of climate changes, it is more important than ever to start looking at food security in a more sustainable and community-driven way. There are already several examples dating back centuries of how communities around the world have organized themselves around agriculture and the food they produce, as well as how to preserve it and make it last.

Sustainable agricultural practices that are less energy intensive and less environmentally destructive are leading the way for food security today. Urban agriculture, for example, has brought the power to urban dwellers to grow food for themselves and their communities, while making an additional income off the surplus. Whatever surplus is not sold is preserved using a variety of techniques like canning, pickling, fermenting, salting, curing and solar drying to mention but a few. Today, a variety of foods from meats to dairy products, fruits and vegetables can be easily preserved and saved for future use or for sale.

In developing and less developed communities, however, this is a challenge. The main problem is that many rural and urban communities are facing extreme food shortages due to post-harvest food spoilage/losses. Most rural communities are predominantly farming communities dependent on agriculture for their sustenance. They grow food crops for self-

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consumption or cash crops for export. With limited access to electricity, refrigeration and storage facilities like the developed world, much of the produce goes to waste or is sold at a loss.

As a result of increasing losses in the agriculture sector, communities around the world need to adapt new techniques and methods of food preservation with support from the international community and their local governments in order to ensure improvement in losses along the food supply chain right from the grassroots.

Additionally, as the deadline for the completion of the Millennium Development Goals (MDGs) approaches in 2015, of which the first is halving hunger by 2015, the international community needs to start discussing what the post-2015 Sustainable Development Goals (SDGs) will be around global food security.

This paper will help demonstrate how household food security can be improved with the introduction of three key food preservation techniques (canning, pickling and fermenting) and show how this can also contribute to improving household nutrition, health and income if introduced to small rural farming communities in Uganda.

In the first section of the research paper, I will first analyze the global and local Ugandan realities of food security. Secondly, I will look at a series of issues connected to the key concepts of household food security and food preservation, to include touching on how household food security contributes to the household's nutrition, health and income. Thirdly, I will analyze the three key food preservation techniques and how they can help improve household food security, nutrition, health and income if introduced to rural farming communities in Uganda.

The second section will be my central analysis of the problem statement followed by my recommendations, which reflect on the relevance of this research to sustainable development.

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Finally, I will synthesize the main conclusions and comment on the way forward for food preservation in Uganda.

I believe that, *if* these three key food preservation techniques (i.e. canning, pickling and fermenting) are introduced in Uganda, *then* there will be a significant improvement in household food security, nutrition and health, because households will have the knowledge and skills to preserve whatever resources they produce before they get spoilt. As a result, this will not only contribute the food security but will also contribute to the household's nutrition, health and income security as a result.

Changing dynamics from global to household food security, food waste and malnutrition

The roots of the issue of food security date back to the 1940s, particularly at the time when the Universal Declaration of Human Rights, which, in 1948, recognized the right to food as a fundamental part of an adequate standard of living (UN, 1948). It became an important development concern in the second half of the 1980's following the world food crisis in 1972-74 and the African famine of 1984-85. It has since generated great academic, conceptual and development interest and innovations for international, national and local programs, especially in sub-Saharan Africa where the situation was gravest.

According to Smith, et. al. (1992), the period between 1986-91 saw a shift in the focus on food security. They state in their report, "The main cause of increasing complexity is the change in the level of analysis, from the main concern being with national and international food security in the 1970s (defined in terms of food security levels and the reliability of amassed food supplies of regions or countries) to a focus on the individual and household food security in the

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1980s (with the emphasis being on access, vulnerability and entitlement). Here, as we shall see, the links spread widely: to nutrition planning, rural development and even environmental sustainability.”

The Food and Agriculture Organization (FAO) estimates that nearly 1.3 billion tons of food is wasted every year (FAO, 2011). It says that “food is wasted at each and every stage of the food supply chain from agricultural production down to final household consumption” and that “food losses in more industrialized countries are just as high as in developing countries, but that in developing countries, more than 40% of the food losses occur at post-harvest and processing levels, while in industrialized countries, more than 40% of the food losses occur at retail and consumer levels.” The numbers are really shocking when looked at in comparison, the food waste at consumer level in industrialized countries stands at 222 million ton which is almost as high as the total net food production in sub-Saharan Africa at 230 million ton (FAO, 2011).

As the United Nations Global Impact clearly points out in its 2012 report, “With the world’s population expected to grow by 30%, from 7 billion to 9 billion, in the next four decades, the demand on our food and agriculture systems will be greater than ever” (UN, 2012, p.4).

Food insecurity, food waste and malnutrition in Uganda

According to the *Comprehensive Food Security and Vulnerability Analysis (CFSVA)* by the World Food Programme (WFP) of 2013, “Uganda is endowed with plentiful natural resources, including large fresh-water resources, as well as favorable soil conditions and climate.” It is safe to say that Uganda has great agricultural potential. The analysis goes on to state that “over 81%

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of all households (4.2 million) are engaged in agriculture, although it is as high as 95%, 93% and 91% in the northern, western and eastern regions of the country, respectively, with a dip to 74% in central Uganda” (CSFVA, 2013).

The report continues to state that “food availability is seasonal with a clear marked divide between the regions of the country. Most of Uganda has a sub-tropical bimodal climate with two main rainy seasons between March and June and August and December. This, therefore, means there are two key growing and harvest seasons every year. On the other hand, the Karamoja region, which is the northern most part of Uganda, has a unimodal climate with about six months of rain between April and October followed by six months of no rain. It, therefore, only benefits from one annual growing and harvest season each year” (CSFVA, 2013).

The report also states that “Ugandans are fairly market dependent and markets are the main source of food calories for about 50% of Ugandan households. This contributes to households’ vulnerability to food insecurity if food prices rise sharply”. The report also states that “smallholder farmers produce most of the food that passes through these market outlets in the country. Their lack of proper storage facilities and limited access to credit and sources of income compel them to sell their surplus immediately after harvest” (CSFVA, 2013).

Definition of key terms

Food Security - My research will use a new definition that emerged at the 1996 World Food Summit, where, for the first time, the emphasis was on individuals rather than nations enjoying food security (FAO, 1996). Based on the results of the summit, FAO generally defines food security as “a situation where all people, at all times, have physical and economic access to

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sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.”

Food Insecurity - The United States Department of Agriculture (USDA) states that food insecurity is a situation of “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways” (Buckle et. al. for USDA, 2000).

Household Food Security: - “Household food security exists when all members, at all times, have access to enough food for an active, healthy life” and “individuals who are food secure do not live in hunger or fear of starvation (FAO, 2006).

Food Preservation - is basically any process or method of treating and handling food slow down the spoilage process. According to World of Microbiology and Immunology¹ (2003), “the term food preservation refers to any one of a number of techniques used to prevent food from spoiling. It includes methods such as canning, pickling, drying and freeze-drying, irradiation, **pasteurization**, smoking, and the addition of chemical additives. Food preservation has become an increasingly important component of the food industry as fewer people eat foods produced on their own lands, and as consumers expect to be able to purchase and consume foods that are out of season”(WMI, 2003).

¹ http://www.encyclopedia.com/topic/food_preservation.aspx

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2. RESEARCH METHODS

Data Collection Method: The research for this paper was conducted using mainly secondary research methods. Most of the research was done using desk review method that mainly focused around reviewing already existing knowledge and information (research) on food security, food waste, food preservation and food preservation techniques and methods, as well as focusing primarily on three key primary techniques—canning, pickling and fermenting.

I chose this approach because I believed that secondary data analysis would save me time that would otherwise be spent on collecting data. It was also particularly helpful for reviewing quantitative data and gave me access to a larger scope and higher quality information or data that I would not have been able to access or collect on my own.

Also, I considered secondary data as essential for analyzing social and economic changes, since it would have been difficult to conduct a survey that would adequately capture any past changes in behavior or patterns and developments on the food security and food preservation issues at which I was examining.

Limitations: There were three main limitations to the study. First, it was limited to a secondary/desk review methodology. As a result, other primary research methods were not utilized to give additional dimension to the study.

Second, the reason I chose this approach was because of my limitation in terms of time and money. In addition, I was not able to diversity my research and use resources and material from different libraries and universities across the city. In addition, certain databases reports, articles and papers available online required payment to access the resources.

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Finally, my study was limited in terms of its generalization that food preservation can contribute to household food security. While the proposed study sample could be quite diverse, the fact remains that I was not able to review more than these three different kinds of food preservation (canning, pickling and fermenting) of fruits and vegetables. As a result, the research does not leave a lot of room for other preservation techniques for other products, like dairy and meats, which are also products I would like to have gathered knowledge and information on.

Personal Biases: My first personal bias with this research is that I am Ugandan and I have done this research for purely selfish reasons. I am interested in how I can make a contribution to improving household food security in my country and I am doing this as part of a larger process to help set up a program in the country on food preservation and nutrition retention.

Quantification of data on food security, food waste and nutrition data using available data and results from a thorough literature search on available literature on global food security, food waste and health and nutrition from the internet and other literal sources. Where there were gaps in the information or available knowledge, I made my own assumptions and estimations based on food security, food waste and malnutrition/nutrition levels in comparable regions.

3. LITERATURE REVIEW

The following literature review will explore several aspects of the research question. First, I will look at the global statistics and data on food security, focusing on the current state of food security and nutrition in Uganda. I will also analyze the relationship between food security and the overall nutrition and health of rural families and communities. I will then examine three key food preservation techniques traditionally common to Western society but that are not being used

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in Uganda. These are canning, pickling and fermenting, which can be used to preserve different kinds of fruits, vegetables, herbs and other seasonally available produce.

I believe that food preservation can have a significant impact on reducing food wastage and argue for why it is important for these rural households and communities to have knowledge and skills about food preservation. I hope this paper will demonstrate the linkage between food preservation and improvement of nutrition, health and vitality of rural populations in Uganda.

Global Food Security

In 2010, the FAO stated that “the number of undernourished people in the world remained unacceptably high in 2010 despite an expected decline – the first in 15 years. This decline is largely attributed to a more favorable economic environment in 2010 – particularly in developing countries – and the fall in both international and domestic food prices since 2008” (FAO, 2010, p.1).

Even with global hunger declining and economic environments improving across the globe, according to FAO, “the issue of extreme poverty and food security are still critical and requires the world’s full attention and strategic support.” It states in the report that “the recent increases in food prices, if they persist, will create additional obstacles in the fight to future reduce hunger” (FAO, 2010, p.1).

Food security is connected to several other development initiatives, such as education, health and gender equality. Therefore, “food security cannot be understood in isolation from other developmental questions such as social protection, sources of income, rural and urban

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development, changing household structures, health access, access to land, water and inputs, retail markets or education and nutrition knowledge” (Altman, Hart & Jacob, p.8).

An overview of Food Insecurity and Malnutrition in Uganda

For many decades, Uganda was known as the food basket of the East and Central African region. This land, where everything grows, is blessed with rich fertile soils, moderate sunshine and steady regular rain fall. But today, just like many other countries in the world, Uganda is struggling with consistent food insecurity and nutritional deficiency on a grand scale.

Food insecurity in Uganda has multiple roots. The country and its population’s overwhelming dependence on agriculture for social and economic subsistence is undeniably a factor to consider. Complicating that, however, are the negative environmental impacts, which have resulted from poor farming practices, particularly in low-land areas.

Dancan Mulhindi, in a 2008 report on a food security project in central Uganda, identified many of the contributing causes of environmental degradation. In swampy lowlands, Mulhindi explains, cutting down existing vegetation and emptying naturally occurring water catchment systems in order to plant rice resulted in worsening rainfall patterns.

Additionally, the productivity of the rice plants was lowered through poor management practices, lack of access to market information or systems, and lack of capital (2008). This kind of land degradation, due to the cultivation of fragile land such as swamps, is widely cited as a major cause of food insecurity in Uganda and the region. This has been exacerbated by the use of artificial imported fertilizers, which damage the soil. This not only affects the food supply for small scale farmers and their households and communities, but on a wider scale, creates a

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“vicious cycle of declining productivity, poverty, and further land degradation,”— communities are thus caught in a complex situation very like a trap (Masinde et al., 2009). High population densities and land fragmentation, due to the land inheritance culture in Uganda, also intensify the process and effects of land degradation (Masinde et al., 2009).

Existing projects and research geared toward improving food security in Uganda often choose to focus on improving technology. Mulhindi’s report, for example, documents a program dedicated to moving rice production from swamps to drier uplands in order to minimize the environmental impact of food production, and promoting a new, higher yielding rice variety (Mulhindi, 2008).

Other projects have focused on facilitating behavior change in communities, particularly through the diversification of crops. Save the Children, for instance, in its Food Security/Hunger Prevention campaign in Uganda, emphasized biodiversity and the promotion of different, nutrient-rich produce, particularly vegetables, to reduce families’ risk of food insecurity and malnutrition (Fiebig, 2005). This program targeted children, in particular, in a push to bolster their intake of important nutrients to meet recommended levels. Education is a also common approach in these kinds of programs, particularly nutrition education.

A Livelihoods Enhancement Program study conducted in 2009 by Dorothy Masinde, Robert Mazure, and Haroon Sseguya in Kamuli District in southeast Uganda, focused on enhancing the “human capital” of communities through educating peer trainers and focusing on improving knowledge of nutrition in order to address more comprehensively the variety of complicating factors which contribute to food insecurity.

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In recent decades, there has been a shift away from a focus on the perceived failures of food production at a national level, and toward a realization that local, sustainable methods are both more effective and a more sustainable way to achieve food self-sufficiency (Hendriks, 2005), as exemplified in the very local, grassroots-based focus of the above projects. Something that has been missing from these programs, however, is a discussion of the food produced by small farmers but lost to spoilage before being sold or eaten.

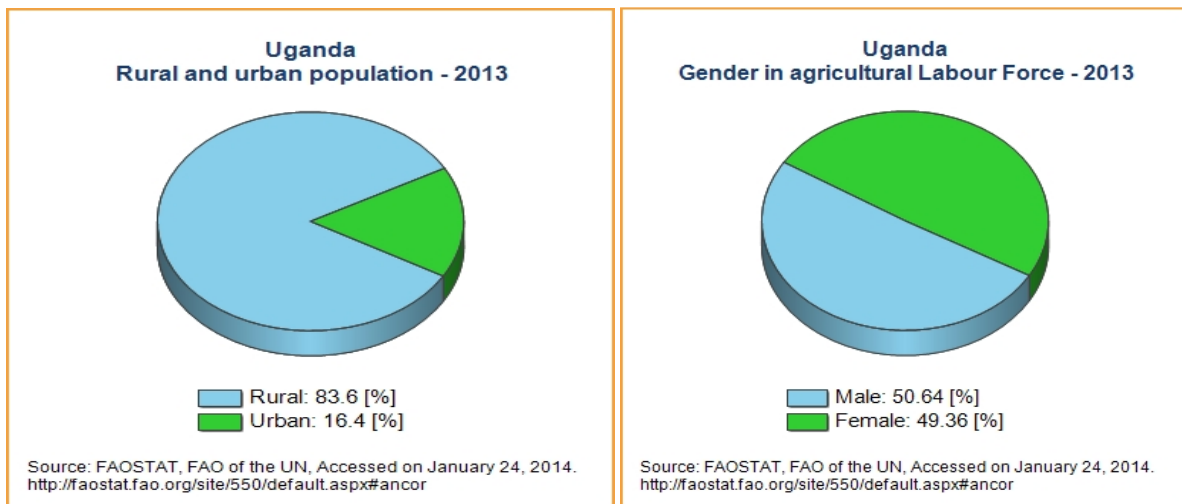


Figure 1: Uganda Population Urban Vs Rural 2013 and Figure 2: Gender in Agriculture 2013

Global and Country Food Losses and Food Waste

According to the FAO 2011 report on Global Food Losses and Food Waste, “the issue of food losses is a high priority in the efforts to fight hunger, raise income and improve food security in the world’s poorest countries”. It continues to state that “food losses have an impact on food security for poor people, on food quality and safety, on economic development and on the environment”. There are a variety of causes of food loss and they change and vary from one

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country or region to the next and are very much dependent on the local conditions and political, cultural, geographical or climatic situation in any given country (FAO, 2011).

According to the New Vision newspaper article², a recent food sector report looking at the post-harvest record of Uganda over the past 50 years that was launched by the State Minister for Agriculture, Professor Mijumbi Nyiira, states that “post-harvest losses in Uganda are estimated at between 5% and 15% for cereals and legumes, 20-25% for root and tubers and over 35% for fruits and vegetables”. The losses are attributed to improper handling or bio-deterioration by microorganisms, insects, rodents or birds. Subsequently, the losses damage the nutritional value of food and have adverse health effects on the consumers (NV, 2014).

In broader terms, food losses can also be influenced by other key factors, such as choices and patterns in crop production, capacity and internal infrastructure, marketing chains and channels for distribution, as well as consumer purchasing and food use practices (FAO, 2011).

A recent UN News article on the campaign to stem food waste by the UN Environment Program (UNEP)³ states that, according to the FAO’s records, an estimated one-third of all food produced each year – equivalent to 1.3 billion tons worth around \$1 trillion – ends up rotting in the bins of consumers and retailers, or spoiling due to poor transportation and harvesting practices.

[The UNEP, together with the UN Food and Agriculture Organization (FAO) and their partners, have launched a campaign called *Think, Eat, Donate, Reduce Your Foodprint* – that seeks to accelerate action to eliminate wasteful practices and help countries share successful initiatives

² Available at <http://www.newvision.co.ug/mobile/Detail.aspx?NewsID=636450&CatID=408>

³ UN News Center Article. Available at <http://www.un.org/apps/news/story.asp?NewsID=44956#.U9FVnpaTGM1>

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on these issues. It specifically targets food wasted by consumers, retailers and the hospitality industry] (FAO, 2011)

In developing countries, food waste and losses occur mainly at early stages of the food value chain and can be traced back to financial, managerial and technical constraints in harvesting techniques as well as storage –and cooling facilities. Thus, a strengthening of the supply chain through the support farmers and investments in infrastructure, transportation, as well as in an expansion of the food –and packaging industry could help to reduce the amount of food loss and waste (UNEP, 2009).

UNEP emphasized that unconsumed food wastes both the energy put into growing it and the fuel spent on transporting produce across various distances, adding that this significant amount of waste has serious moral implications in a world where almost 900 million people go hungry every day.

UNEP said in a news release, “In industrialized regions, almost half of the total food squandered, around 300 million tons annually, occurs because producers, retailers and consumers discard food that is still fit for consumption—more than the net food production of sub-Saharan Africa and enough to feed the world’s hungry.” Adding that, “while traditional methods of preserving food may not be adaptable to all regions and cultures, they do underline how much room there is for consumers to change the way they buy, store and consume food.”

The Executive Director of UNEP, Achim Steiner, said, “Reducing food waste and loss is an economic, ethical and environmental challenge that links to some of the greatest challenges of today, from hunger and nutrition to climate change, deforestation and land degradation.” He

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added, “One of the ways everyone can contribute to these twin challenges is by looking at how less-wasteful cultures place such value on every morsel of food and considering how to emulate them.”

The United Nations environment agency is also stressing the importance of reducing food waste and, as highlighted in the article, some food preservation technique, including fermenting birds, naturally freeze-drying potatoes and squeezing meat on a saddle have been some of the traditional methods used by cultures around the world to preserve food for centuries.

At the launch of a recent UN Report called *Food Wastage Footprint: Impacts on Natural Resources*, the Director-General of FAO, José Graziano da Silva, said, “All of us – farmers and fishers; food processors and supermarkets; local and national governments; individual consumers – must make changes at every link of the human food chain to prevent food wastage from happening in the first place, and re-use or recycle it when we can’t.”

Relationship between food security and the overall nutrition and health

According to the FAO’s 2010 *Nutrition and Consumer Protection Report*⁴, “In the years 2011-13, an estimated 842 million people were suffering from chronic hunger.” It also states, “Food security incorporates a measure of resilience to future disruption or unavailability of critical food supply due to various risk factors including droughts, shipping disruptions, fuel shortages, economic instability, and wars.” The same FAO report also identified the four pillars of food security as availability, access, utilization, and stability.

⁴ FAO Nutrition and Consumer Protection Report 2010. Available at: http://www.fao.org/ag/agn/nutrition/household_community_en.stm

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It is becoming increasingly clear today that health, nutrition and food security are all interlinked. FAO's *Nutrition and Consumer Protection 2010* article, focusing on household security and community nutrition⁵, states that "Vitamin and mineral deficiencies have a significant impact on human welfare and on the economic development of communities and nations. These deficiencies can lead to serious health problems, including reduced resistance to infectious disease, blindness, lethargy, reduced learning capacity, mental retardation and, in some cases, to death. Among the debilitating consequences of these dietary deficiencies is loss of human capital and worker productivity."

According to the World Health Organization (2006), 16.4% of children under the age of five in Uganda are classified as having malnutrition. This statistic disproportionately affects male children; 18.2% of male children have malnutrition versus 14.6% of females (WHO, 2006). The World Bank's most recent data concludes that the malnutrition rate in 2011 was 14.1% (World Bank, 2011). These statistics imply that the rate of malnutrition in children under five has not decreased dramatically over the past six years, signifying a need for further interventions.

Malnutrition on its own can have significant devastating health effects, most notably affecting those who have a weakened immune system from HIV/AIDS or a non-communicable disease. According to a report on children living with HIV in sub-Saharan Africa, increased malnutrition not only leads to developmental problems but also negatively impacts their immune system, thus making them more susceptible to other illnesses (Anabwani & Navario, 2005, p. 96). The same report concluded that malnutrition coupled with HIV can speed up the progression

⁵ FAO Nutrition and Consumer protection Article (2010). Available at: http://www.fao.org/ag/agn/nutrition/household_micronutrients_en.stm

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of the disease (Anabwani & Navario, 2005, p.98). This literature determines that nutrition can be a complimentary treatment and prevention technique for many diseases, while increasing overall health of Ugandans.

Understanding Food Preservation - Canning, Pickling and Fermenting

Food preservation is the treatment and preparation of food to keep it from going bad or slowing down the spoilage process. Food preservation basically provides an unfavorable condition for growth of bacteria and microorganisms that lead to food spoilage. Food preservation can be done through various techniques or methods such as drying, exclusion of air, refrigeration and the use of preservatives. All these help with increasing the shelf life of a variety of different types of foods including fruits, vegetables, meats, dairy and fish products (Nunmer. B, 2000).

According to foods and beverages expert Mark Gold, “Some of the oldest technologies still being used by man today are the various food preservation techniques. People will always disagree on which is the best method of food preservation, but in general people want safe, nutritious foods that are considered to be of a very good quality. This is determined by taking into account wholesomeness, freshness, flavor, aroma, nutritional value, texture and color. Food is generally considered safe when there is no potential danger from pathogenic microorganisms, naturally occurring toxins or any other chemicals that are deemed to be potentially harmful” (Gold, M. 2010).

Food preservation has permeated every culture on earth at nearly every moment in time. To survive, ancient man had to harness nature. In frozen climates, he froze seal meat on the ice, and, in tropical climates, he dried food in the sun. Food by its nature begins to spoil the moment

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it is harvested. As food preservation evolved, it enabled ancient man to create roots for his family, live in one place, and form a community. He no longer had to consume the kill or harvest immediately, but could preserve some for use later. Each culture preserved their local food sources using the same basic methods of food preservation (Nummer. B, 2002).

Maintaining or creating nutritional value, texture and flavor is an important aspect of food preservation, although, historically, some methods drastically altered the character of the food being preserved. In many cases, these changes have come to be seen as desirable qualities – cheese, yoghurt and pickled onions being common examples (Nummer B, 2002).

According to Chelsea Green Publishing, “many processes designed to preserve food involve a number of food preservation methods”. For example, canning which is used for preserving mainly fruit by turning them into jams or sugaring which is used to prevent the re-growth of bacteria by sealing fruits in an airtight jar (to prevent recontamination). “There are many traditional methods of preserving food that limit the energy input and help reduce carbon footprint.”⁶

4. CENTRAL ANALYSIS

Global and Country overview on Food Security

Globally, food security continues to be a primary concern for many countries, particularly those where the population is largely dependent on agriculture to survive. Food security, besides being a factor in state and social instability, contributes to rates of malnutrition, which has far-reaching effects on the development of a country. According to the World Health Organization’s “*10 Facts on Nutrition*”, improved nutrition also leads to “improved infant, child, and maternal

⁶ Chelsea Green Publishing, 1999. Available at http://www.chelseagreen.com/authors/gardeners_farmers_of_terre_vivante/

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health, stronger immune systems, safer pregnancy and childbirth, [and] lower risk of non-communicable diseases” (WHO, 2012).

Additionally, “Healthy children learn better. People with adequate nutrition are more productive and can create opportunities to gradually break the cycles of poverty and hunger” (WHO, 2012). In improving health and education levels in the regions most affected by malnutrition—often poor, rural areas, with marginalized populations—through improving food security, countries can have a real and positive effect on their own sustainable development.

This is, of course, easier said than done, and the reality of food security on the ground is often complicated by other factors. Uganda, for example, has historically struggled with malnutrition and food security, a situation which has been complicated by enduring poverty, high rates of HIV, and the limited capacity of the state to provide relief. Ugandan government spending on health is far outstripped by international development assistance, but food security is generally absent from health-focused interventions; most projects are designed to address specific diseases within a limited amount of time (Stierman, 2013).

With mortality from non-communicable diseases such as cancer, diabetes, chronic respiratory disease, and cardiovascular disease rising (WHO, 2008), and a reported 7.7% of the total Ugandan adult population infected with HIV (WHO, 2013), there is certainly a need for health interventions. But such a narrow focus within projects often neglects underlying causes or exacerbating factors of disease. Malnutrition plays a contributing role in accelerating the course of non-communicable diseases and HIV, and sustainable projects focused on improved nutrition can have a positive effect on prolonging and improving the lives of many Ugandans.

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In countries like Uganda, food security is limited by climatic factors: production and availability are seasonal, due to the bi-modal climate of the country, which is characterized by two annual rainy seasons (Kiremire et al, 2010). Insecurity is also amplified by destructive farming practices and environmental degradation, and this is where most initiatives aimed at improving food security have been focused (Mulhindi, 2008). Missing from these programs, however, is a discussion on the portion of farmers' production which is lost between harvest and consumption. A large percentage of the losses suffered by poor farmers happen post-harvest, often due to spoilage. Although some crops are traditionally preserved through solar or oven drying, most small farmers do not or are unable to store their produce after harvest, and therefore must either consume the food themselves or sell it immediately. As a result, they often do not have food or income to last them through the dry season to the next harvest (Masinde et al., 2009).

By improving food preservation and promoting consumption of the leafy vegetables, herbs, tubers, pulses, cereals, and fruits which are abundant during the rainy seasons, the scarcity prevalent during the dry seasons can be mitigated, and both the food security and nutritional intake of poor Ugandans can be improved. A project promoting broader dietary diversity and new preservation techniques such as canning, pickling, and salting in conjunction with traditional drying techniques can fill the existing gaps in the efforts to address food insecurity in Uganda, and go far toward sustainably diminishing the effects malnutrition has on the health and overall development of marginalized groups and the population as a whole.

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Uganda Nutrition Country Profile



Figure 3: Map of Uganda

Source FAO, 2010

FAO's nutrition country profile⁷ for Uganda states that, "the Republic of Uganda is a landlocked country of East-central Africa endowed with large fresh-water resources and a high agricultural potential. The population, young and predominantly rural, is mostly engaged in subsistence rain-fed farming. A high population growth rate exerts pressure on

the country's resources. Although poverty

is decreasing, it remains widespread, especially in the northern regions. Northern and north-eastern regions of Uganda have experienced severe civil insecurity which resulted in mass displacement of people to Internally Displaced Persons camps. Since 2006, the security situation in northern Uganda has progressively improved; but the situation remains tense in the north-east (Karamoja) (FAO, 2010)

In its description, it continues to state that "the high incidence of infectious diseases, compounded by very limited access to improved sanitation, together with a low immunization coverage and limited access to essential health care contribute to a high rate of young child

⁷ FAO Nutrition Country Profile-Uganda. Available at http://www.fao.org/ag/agn/nutrition/uga_en.stm

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mortality. The maternal mortality ratio also remains very high. Nevertheless, both young child and maternal mortality rates are decreasing.

Although the contribution of the agricultural sector to the economy is declining, this sector continues to play a pivotal role in Uganda's development. As for staple food crops, a steady increase in production has been observed and although cereal imports have been increasing, dependence on imports for staples is limited". (FAO, 2010)

According to the World Bank Uganda country profile, Uganda ranked 161 of 187 countries on the Human Development Index compiled by the United Nations Development Programme (UNDP) in 2012. It also states that "estimates from the latest available Uganda National Survey show that in 2009/10, only 12% of households used electricity for lighting. Agriculture is the most important sector of the economy, employing over 80% of the work force. Coffee is the major export crop and accounts for the bulk of export revenues". (World Bank, 2014)

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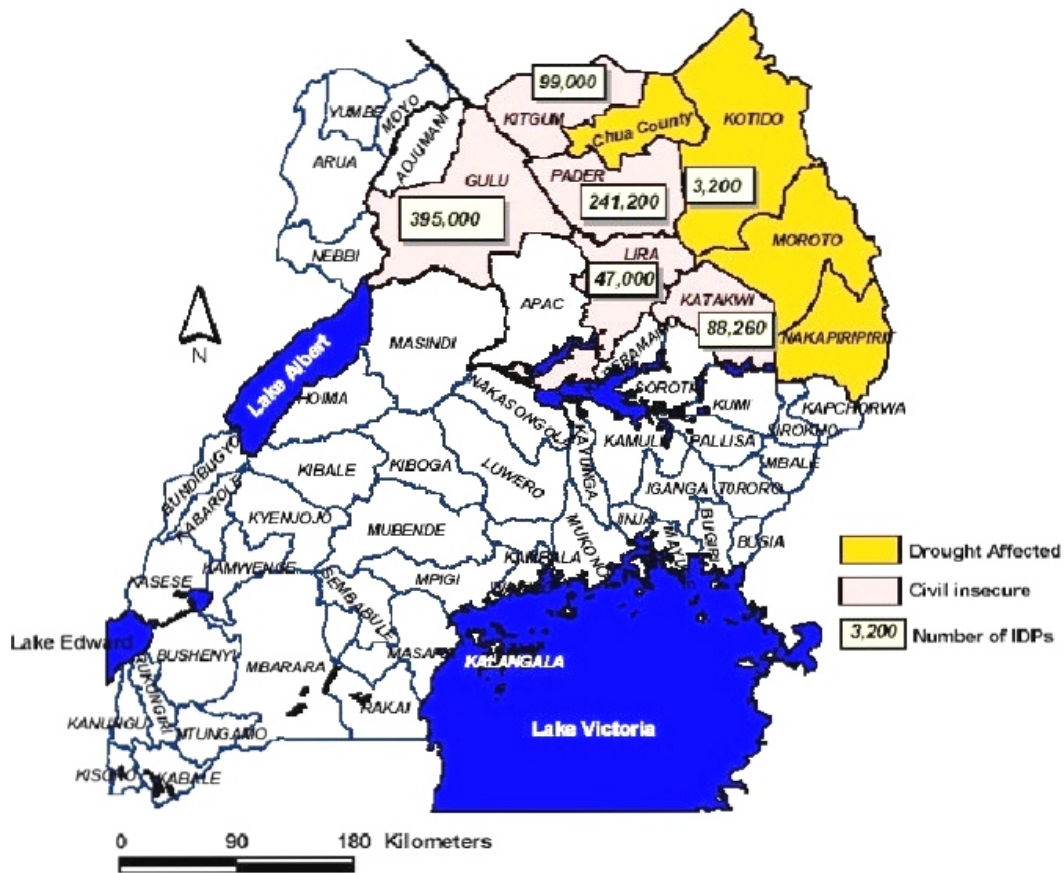


Figure 4 Map showing Food insecure people in Uganda

Source: (FEWS NET, 2013)

Masinde and her co-researchers illustrate that impact more specifically in their report, noting that “most households do not store the foods after harvest. They are either sold after a few days or consumed in the next few months. As a result, food scarcity progressively sets in before the next crops are harvested” (Masinde et al., 2009). As a result, families must spend more income on purchasing food in times of scarcity, while waiting for their next crop to ripen (Masinde et al., 2009). Selling crops immediately to avoid spoilage or due to economic necessity also results in a lower return on that crop—because most farmers are trying to sell at the same time, there is an overabundance in supply, and prices drop drastically.

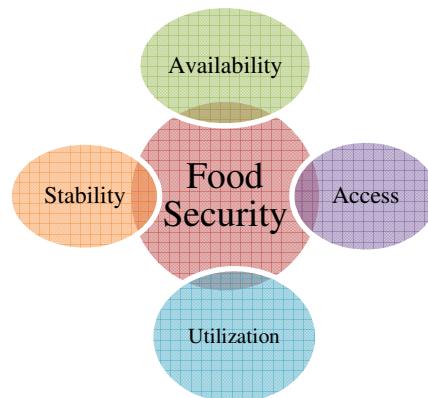
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This is concerning on multiple levels, not least because families that must purchase food in times of scarcity are more vulnerable to increasing food prices (Hendriks, 2005), which often force them to take on extra debt in order to survive until the next season.

Food Supply, Demand and Accessibility

The key defining characteristics of household food security are secure access at all times to sufficient food (Maxwell and Smith, 1992), of which four key elements should be taken into consideration:

- (i) ***Availability*** - looks at the supply side of the food supply chain and is determined by food production and stock levels.
- (ii) ***Access*** – this on the other hand looks at national vs household incomes, expenditure, markets and prices needed to achieve food security
- (iii) ***Utilization*** – how our bodies utilize the nutrients in food in order to determine our nutritional status
- (iv) ***Stability*** – dependent on the other three elements remaining constant over time. A change in availability, access or utilization over time could lead to a change in one's



nutritional status.

Figure 5: The four pillars of food security showing their inter-relationship with each other.

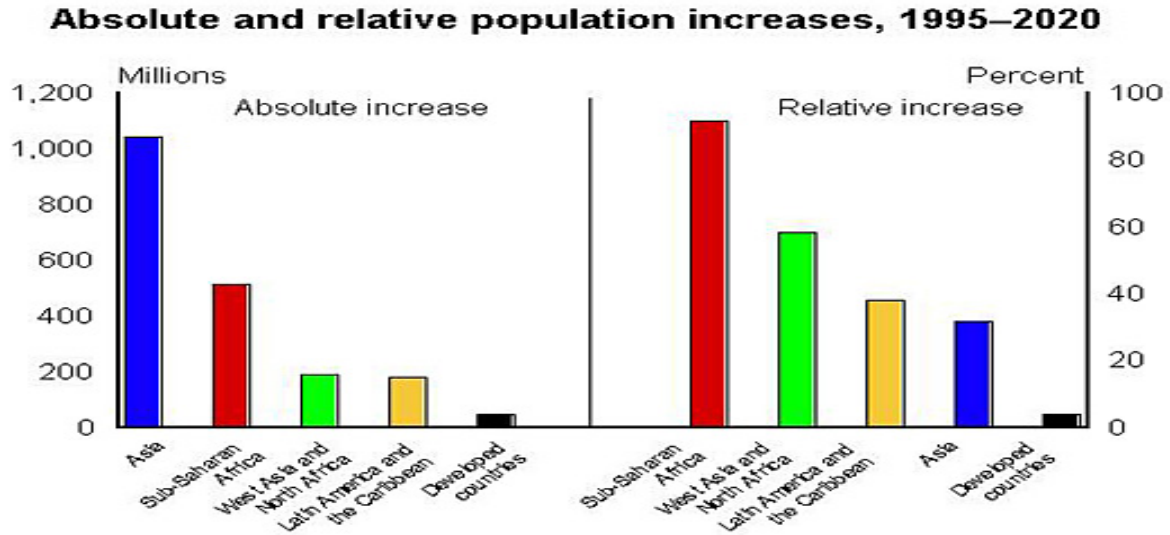
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Therefore, to be truly food secure, all four elements must be fulfilled simultaneously. As a result, it is not safe to say that the presence of sufficient food supplies at national, local or household levels is not enough to ensure that everyone will have enough to eat, nor even that everyone who has enough to eat will be able to maintain a healthy active life.

Demand for food is influenced by a number of forces, including population growth, income levels, urbanization, lifestyles, and preferences. Almost 80 million people are likely to be added to the world's population each year during the next quarter century, increasing the world's population by 35% from 5.7 billion in 1995 to 7.7 billion by 2020 (UN, 1996). More than 95% of the population increase is expected in developing countries, whose share of global population is projected to increase from 79% in 1995 to 84% in 2020. Over this period, the absolute population increase will be highest in Asia, but the relative increase will be greatest in sub-Saharan Africa, where the population is expected to increase by 80% by 2020 in spite of the

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severe impact of HIV/AIDS (UN 1996).



Source: United Nations, *World Population Prospects: The 1996 Revisions* (New York, 1996).
 Note: Medium-variant projections.

Figure 6: Comparative between absolute and relative population increases between 1995-2020

Uganda and the global status of food security, nutrition and income insecurity

FAO assessments suggest that “nearly one billion people in the world today are undernourished, and that every year more than three million children die from under nutrition before their fifth birthday. Micronutrient deficiencies, which affect about two billion people, lead to poor growth, blindness, increased severity of infections and sometimes death” (FAO, 2014).

According to the FAO’s 2010 *Nutrition and Consumer Protection Report*, “In the years 2011-2013, an estimated 842 million people in the world were suffering from chronic hunger”

FAO states that “the root causes of world hunger - including rural poverty, population growth and environmental degradation - are exacerbated by the global economic slowdown, volatile food prices and the impact of climate change” (FAO, 2014).

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FAO's strategy for improved food security and nutrition calls for action to meet the immediate needs of vulnerable populations and to strengthen national government capacities to formulate and implement food security policies and address nutrition issues.

The Uganda Bureau of Statistics says that “most of Uganda’s population is based in the rural areas of the country, and over 80% of the population is dependent on agriculture and agriculture related activities for their livelihoods” (UBOS, 2002).

Recent research shows a reduction in Uganda’s per capita agricultural productivity (Nkonya et al., 2004) with resulting negative impacts on national and household food security, incomes, and overall livelihood conditions. According to Bahiigwa (1999), Uganda’s per capita food production in 1997 was 44% less than in 1970 as a result of a population growth rate (109%) that was far higher than growth in total food production (17%).

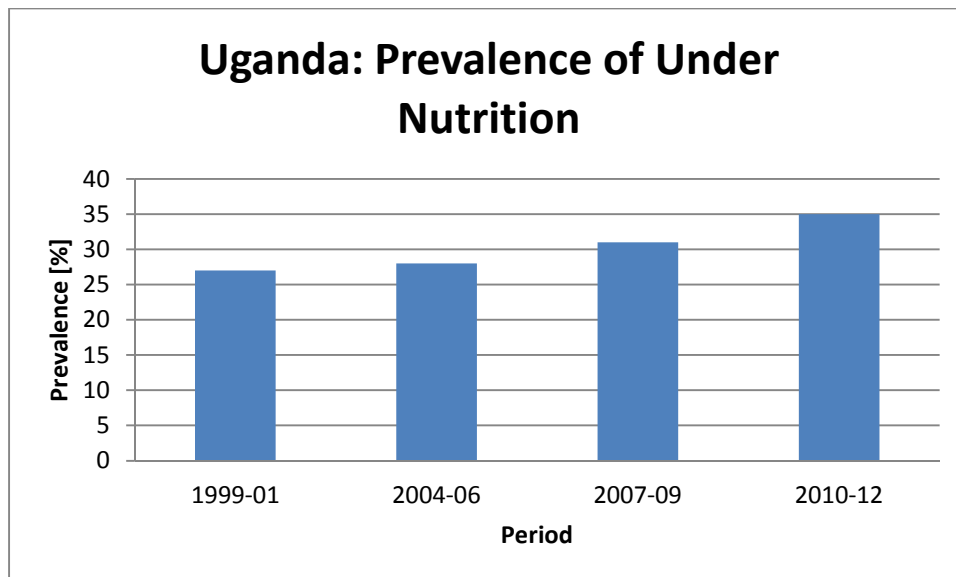


Figure 7: Prevalence of under nutrition in Uganda from 1999 to 2012

Source: (FAO, 2012)

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To achieve sustainable reductions in under-nutrition and other forms of malnutrition, national policies and programs must be complemented by effective community-based actions. These actions must address and remove local causes of malnutrition, such as chronic or seasonal shortages, lack of dietary diversity, or inadequate feeding practices. UN Member Nations, as well as institutions and communities, require methodological support and technical advice to formulate and implement solutions (FAO, 2010).

The role of women in household food security, dietary diversity and children's health

In most developing countries, women and men play different roles in ensuring food security for their households and communities. While the men mainly grow cash crops, women are responsible for growing, preparing and preserving most of the food for household consumption along with rearing and raising the livestock, which is a key source of protein for the household.

According to FAO, “women make up on average 43% of the agricultural labor force in developing countries. Women are also in charge of carrying out most of the home food processing tasks, which guarantees diversity in the household diet, minimizes food losses and provides food products for market or sale. However, women are more likely than men to spend most of their incomes on household needs like food, education or health to meet theirs and their children's needs - research has shown that a child's chances of survival increase by 20% when the mother controls the household budget. Women, therefore, play a very decisive role in food security, dietary and nutrient diversity and children's health”. (FAO, 2014).

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However, gender inequalities between men and women and the control of livelihood assets limit women's food production. In sub-Saharan Africa, studies have found that insecure access to land and poor land rights led women farmers to practice shorter fallow periods than men, which reduced their yields, income and the availability of food at the household level. Also diseases such as HIV/AIDS force women to assume greater caretaking roles, leaving them less time to grow and prepare food (FAO, 2014).

FAO in this report also highlights that “women's access to education is also a determining factor in levels of nutrition and child health. Studies from Africa show that children of mothers who have spent five years in primary education are 40% more likely to live beyond the age of five” (FAO, 2014).

According to the FAO annual publication, *The State of Food and Agriculture (2010-11)*, “having an adequate supply of food does not automatically translate into adequate levels of nutrition. In many societies women and girls eat the food remaining after the male family members have eaten. Women, girls, the sick and disabled are the main victims of this "food discrimination", which results in chronic under nutrition and ill-health” (FAO, 2011).

Food preservation as a sustainable approach to food security

According to this food preservation expert, “food by its nature begins to go bad the moment it is harvested” (Nunmer, 2002). He continues to say that “in times past, the traditional food preservation methods were commonly used especially in rural areas where there was limited access to electricity and refrigeration and storage. Having easily available sustainable and stable food supplies was paramount for the establishment of food security at the household level”

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(Nunmer, 2002) Preservation practices ensured regular flow of food into the household throughout the year for the members of the household and the immediate community. FAO argues that, “the promotion of these readily available technologies for home preservation such as drying of vegetables and fruits at home reduces food wastage and ensured better use of fresh produce available in plenty during the harvest season” (FAO/USDHAW, 1986).

In several other West African countries, cassava, yams and other tubers are peeled, washed and grated, pressed, fermented and roasted resulting in a dry coarse foodstuff called **garri**⁸, that can then be stored for long periods of time and is readily available. And in South Africa, *Biltong*, seasoned dried beef is a popular snack that has span decades with increasing international popularity today. Biltong can last for up to a year without spoiling if kept dry.

According to the *Uganda Food Nutrition Policy* (2003)⁹, “the traditional household food preservation and processing methods commonly used in Uganda, such as solar drying, fire drying, salting, smoking, roasting and grinding, are slowly declining and gradually being replaced by industrial methods”.

Of these methods, solar drying is the most common form of food preservation in most developing countries across the globe, especially in Uganda, and it is used to extend the shelf-life of food commodities. However, it is applied more frequently to cereals and legumes than to fruits and vegetables.

Food preservation using fermentation is the second common method of food preservation used in Uganda; however, this is used mostly for making bread and local

⁸ <http://www.ghanaweb.com/GhanaHomePage/food/gari.html>

⁹ <https://extranet.who.int/nutrition/gina/sites/default/files/UGA%202003%20The%20Uganda%20Food%20and%20Nutrition%20Policy.pdf>

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brew. It is therefore not used for preserving foods like vegetables and herbs which are crucial to the household's diet. It is, therefore, crucial for rural households and small farmers learn to maximize on their available food stocks by adding value to the produce they have in season by learning these key techniques in food preservation.

Understanding Canning Pickling and Fermentation.

The key food preservation techniques in focus are canning, pickling and fermenting, which, if introduced in Uganda, can help promote the preservation and consumption of leafy vegetables, tubers and fruits, which are abundant in the wet seasons but scarce in the hot season. This will help improve availability of highly nutritious foods year round and help improve household food security, the nutrition intake and the health and income of many rural households and communities in Uganda.

This research, therefore, aimed to demonstrate the relevance of three key food preservation techniques--canning, pickling and fermenting—and how they can help reduce unnecessary household and small farm food wastage, which is a key contributor to household food insecurity, malnutrition, poor health and poverty at household, community, national and global level.

If the following food preservation techniques are introduced in Uganda, then there will be a significant improvement in household food security as well as improvement in household nutrition, health, and income.

Canning: The term "canning" refers to this method although the specific container can be glass, plastic, or some other material as well as a metal can, from which the procedure originally obtained its name. The basic principle behind canning is that a food is sterilized, usually by heating, and then placed within an air-tight container. In the absence of air, no new

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pathogens can gain access to the sterilized food. In most canning operations, the food to be packaged is first prepared in some way—cleaned, peeled, sliced, chopped, or treated in some other way—and then placed directly into the container. The container is then placed in hot water or some other environment where its temperature is raised above the boiling point of water for some period of time. This heating process achieves two goals at once. First, it kills the vast majority of pathogens that may be present in the container. Second, it forces out most of the air above the food in the container (WMI, 2003)

Pickling: Pickling involves preserving foods in vinegars (or other acids like lemon or lime). Vinegar is produced from starches or sugars fermented first to alcohol. The alcohol is then oxidized by certain bacteria to acetic acid. Wines, beers and ciders are all routinely transformed into vinegars. Pickling may have originated when food was placed in wine or beer to preserve it, since both have a low pH (Nummer, 2002).

Fermenting: Fermentation was not invented, but rather discovered. No doubt that the first beer was discovered when a few grains of barley were left in the rain. Opportunistic microorganisms fermented the starch-derived sugars into alcohols. Examples of fermented foods include fruits fermented into wine, cabbage into kimchi or sauerkraut, among others. Fermentation is a valuable food preservation method, it not only, preserves foods, but it can also create more nutritious foods and can be used to create even more palatable foods from less than desirable ingredients. A good example is cheese from spoilt milk. The microorganisms responsible for fermentations can also produce vitamins as they ferment which produces a more nutritious end product from the ingredients (Nummer, 2002).

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6. ANALYSIS AND RECOMMENDATIONS

Most Ugandans are market dependent as markets are the main source of food for Ugandan households, which makes them extremely vulnerable to food insecurity if food prices go up. Small-scale rural farmers produce the majority of the foods that are sold in these markets across the country. There is a huge lack of electricity, refrigeration, proper storage spaces and facilities for farmers to store surplus produce.

Uganda is therefore facing food security challenges due to food wastage, an inefficient food preservation culture and a lack of knowledge and understanding regarding nutrition and food value. The introduction of canning, pickling and fermenting, specifically for the preservation of fruits and vegetables, will have a significant impact on household food security and in turn contribute to household nutrition, health and income.

They also have very limited access to credit and alternative sources of income, so this pushes them to sell their produce at a loss. Usually, this surplus produce is sold to produce brokers operating between the farmers in the rural areas and the consumers in the cities at a low bulk price. With the limited shelf life of most of this fresh produce, farmers are left with no choice but to take whatever they can get for the surplus of risk getting stuck with spoiling produce.

Furthermore, they do not have an awareness of proper nutrition practice, the importance of food security and the value of food preservation as the impacts of climate change take effect across the globe. Ugandan farmers depend on the agricultural calendar, characterized by two main rain seasons, to grow their food. With current changes in the climate and unpredictability of the rainfall patterns (i.e., the onset, duration, volume and end of rain seasons), the rainy seasons

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are getting shorter and dry seasons longer, or the rains are becoming heavier and the dry seasons harsher, which, in turn, means reduced production levels and smaller harvest.

Also, with the current global life style of fast foods and junk foods and other such related food trends and patterns of diets today, there is an increase in the number of cases of non-communicable diseases, such as heart diseases, obesity and diabetes in developing countries across the globe. There is a concern that low income and developing countries are increasingly consuming foods with high sugar and fat content, thereby creating a shift from the common health problems like malnutrition to more non communicable diseases like obesity through the consumption of cheaper western foods and drinks.

Finally, the greenhouse gas emissions produced from growing, processing, packaging and transportation of food from imported into developing countries for relief aid or otherwise is contributing to the increasing global carbon footprint of food. By preserving food and distributing locally, we can reduce the carbon footprint from imported food stuffs from around the world.

Today, Uganda is still facing high food shortages and severe malnutrition rates, with food insecurity being the primary cause. This is exacerbated by the fact that many households and small farming communities do not have the knowledge about food preservation techniques or ability to preserve the food that they do have. Outside of the traditional solar drying, which is commonly used to sun dry cereals, coffee, tea and other foods, rural farmers do not know techniques for preserving much needed fruits, vegetables and herbs that are crucial for a healthy balanced diet.

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To help reduce the amount of food loss and waste there is a need to strengthen the food supply chain through;

- The government should support the development of training programs on food preservation especially for rural farming communities
- Supporting farmers with access to the export market for locally preserved and manufacture produce.
- Investments in infrastructure and transportation networks,
- Expansion of the food –and packaging industry could help small scale farmers earn an income.
- Nutrition Education programs to be included on the local education programs and curriculums so that children grow up knowing the importance of nutrition and the nutritious value of food.

Advantages of Canning Pickling and Fermenting

These techniques come with several advantages that would vouch for the feasibility of applying these techniques in the Ugandan context. For starters, these three simple techniques do not need electricity or refrigeration but require simple basic things. They all require a pan of boiling water for sterilization and for boiling the canned food in the canning process. They also require glass or plastic jars and lids depending on the method you are using or what you have available. Canning, pickling and fermenting as techniques for food preservation had numerous advantages or benefits. They help to protect food from pest and bacterial that could make it go bad and keeps the food fresh for up to a year or even longer.

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Food preservation using canning, pickling and fermenting can contribute immensely to the household's diet in that seasonally available fruits, vegetables and herbs can now be saved and available for consumption throughout the year. This helps with diversification of the household diet and contributes to improvement of nutrition which in turn helps improve the overall health of the household.

Additionally, there are many foods that lend themselves to basic canning, pickling and fermenting principles and use few readily available ingredients like salt, lemon juice, sugar, and spices. Most importantly, canning jars are re-cyclable. The glass jars used for these processes can be easily washed, sterilized with boiling water and reused.

Also families can preserve their surplus produce and sale it for income or barter it for other essential foods and services for the household. Households especially women can in turn have an additional source of revenue to supplement their income from farming.

Despite focused efforts on improving access to and availability of nutritious food, food security and malnutrition remain global concerns, particularly in poor, rural countries dependent on agriculture, such as Uganda. While gains have been made, especially since the shift away from national programs aimed at increased production toward local projects which focus their efforts on addressing the real root causes of food insecurity, there is much room for improvement. By targeting existing gaps in the efforts to decrease food insecurity and thereby positively affect the poverty levels of rural communities, existing interventions would be enhanced and new gains would be made toward improving the livelihoods of all people if these key techniques are introduced.

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I believe that food preservation is a sustainable food security practice that can help prolong the shelf life of food while adding value and maintaining nutritional value of various fruits, vegetables and herbs that are crucial to a healthy diet.

Recommendations

After thoroughly reviewing the literature from several sources including international development organizations, aid organizations, non-profit organizations and Uganda's various ministries' reports, articles, research and studies conducted on Uganda around the key issues of food security, household food security, malnutrition and food preservation, the following recommendations can be made:

- The World Bank and the WHO's statistics have proven the need for continuous health interventions in Uganda. Malnutrition, specifically, is a rising concern that has not been addressed as frequently in relation to HIV/AIDS. Nutrition can be used as a prevention and treatment tool for illnesses in sustainable development work.
- Education strategies to improve the understanding of nutrition, food security, and its link to preventing HIV are necessary. If people, women in particular, have access to food for their families, they have no reason to engage in risky sexual behavior to acquire money to buy food. Organizations should focus on food security as a gateway to better nutrition and sexual health related practices.
- A lack of focus on the importance of nutrition and food security in HIV outreach is evident. Food aid should only be provided in dire situations. Organizations should increase food security initiatives and work to incorporate micro-finance projects and

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small scale operations to allow communities to produce and preserve their own food. This approach could also target HIV prevention and lead to poverty alleviation.

- The length of programs targeting health concerns in Uganda is of concern. As previously discussed, there are many short-term programs being implemented. Long-term programs with a comprehensive monitoring and evaluating element are necessary to achieve the desired goals. Also, local agencies and community leaders should be sought out and included in outreach efforts to ensure sustainable results.
- A program focused specifically on the prevention of spoilage and the preservation of vegetables could go far toward filling the existing gaps in the efforts to diminish food insecurity and malnutrition. Programs should be developed to address both the nutrient depletion and contamination of stored food at a local level, in order to increase the food security of communities and therefore improve their overall health, especially the health of young children.
- While the issues regarding food security and the factors that feed into it are complex and often seem intractable, this could be a very simple way to improve the livelihoods and affect the poverty levels of rural families, thereby helping to break the “vicious cycle” mentioned above. Such a program should absolutely involve women as major stakeholders and take their voices and opinions into consideration while developing the project. Some existing initiatives, particularly those focused on improving technology and farming practices, address food security on a community level but do not appear to include women as an integral part of program development: this is a mistake.

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- Women are generally the primary caretakers in families, responsible for raising children and, thereby, the most directly involved in ensuring their young children receive the necessary nutrients to stay healthy. With healthier children, the deleterious effects of malnutrition on education levels, medical expenses, and overall poverty levels are reduced. By involving women not only as stakeholders or passive recipients but as active participants in the development process and execution, a program gains not only a greater degree of legitimacy and efficacy on the ground but also a greater long-term sustainability.

7. CONCLUSION

My intention for pursuing this research was the hope that the results would gather transferable knowledge for development interventions in Sub-Saharan Africa to move away from direct service delivery and focus on capacity building and equipping rural farming communities and households with direct skills like food preservation techniques that they can apply. By putting the power of change directly in the hands of the people and getting them away from dependence on aid and handouts, we can all be agents of change for the fight to end world hunger and poverty. I hope that the results will allow agents to determine the efficacy of food preservation interventions in relation to food security, nutrition and health issues and hopefully lead to healthier communities.

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