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Improving Child Malnutrition Through Family Nutrition: Promoting Locally Grown Food and Breastfeeding in Buguruka Village, Tanzania.

Annapryssma Anatory Safari

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IMPROVING CHILD MALNUTRITION THROUGH FAMILY NUTRITION: PROMOTING LOCALLY GROWN FOOD AND BREASTFEEDING IN BUGURUKA VILLAGE, TANZANIA

Annapryssma Anatory Safari

BS, Cedar Crest College, 2000

A Thesis

Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Public Health

at the University of Connecticut

2005
APPROVAL PAGE

Masters of Public Health Thesis

IMPROVING CHILD MALNUTRITION THROUGH FAMILY NUTRITION: PROMOTING LOCALLY GROWN FOOD AND BREASTFEEDING IN BUGURUKA VILLAGE, TANZANIA

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2005
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Thanks to my advisory committee, professors; Judy Lewis, Rafael Perez-Escamilla and Joseph Burleson for guiding me through this work.

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I could not have performed all the statistical analysis to the level that I did without Dr. Burleson’s help, and therefore I am very thankful for all his time and excellent explanations that made me understand why and how to compute many statistical tests.
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Last but not least I would like to thank the Buguruka community at large for welcoming me and my colleagues to their lives and for working with us from the beginning to the end of the project. Many thanks to BOCED, Buguruka village leaders, especially to the head of the village, Mr. Ndamwesiga Karoma for coordinating activities with other leaders and local people. Other intervention helpers; Mr. George Ngaiza, Bashir Rwebugisa, and Focus Kisalu, were very enthusiastic, and dependable.
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Introduction

While there have been many programs to improve child nutrition in developing countries, there is still a great need for strategies to develop locally effective interventions. The goal of this project was to improve infant nutrition in a rural Tanzanian community. To do so, the project was designed to provide hands-on health educational intervention to promote exclusive breastfeeding up to six months of age, followed by the introduction of high quality complementary foods. It incorporated locally grown fruits, vegetables and other foods to educate people about improving child and family nutrition.

This thesis begins with a more extensive discussion of malnutrition and a review of efforts to improve community and child nutrition. It then discusses the locale of the project, a rural area in Northeastern Tanzania, giving the background of this area, and nutritional assessments. The process of intervention development and implementation is presented, followed by an evaluation of the project outcomes. It concludes with a discussion of difficulties encountered, limitations and recommendations for future projects.

Malnutrition is a condition that results from lack of, or too many nutrients and it affects all age groups. This thesis focuses on the problem of malnutrition caused by lack of nutrients (under nutrition). Illnesses such as diarrhea can cause malnutrition, but also the condition itself exacerbates infections: When nutrients are lacking the body cannot perform its functions well and the immune system becomes unable to prevent infections.
It is widely reported that under nutrition is implicated in more than half of child
deaths worldwide. And malnutrition does not need to be severe to pose a threat; in fact
more than 80 percent of malnutrition associated deaths in children are due to mild and
moderate malnutrition.\textsuperscript{1} Usually diseases such as pneumonia, diarrhea or measles are
blamed for cause of death in moderately malnourished children. Current findings support
that well nourished children are less likely to suffer from these illnesses, and when they
do, they are more likely to recover from them.\textsuperscript{1}

Malnutrition is the major cause of underweight, growth retardation, stunting, and
disease in the developing world.\textsuperscript{1} Growth retardation is associated with delayed mental
development, poor school performance, and significant functional impairment in adult
life. Early weaning, coupled with weaning foods of poor nutritional quality and density,
is correlated strongly with malnutrition throughout childhood.\textsuperscript{1}

Whereas childhood malnutrition has declined in the world as a whole over the
past two decades, rates have actually increased in Sub-Saharan Africa where nearly one
third of children under five remain underweight.\textsuperscript{1,2} Prevalence of stunting; low height
and weight-for-age ratio, has also increased in Eastern Africa over the past twenty years.
This trend is attributable to the region's extreme poverty, poor access to education and
health care, also due to the devastating effects of HIV/AIDS.\textsuperscript{1,2,3,4}

Malnutrition is a very complex issue, because it has many causes that are
embedded in social, economic and cultural structures; it has immediate and long-term
effects; and its consequences affect all members of the society either directly or
indirectly. To break malnutrition cycle one has to consider addressing the problem for all
age groups. When adults are nutritionally fit, they perform better at activities and are able to care for their children.

Women of reproductive age need to meet their nutrition requirements to avoid giving birth to underweight babies. It takes great effort to raise the weight of an underweight infant, especially in developing countries where infant care is limited. Many children who are born underweight in developing countries die at an early age. Malnourished children who manage to survive, if they continue to live under malnutrition conditions, they grow up to become unhealthy adults and are more likely to have children who are underweight or have birth defects thus the malnutrition cycle continues.

Improving the health and nutritional status of pregnant women improves birth outcomes. It has been proven that infant breastfeeding and gradual introduction of nutritious complementary foods will help children grow and stay healthy. These issues were incorporated in the educational intervention study.

The first and major intervention was conducted between June and August, 2002. A second intervention was administered from end May to mid June, 2003, while assessing long term nutrition knowledge retention. In order to ensure that the project suited local people’s needs, community members and leaders were involved in the planning and implementation stages. Topics covered by the intervention were exclusive breastfeeding for the first six months of age, appropriate introduction of complementary foods at six months, overall nutrition for children and women of reproductive age, pregnant women, also family nutrition. Participants’ nutrition knowledge was assessed before the intervention; to gain a better understand of how much nutrition knowledge participants had, right after the first intervention phase; to determine if there was any
change in participants’ nutrition knowledge, and at about 10 months after the first intervention phase ended; to assess nutrition knowledge retention.

**Definition of Malnutrition**

Malnutrition is a disorder that results from a consistent imbalance between the body's needs and the intake of nutrients, which can lead to syndromes of deficiency, dependency, toxicity, or obesity. Not getting enough nutrients or under nutrition and getting more than needed nutrients (over nutrition) are both classified as malnutrition. Malnutrition (under nutrition and over nutrition) develops in stages, which usually require considerable amount of time to result in symptoms, morbidity and mortality. The causes of under-nutrition are sometimes the results of malnutrition. Immediate causes/effects of under nutrition include not consuming enough food, not getting enough nutrients, abnormal absorption, abnormal systemic loss of nutrients due to diarrhea, hemorrhage, renal failure, excessive sweating, infection, drugs or a combination of these.

**Child Malnutrition from a Global Perspective**

Child malnutrition is currently defined by three measures. These measures were developed in the 1970s when nutritionists determined that the measure of weight for age was not sensitive enough. The current measures are wasting, stunting and the combination of stunting and wasting. Wasting refers to an acute malnutrition of a short duration. It results in low weight for age and low weight for height, but normal height for age. Stunting reflects past chronic malnutrition and is reflected by low weight for age and reduced height for age, but normal height for weight. Wasting and stunting reflects
both acute and chronic malnutrition and results in low weight for age, height for age and weight for height.¹ This study will most often refer to stunting, or low weight and height for age.

In developing countries as a whole the prevalence of stunting dropped from 47 percent in 1980 to 33 percent in 2000 (a total decrease of about 40 million cases). Most decreases were seen in South-East Asia where there was a decrease from 52.4 percent in 1983 to 32.8 in 2000, followed by South-Central Asia from 60.8 to 43.7 percent and South America 25.1 to 9.3 percent. By contrast, in East Africa the prevalence of stunting increased from 46.5 percent in 1980 to 48.1 percent in 2000. In 2005 the prevalence of stunting is expected to rise to 48.5 percent in East Africa.²³

Overall there has been a decrease in malnutrition worldwide since the 1970s, however more effort to fight malnutrition is still needed as more than 20% (over 780 million people) in developing countries are currently malnourished. Among this percentage, approximately 17 million are children under age five.¹ Of all malnourished children, 75% live in developing countries.² The situation has varied over time with improvements in some regions and increased malnutrition in others. For example in the past two decades there was a tremendous decline in child malnutrition in South Asia, although the area still has the highest number of cases (50 percent of all malnourished children live in South Asia). Sub Saharan African has the second highest prevalence of child malnutrition, but the incidence is higher than in South Asia. The larger numbers in South Asia are due to the larger population base. From 1970 to 1995 child malnutrition decreased from 72.3% to 49.3% in South Asia, while Sub Saharan Africa had the least decrease of all developing country regions; 35.0% to 31.1%.³ A low rate decrease in Sub
Saharan Africa is due to increasing population demands, natural disasters, war and HIV/AIDS. Between 1970 and 1980 Sub-Saharan Africa had a slightly high decrease in malnutrition prevalence (35.0 to 28.9%), but this trend did not continue into the 1990s and currently the prevalence is 30.0%. Most malnutrition cases in Sub-Saharan Africa are found in East Africa. Tanzania has the highest number of underweight and stunted children among the East African countries, 29.4% and 43.8% respectively. If the current trend does not change, by the year 2020, the prevalence of child malnutrition is predicted to increase or stay about same in Sub-Saharan Africa while most other regions are likely to experience decreased rates.

Table 1: Trend and projection of child malnutrition in developing countries (Smith and Haddad, 2000)

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent underweight</td>
<td></td>
<td></td>
<td>(percent)</td>
<td>status quo</td>
<td>Optimistic</td>
</tr>
<tr>
<td>South Asia</td>
<td>72.3</td>
<td>49.3</td>
<td>37.4</td>
<td>40.3</td>
<td>34.5</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>35.0</td>
<td>31.1</td>
<td>28.8</td>
<td>32.4</td>
<td>25.7</td>
</tr>
<tr>
<td>East Asia</td>
<td>39.5</td>
<td>22.9</td>
<td>12.8</td>
<td>13.1</td>
<td>12.6</td>
</tr>
<tr>
<td>Near East And north Africa</td>
<td>20.7</td>
<td>14.6</td>
<td>5.0</td>
<td>7.4</td>
<td>3.7</td>
</tr>
<tr>
<td>Latin America and the Caribbean</td>
<td>21.0</td>
<td>9.5</td>
<td>1.9</td>
<td>4.0</td>
<td>0.0</td>
</tr>
<tr>
<td>All developing countries</td>
<td>46.5</td>
<td>31.0</td>
<td>18.4</td>
<td>21.8</td>
<td>15.0</td>
</tr>
<tr>
<td>Number underweight</td>
<td></td>
<td></td>
<td>(millions)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Asia</td>
<td>92.2</td>
<td>86.0</td>
<td>66.0</td>
<td>71.1</td>
<td>60.9</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>18.5</td>
<td>31.4</td>
<td>48.7</td>
<td>54.6</td>
<td>43.3</td>
</tr>
<tr>
<td>East Asia</td>
<td>77.6</td>
<td>38.2</td>
<td>21.4</td>
<td>21.9</td>
<td>20.9</td>
</tr>
<tr>
<td>Near East And north Africa</td>
<td>5.9</td>
<td>6.3</td>
<td>3.2</td>
<td>4.8</td>
<td>2.4</td>
</tr>
<tr>
<td>Latin America and the Caribbean</td>
<td>9.5</td>
<td>5.2</td>
<td>1.1</td>
<td>2.3</td>
<td>0.0</td>
</tr>
<tr>
<td>All developing countries</td>
<td>203.8</td>
<td>167.1</td>
<td>140.3</td>
<td>154.6</td>
<td>127.6</td>
</tr>
</tbody>
</table>
Adult Malnutrition

Although malnutrition affects mostly children under five years old, there is also evidence that the other at-risk age groups are school children and women of reproductive age. Adults in developing countries live physically demanding lives and this often includes household food production. Usually people work long hours, while continuing to eat food of low quality, with the consequence that malnourished adults cannot perform well enough to provide for their families. In cultures where men are fed first and get the best foods, women and children have even poorer nutrition. For women of child bearing age, the situation worsens when they become pregnant. Anemia, short stature and hard physical labor put them at greater risk for complications of pregnancy and childbirth. Babies who do survive are often low birth weight, making their lives more vulnerable from the beginning. Studies have confirmed that if malnourished children survive childhood illnesses, many of them suffer from poor cognitive development and lower productivity. And in their adult life, their responsibility to assure good nutrition for their children becomes compromised, leading to a continuation of a vicious cycle. Older malnourished adults are also at risk because of the body mass loss due to aging which is often worsened by malnutrition. The association between infant and adult nutrition proofs that projects that attempt to reduce malnutrition should not focus on children alone.
Table 2: Malnutrition across the lifespan
Modified from http://www.mikeschoice.com/reports/malnutrition_worldwide.htm#spectrum

<table>
<thead>
<tr>
<th>Life Stage</th>
<th>Common Nutritional Disorders</th>
<th>Main Consequences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embryo/Fetus</td>
<td>IUGR*, IDD*, Folate deficiency</td>
<td>Low birth weight</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brain damage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Neural tube defect</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Still births</td>
</tr>
<tr>
<td>Neonate</td>
<td>Low birth weight, IDD*</td>
<td>Growth retardation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Developmental retardation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Brain damage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Early anemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continuing malnutrition</td>
</tr>
<tr>
<td>Infant and Young Child</td>
<td>PEM*, IDD*, VAD*, IDA*</td>
<td>Developmental retardation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased risk of infection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High risk of death</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blindness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anemia</td>
</tr>
<tr>
<td>Adolescent</td>
<td>PEM*, IDD*, IDA*, Folate deficiency, Calcium deficiency</td>
<td>Delayed growth spurt</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stunted height</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed/retarded intellectual development</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Goiter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased risk of infection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blindness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inadequate bone mineralization</td>
</tr>
<tr>
<td>Pregnant and Lactating Mothers</td>
<td>PEM*, IDD*, IDA*, VAD*, Folate deficiency, Calcium deficiency</td>
<td>Insufficient weight gain in pregnancy-IUGR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maternal anemia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maternal mortality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased risk of infection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Night blindness/blindness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low birth weight/high death rate for fetus</td>
</tr>
<tr>
<td>Adults</td>
<td>PEM*, IDA*</td>
<td>Thinness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lethargy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anemia</td>
</tr>
<tr>
<td>Elderly</td>
<td>PEM*, IDA*, Osteoporosis</td>
<td>Thinness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spine and hip fracture; Accidents</td>
</tr>
</tbody>
</table>

IUGR-Intra-uterine growth retardation
IDD-Iodine deficiency disorders
PEM-Protein-energy malnutrition
VAD-Vitamin A deficiency
IDA-Iron-deficiency anemia
Causes of Malnutrition (under nutrition)

Direct causes

Most known direct causes of malnutrition are eating too little food, not getting enough nutrients and illnesses. For infants, lack of exclusive breastfeeding during the first six months of life and early weaning with food of less nutritional value can cause malnutrition. In developing countries child malnutrition correlates strongly with early weaning mainly because weaning foods have poor nutritional quality and density.2

Recently the World Health Organization (WHO) supported the United Nations Children’s Fund (UNICEF) recommendation for introduction of complementary foods at six months, thus exclusive breastfeeding for the first six months. All over the world infants are being fed other foods too early, in some cases even during the first week of life.1 Some believe that giving breast milk alone is not enough, so they start feeding other foods “to get the baby full”. Current studies have confirmed that before six months an infant is not ready to process most foods including some in liquid forms. Unfortunately, feeding complementary food to an infant at a very young age, often leads to malabsorption and other malnutrition complications. And since hygiene is an issue in developing countries, infants usually get sick from contaminated foods. All these issues need to be addressed when conducting a child nutrition intervention.1,7,8

When the body does not get enough nutrients due to poor food quality, quantity, abnormal absorption or due to losing nutrients through diarrhea and other illnesses it becomes at risk for malnutrition. Yet malnutrition weakens the body making it vulnerable to more infections. Although in many parts of the world malnutrition is due to lack of food, in some other places nutritious food is available locally but children are fed
starches because people believe it fills them up faster.\textsuperscript{9} There are consequences of eating mainly starchy foods, especially for children who need protein and vitamins for healthy growth. These children suffer from protein-energy malnutrition (PEM) and lack of essential micronutrients such as Vitamin A, Iron, and Iodine.\textsuperscript{1}

Protein Energy Malnutrition (PEM) results from lack of protein and energy that causes body malfunction. About 20 percent of children who suffer from this condition develop kwashiorkor, marasmus or marasmic-kwashiorkor; the rest develop mild to moderate malnutrition symptoms.\textsuperscript{1} Since evidences show that among malnutrition related death in children, 80% are explained by mild and moderate rather than severe malnutrition this portion cannot be ignored.\textsuperscript{1,5,10}

**Marasmus**, the predominant form of PEM, affects children who usually consume too little food. Marasmic children lack protein and energy supplies; babies are not breast fed enough milk. In some cases marasmus in children is caused by losing nutrients through diarrhea, usually from infections, poor hygiene, or inappropriate infant care. These children become very thin from loss of muscles and body fat. They look like an old person with loose skin. **Kwashiorkor** is a condition caused by lack of protein. In developing countries many children are affected during the weaning period when they get less or none breast milk while gruel of poor nutritional value is given. A child with kwashiorkor presents with a big belly, weak reddish hair, and edema. The condition is called **marasmic-kwashiorkor** when a child has both forms of PEM. Normally a marasmic-kwashiorkor child presents swellings in some parts of the body and overall has more body fat than that of a child with marasmus alone.\textsuperscript{9}
Adults can also present with symptoms of PEM. Adults with kwashiorkor have similar symptoms as children, plus a loss of mental concentration. In addition to swollen limbs, adult males might show swollen in scrotum. Marasmus in adults also presents similar symptoms to those in children. Sometimes marasmus in adults results from infection induced diarrhea, for example in HIV/AIDS when the patient does not eat much and infections causing diarrhea worsen the condition.1,5

The lack of essential micronutrients such as Vitamin A, Iron and Iodine is directly associated with malnutrition. Although a small amount of vitamins and minerals is enough to sustain normal nutrition requirements, studies have concluded that severe deficiencies exist.

*Vitamin A Deficiency.* Vitamin A is important for health, especially vision and prevention of infection. Vitamin A deficiency is the most common known cause of blindness in children in developing countries. Children lacking vitamin A are prone to infectious diseases such as measles and are more likely to die from these diseases.2,5 A rich source of vitamin A is red palm oil, which is available from local production in many developing countries. However, it is usually not consumed in large enough quantities to prevent vitamin A deficiency.1 Other sources of Vitamin A include egg yolk, dark green leafy vegetables, mangoes, tomatoes and papayas.

*Anemia.* Iron is required by the body to manufacture hemoglobin and to provide oxygen transport to the cells. Although intestinal worms (mainly hookworms), malaria and sickle cells disease also cause anemia, lack of iron in the diet is the major cause of anemia, especially in children and pregnant women. Also researchers have concluded that children who lack iron are more likely to have poor learning ability, behavioral
abnormalities, poor appetite and growth. Over 60 percent of women and children in developing countries are affected by anemia.\textsuperscript{1,4}

\textit{Iodine Deficiency.} Iodine is a critical element for the proper functioning of thyroid gland (a gland that regulates growth and metabolism). When there is not enough iodine the thyroid gland is overworked and goiter can develop. Another consequence of maternal iodine deficiency is the effect on developing fetuses, resulting in cretinism/mental retardation. In many parts of Latin America, Asia and Africa iodine deficiency is one of the major causes of children's failure to develop psychologically to their full potential. Iodine deficiency also causes complications during pregnancy, neurological development and other birth defects.\textsuperscript{1,2} Usually consuming a small amount of iodized salt or other common foods that contain iodine can prevent these conditions. Recently there has been a major global initiative to iodize all table salts.\textsuperscript{11}

\textbf{Indirect causes}

Environmental, cultural and social factors all contribute to malnutrition: Weaknesses in women's status, formal education, breastfeeding, nutrition education; child and mother care; availability, accessibility and quality of health care services; political systems and practices, political stability, emigration, food availability, income generation, and sanitation are contributing facators.\textsuperscript{1,2} It is widely known that when some of these factors are improved the rate of malnourished children decreases. For example, increase in women's education, food availability, and sanitation in South Asia since 1970, have been associated with a 23\% decrease in child malnutrition. East Asia has seen a decrease of 17\%, while Sub Saharan Africa has seen a limited decrease of close to 4\% (and most of this occurred between 1970 and 1980). Sub Saharan Africa region has
maintained a low rate for women education and status throughout the years.\textsuperscript{1,2,3} This combined with extreme poverty, the spread of HIV/AIDS, drought in some areas and lack of nutrition education have all contributed to increasing rates of malnutrition.

**Initiatives to Reduce Malnutrition**

International conferences, organizations and local agencies are putting emphasizes on dedicating more effort to fight malnutrition. At the World Summit for Children in 1990, leaders from more than 150 countries promised to give priority to children's rights, reducing micronutrient deficiencies and improving women and children's nutrition. In 1990, WHO and UNICEF held a conference in Florence that identified four focus areas to supporting breastfeeding. These were; high-level national coordination, changes in maternity services, establishing an International Code of marketing for breast milk substitutes and proposed legislation protecting the rights of working women. At the Ending Hidden Hunger Conference in 1991, world leaders pledged to reduce micronutrient malnutrition. In 1992, at the international conference on nutrition, leaders set goals for a global reduction in malnutrition. In 1996, the World Food Summit made a commitment to recognize that all have a right to adequate nutrition and freedom from hunger. In 1997, more than 190 countries accepted a proclamation of children's rights that includes the right for adequate nutritional care for children.\textsuperscript{12}

In June 2003 at the G8 summit (a summit for heads of eight major industrial countries), Save The Children organization requested that leaders commit more funds to the under funded UN food aid appeals. The organization also recommended that money for these projects be used to purchase local foods in countries being helped. The
approval of such a program would encourage more local food production which in turn would allow people to become self-dependent. In addition, the organization proposed that the rules for fair trade be applied in developing countries that are receiving agricultural products. The amount of contribution towards malnutrition from G8 countries has varied over the years, and as a result, by July 2004 they had not met Save the Children's request.13

Organizations have tried to live up to their promises by providing quality health services that include nutrition. In 1991, WHO and UNICEF established the Baby Friendly Hospital Initiative (BFHI). This program attempts to help women overcome barriers about breastfeeding and encourages mothers to breastfeed. In 1998 about 16,000 Health Service Facilities in 60 countries had met the requirements for BFHI endorsement.14

WHO, UNICEF and the International Council for the Control of Iodine Deficiency Disorders (ICCIDD) are working together to get all table salts iodized. In 2003 about 70 percent of all the salt worldwide was iodized; this includes 50 percent of the salt in developing countries.15 Other agencies including USAID and CIDA have joined with WHO and UNICEF to reduce Vitamin A deficiency. Children in many of the high risk countries receive vitamin A supplements through pills, fortified foods or appropriate diets.12,16 Although these projects are intended to control micronutrient deficiency worldwide, it is questionable whether they reach people in very remote areas who need them the most.15
Since the causes and effects of malnutrition are long range, organizations are looking for more holistic approaches to combat hunger. Beginning in the early 1990's World Vision, USAID, The World Bank, Freedom from Hunger and most other major international organizations increased support toward Micro Credit programs. These programs lend money to members of poor households, especially to women who want to start their own small business. Several studies reveal a correlation between income and malnutrition therefore by improving income malnutrition rates can be reduced. Most NGO sponsored Micro Credit programs offer nutrition education in addition to providing loans. Participants learn how to care for children, and earn income to assist with expenses.

International Organizations and Nutrition Interventions

In the early 1980's WHO and UNICEF, with support from the government of Italy, initiated projects to eradicate child malnutrition in Indonesia, Thailand, India and Tanzania in the Iringa region. Since then this approach has been adopted in other regions in Tanzania as well as other developing countries. In Tanzania, the Iringa region was selected because it was known for its high level of food production at the same time that it had high prevalence of child malnutrition.

The program in Iringa was very comprehensive, covering water and environmental sanitation, household food security and income-generating activities. The program maintained community participation, assessed nutrition status of the children through growth monitoring, analyzed patterns and likely causes of malnutrition and appropriate actions were taken. During the five years of the program in Iringa (1983-
1988), moderate malnutrition was reduced from 57 percent in 1983 to 37 percent in 1988. Severe malnutrition was reduced from six to two percent. Attendance at the health clinics rose from 25 to 80 percent. The child immunization rate increased from 38.6 percent in 1980 to 92.8 percent in 1988. The cost for this project was considered high at that time, approximately US $19 per child per year in an area of 2.1 million people. It is well documented that funds ended in 1988, but there is limited data documenting what happened after 1988. One limitation of the program that was reported, is that nothing was done to improve agricultural skills; an important area for sustainability. A nutrition evaluation in Tanzania 2002, studied what had happened in Iringa since 1988. It reported that projects that followed in the 1990’s were committed on emphasizing health care but did not give particular attention to nutrition. Another report mentioned that the malnutrition rate in Iringa has risen again.

The Hearth nutrition model is another project that has demonstrated effective results reducing malnutrition. In the early 1990’s the Hearth model was introduced in Haiti, Vietnam, and Bangladesh and it has been replicated in other countries, e.g., Guinea. This model evolved from the Mothercraft Centers which was the earlier community-based approach to alleviate child malnutrition in Haiti and other countries around the 1960’s. The Mothercraft Centers built temporary centers and used paid nutrition educators to educate mothers about nutrition for three months. The Hearth Model uses a local volunteer’s kitchen for two weeks so it is cost effective and able to reach many children. The protocol for the Hearth Model differs slightly from area to area. Usually malnourished children and caretakers gather at the kitchen of a local volunteer mother where children are given a supplementary meal prepared with local
calorie-dense foods once a day for two weeks. Caretakers are expected to continue feeding these meals to children after the two-week training. The program is supported by growth monitoring and counseling for mothers. Growth monitoring is intended to motivate mothers to continue good feeding behaviors because they are able to see improvements in a child’s growth. Findings in Haiti indicated that the short-term rehabilitation of malnourished children was highly motivating to mothers, but in the long term the program needed to focus on the prevention of malnutrition. A follow up study in Haiti found lower death rates in rehabilitated children than in similarly malnourished children who did not attend the program. In Vietnam the program improved weight gain among participating children by 0.36 Z-scores on average, and reduced 82 percent of severe malnutrition in this group. Data from Bangladesh showed that the program helped to lower malnutrition in the project area from 37.6 to 33.4 percent.\(^{23}\)

Projects that have worked to improve malnutrition at the community level try to use local resources and to involve key people so that the community owns the project.\(^{12}\) Although child nutrition used to be viewed as a woman’s issue, people have come to realize that the problem is more complex and that men need to be aware of their children’s nutritional needs. One USAID sponsored program; the Nutrition Communication Project (NCP) (1989-1995), attempted to involve men by including food production in the education package. NCP worked with Ministries of Health, the Helen Keller Foundation (HKI) in collaboration with UNICEF to address nutrition status of children and pregnant women in three West African countries; Burkina Faso, Mali and Niger. The program educated women on actions they could take to improve their children’s nutrition. Mothers were educated on appropriate diets for pregnant women
and children. The approach was educational counseling at health centers and through health educators as well as radio messages. Men were taught agricultural skills to improve food production. A survey evaluation showed that people gained knowledge of breastfeeding, appropriate diets for children, recommended fruits and vegetables for pregnant and nursing women and learned that it is important for fathers to participate in improving their children's diet.24,25,26

International organizations are increasingly collaborating with local governments and agencies in developing countries to combat malnutrition by tackling more than one cause. One current example is Save The Children organization, which has been working with the Ministry of Health in Uganda since 2002 to address both immediate and long-term nutrition needs of poor children. The collaboration focuses on providing non-formal primary education, adult education, hot meals at school, youth outreach projects, reproductive health/HIV education, immunizations, and advice to mothers on how to feed and care for babies. This program also trains poor farmers in food production and management.27 As this project is relatively new, currently there is no data available therefore we have yet to see the outcome of such interventions.

**Local Designed Nutrition Interventions**

The use of local resources is not only cost effective for the program, but local educators are also the best ambassadors. They can pass the message effectively to others in the community. The study described below evaluates the outcome of a nutritional education conducted by local trained women. Between 1989 and 1992 a cross-sectional study was conducted in South Africa to evaluate the efficacy of a nutritional education
intervention program undertaken by trained local women in the Northern Province. A baseline study was undertaken in 1989 asking questions about breastfeeding, infant feeding practices, use of non-breast milk, brown bread, legumes and nuts. Participants were also asked to answer if their older children took lunch boxes to school. Half of the participants received nutrition education from six trained local women. In 1992 the survey was repeated using the same questionnaire in both the control and the study groups. The study reported that the intervention group gained better outcomes than the control group but only findings from the study group were presented: Women who initiated breast-feeding on the day of birth improved from 60% to 90%, the frequency of breastfeeding infants at six months improved \( p<0.01 \), and the introduction of solid foods to infants on the first day decreased from 26.5% to 6.3%. It was also reported that the only areas that did not show significance differences between the study and the control groups were; use of milk (non-breast milk), brown bread, legumes, nuts and the use of school lunch boxes by older children.\textsuperscript{28}

Improving food production, hygiene and food intake can significantly reduce the prevalence of malnutrition. In 1994 a project aiming at decreasing incidence of PEM among children under the age of five was conducted in the Islamic Republic of Iran. The project was conducted through the primary health care system. The intervention gave instructions on infant feeding, provided deworming and environmental sanitation, and promoted the use of homegrown vegetables while reinforcing the growth monitoring program. After one year indicators were assessed. Results showed that mothers had become aware of nutrition and that the incidence of malnutrition had dropped from 6.5% to 1.8%.\textsuperscript{29}
Locally grown food can improve not only PEM but also micronutrient deficiency. An intervention to improve Vitamin A deficiency through inexpensive locally available sources of B-carotene was implemented in an orphanage in Delhi, India, in 1994. Subjects were children 7-12 years old who were randomly assigned to study and control groups. Dietary intakes of the groups were assessed and there were no significant differences in the groups before the intervention. Source of B-carotene; papayas, coriander, and mint, were offered daily to the study group for one month. At the end of the study, the experimental group had significantly higher serum vitamin A than the control group t=2.02, p<.05.

Locally grown foods are still the best option of solving malnutrition in remote areas as it is difficult for food aid to reach these places due to limited access. To improve women’s food knowledge in Kabarole district, Western Uganda, a nutrition education intervention was introduced in 2001. The intervention offered nutrition education sessions and cooking classes which taught participants to prepare locally available foods for their children. Three food groups; energy yielding food, body-building foods and body-protective foods were emphasized. Varieties of processed and non-processed foods that were available locally were discussed during the intervention. After the intervention, knowledge was assessed and the results revealed that women in the study group had gained food knowledge (p=.001), improved perceptions on what they believed were the appropriate foods for children (p=.005), and were more likely to select a variety of foods (p=.011) compared to women in the control group.
Lessons Learned From Previous Nutrition Interventions

The experience of the past two decades has resulted in recommendations for future projects. There are manuals and books to guide those conducting nutrition interventions. The following key points have been recommended by several projects. 1,7,8,12,32

1. Collaboration and partnership with others in the area such as political leaders, NGOs, health facilities, and other key people in the community.

2. Utilize existing community resources and organizational systems; this is cheaper and easier for people to adopt than starting everything new.

3. Involve the community in the planning stage so that local people can give input on what is important to them.

4. The community should contribute to the financial cost of the program, to guarantee that actions being taken are important to the community.

5. To motivate the community to solve their nutrition problems people need to know the prevalence and consequences of malnutrition as well as low cost solutions.

6. The complex causation of malnutrition requires the inclusion of other interventions such as food security, income generation, environmental hygiene and water supply to complement nutrition projects.

7. The program should be limited to a few critical components because it is not possible to address all causes of malnutrition.

8. To have an impact, nutrition programs should focus on feasible interventions that communities can manage themselves from the beginning. This avoids problems when funding ends or experts leave, and provides ownership to the community.
9. It is important to have specific objectives, for example, "to reduce malnutrition prevalence in children under age five by a certain percent", however strategies need to be flexible enough to adapt changes required to meet objectives.

10. It is important to maintain an ongoing evaluation of the project, discuss findings with key partners and make changes based on these findings.

The intervention presented in this thesis was based on the above recommendations. A collaboration was formed with key people and the community at large, who decided what would be a feasible intervention for Buguruka at that time. Based on community feedback, available funds and resources it was decided to use locally grown nutritious foods such as fish, beans, nuts, fruits and vegetables for the intervention. These are foods that people in Buguruka already have, so they will continue to be available. Unlike many projects in which food was provided to mothers, participants brought in their own food so that only foods that people were familiar with would be used. Participants learned to make nutritious complementary meals and family dishes by combining these food items. Although attempting to reduce malnutrition using locally grown food can be a slow process, it promises a long term impact, since the community can sustain it. The only new approach in the intervention was learning how to combine different food items to create nutritious weaning meals for children and to improve the content of family dishes.
Background Information on Study Area

National Context: Tanzania

Tanzania is located on the east coast of Africa. A part of Lake Victoria belongs to Tanzania on the north side where it borders Uganda and Kenya. To the west, it borders Burundi, Rwanda, The Democratic Republic of Congo (formally Zaire), and Zambia. Malawi and Mozambique are located to the south. On the east there is Indian Ocean where the Islands of Zanzibar are located (see map in Appendix 1). The union of Tanganyika and the islands of Zanzibar formed the United Republic of Tanzania in 1964. Tanganyika became independent from the British in 1961 and the Islands in 1963. Tanzania was a single party democratic country until 1995, when it became multiparty. Tanzania has a tropical climate but rainfall and seasons differ in parts of the country. In areas around Lake Victoria, rainfall is distributed throughout the year with a dry season between June and August. The southern part of Tanzania experiences two rain seasons and a long dry season from May to October.\textsuperscript{33,34,35}

The population of Tanzania is estimated at 36 million, with an increase of 2.7 per year and a per capita income of $270. Although Tanzania is a relatively stable country, this has not produced economic growth. In 1999 the United Nations Development Program (UNDP) ranked it in the lowest third of developing countries (140 out of 162). Nearly 20\% of the population lives on an income of less than $1 a day, and 60\% survive on less than $2 a day. Fifty-one percent of the population falls below the national poverty line. About 32\% of the population lives in urban areas and the urbanization rate is 6\% per year. The population is 49\% male, and 51\% female. The age distribution is 20.4\% age 4 and under, 28.7\% aged 5-14 years, 18.8\% aged 15-24, 26\% aged 25-60 and
6.1% over 60 years. Other characteristics are; average life expectancy 44 years, fertility rate 5.3, infant mortality rate 102/1000 per live births, and maternal mortality rate 530/100000.\textsuperscript{36,37}

Agriculture contributes about 80% of the economy and employs over 85% of the labor force. Coffee is a major cash crop contributing about 20% of all the country’s exports, followed by cotton at 18\%.\textsuperscript{36} Cashew nuts, tea, tobacco, spices, coconuts, banana, beans, mangoes and several other crops are also exported in smaller quantities. Farming is a major source of household food, especially in rural areas. Many varieties of food are grown throughout Tanzania, depending on the availability of rain and labor. These foods include maize, cassava, yams, beans and many different types of tropical fruits and vegetables.

The educational system in Tanzania is based on the British system. The system is structured into pre school; primary school (standard/grade 1-7); secondary school begins with grade 9-12, called forms one-four (there is no grade 8); and high school (grade 13-14 or forms five and six). In rural areas there is no age requirement for entering primary school, and therefore it is common to find both a 7 and a 13 year old in first grade. Currently pre-school is not required for entering primary school. Sometimes parents delay schooling for their children so that they can help out at home. In 1999, 40% of women and 31% of men in Tanzania had never been to school, however the proportion increased with age. Between ages 20-29 about 62% had completed primary school compared to 34% of 50-59 year olds and 17% of those aged 60 and older. Even though today, younger people are more likely to complete primary school, only 21% attended high school.\textsuperscript{37} Only pupils who pass the standard seven national exam are selected for a
few less expensive government schools. Students who do not pass (and these are many) can go to private schools, which are expensive by Tanzanian standards. In 2001, the government of Tanzania increased its education budget by 20% to support free primary education and to construct new buildings to accommodate the increased enrollment. Prior to this, pupils were charged a contribution for the education fund, which some parents argued that they could not afford. With the new education budget, students are no longer charged fee for the education fund, although the cost of uniforms and other fees can still be prohibitive.

**Nutritional Status in Tanzania**

Fourteen percent of children born in Tanzania are under weight. Stunting affects 44 percent of children under five, and 17 percent of these children are severely stunted. Rural children are more like to be stunted than urban (48 versus 26 percent).³⁷,³⁸ Children are not the only ones affected by malnutrition in Tanzania, teens and adults are as well. Most malnutrition studies concentrate on children but the few studies that have looked at adult and teens report that the problem is widespread. A report from a study conducted in 2000 in Morogoro region provides a summary of what was found that, 70% of adolescents were stunted and 50% were underweight. The report also mentioned that stunted height (<150 cm) in women was a major cause of complications at delivery as these mothers often required surgical interventions. Women of reproductive age in Tanzania had a mean height of 156 cm, 17% were shorter than 150 cm and nearly 3% were shorter than 145 cm.²¹
Although the duration of breastfeeding in Tanzania is longer (21 months average) compared to many countries around the world, the percentage of exclusive breastfeeding at six months is very low. WHO and UNICEF recommend exclusive breastfeeding for the first six months and to continue breastfeeding while giving complementary food up to 24 months and beyond. In Tanzania between birth and 1 month, about 60% of infants are breastfed exclusively, but then the rate falls dramatically. By 4 months it is 32%, and by 4-5 months only 15% of babies are breastfed exclusively. Only about 2% of children are breastfed exclusively for six months.\textsuperscript{37} Infants are given foods of low nutritional value such as starch and porridge (a gruel made of corn or cassava flour, sugar and sometimes milk is added; usually cow milk). People who can afford it might buy the flour that is already mixed with eggs, dried fish, beans and nuts. Although this mixture of complementary food is nutritious, at too young an age a child’s digestive system is not ready to take them. In combination with a lack of hygiene and child care, these foods diminish children’s health instead of helping to promote growth. It also must be noted that about 5% of all infants in Tanzania are not breastfed at all.\textsuperscript{37} For such children the only way to feed is using bottled milk, usually cow milk, and later most of them are fed a mixture of non nutritious porridge.

**Kagera Region**

Kagera is located on the Northwest part of Tanzania, bordering lake Victoria, Uganda, Rwanda and Burundi. The region is about 28,513 square kilometers with a population of 1,326,183 people.\textsuperscript{39} Kagera is divided into six districts; Bukoba Rural, Bukoba Urban, Biharamulo, Ngara, Muleba and Karagwe. Kihaya is the most common
spoken language in Kagera, although many people speak Kiswahili the national language, and a few people can speak English. Other common languages in Kagera are Shubi which is spoken in Biharamlo, Angaza spoken in Ngara, and Kiganda spoken by those near the Uganda border. On average there are five people per household in Kagera. Almost a quarter of the population is 18 years of age and younger, this is due to the low life expectancy of 44 and HIV/AIDS that has killed many people of reproductive age. In 2003 about 75% of all orphans in Kagera were due to HIV/AIDS, and 40% of all primary school children had lost both parents while 60% had lost at least one parent. Kagera represents 50% of all orphans in Tanzania. There is no data on the impact of HIV on school attendance, but in Kagera it is common to see older children caring for sick parents and younger siblings, which could cause school dropouts. In 1998 it was estimated that 48,000 school age children were not in school because they could not afford school fees.

Although the Kagera region has been known for favorable climate and fertile land for crop production, poverty and welfare data indicate that the region is among the poorest in Tanzania. Some problems in Kagera are lack of productivity due to the high mortality rate because of HIV/AIDS, settling refugees from neighboring countries at war, decreasing soil fertility, infections on banana plantations and other agricultural products, an increasing number of ground rats and monkeys that eat crops.

In 1995 more than 9% of babies born in Kagera were underweight due to malnutrition but the rate is likely to be higher now that poverty and HIV/AIDS are worsening. The continuing decline of Tanzania’s economy has an impact on the region’s productivity as well. In 1996 the mortality rate for children under five was 212/1000,
also 17.6% of children under five had symptoms of malnutrition. The Maternal Mortality Rate (MMR) in Kagera has remained around 242/10000 since the 1970s.

Bukoba Rural District

Bukoba Rural is the largest of the six districts of Kagera. It is located near Lake Victoria. The population was 343,956 in 1999 with the same growth rate as the rest of the country at 2.7 per year. In Bukoba Rural there are six divisions, 41 wards and 164 villages. The majority of the people are Hayas who speak Kihaya, a local language and Kiswahili, the official national language that is taught in school. Bukoba Rural has similar characteristics to other districts in Kagera, except that the impact of refugees is minimal compared to districts that border neighboring countries. There are two rain seasons in Bukoba with a dry season from June to August. Income generating activities are farming, fishing and small businesses with coffee, tea, banana and vanilla being the main cash crops. Bananas are the staple food for Hayas although other crops such as yams, cassava, sweet potatoes and most fruits and vegetables are available year around. Beans and maize are seasonal crops.

Bukoba Rural has 44 Maternal-Child Health (MCH) clinics, 53 dispensaries, five health centers and two hospitals which have a total of 190 beds. Kagera region as a whole has a total of 13 health centers and 11 hospitals. The government provides discounted health services for those who cannot afford private health care but the majority of the people do not utilize these services. Many people choose to seek health services after first going to local healers. Some of the reasons people have given for not using these services include not feeling connected or respected by healthcare providers. Based on the
experience of this study, some people cannot seek these services because of transportation problems. Others complain that even when centers are within their reach they cannot afford to pay the discounted rate or the associated costs (medicine, food, supplies, etc).

The way the health care system works in Kagera, people must go to dispensaries first, and the dispensary refers a patient to a health center that makes the referral to a hospital. Sometimes a dispensary can refer someone directly to a hospital if a case is very serious. Unless the health center or hospital is the closest health service facility, all patients for the government services are expected to seek care from a local dispensary first. Private health centers and hospitals accept all patients; people do not need to be referred to get care.

**Buguruka**

Buguruka is an area of about 40 square miles with an estimated population of 20,000 people, near Lake Victoria in Bukoba Rural district of Kagera region, Tanzania. Buguruka has four wards one of which is Buguruka. Other wards are Butahyaibega, Bulinda and Maruku. This project refers the whole area as Buguruka, because that is what a local NGO, Buguruka Orphan Community Economic Development (BOCED) had used. Preliminary work conducted through BOCED had also used the same name, therefore it was best to keep it for this project. Some areas in Buguruka are more accessible than others. It is a hilly village, where most people travel using foot pathways. There is one road from Bukoba city (about 20-30 kilometers from the village) that passes through the village. This is the main road, and is the only one for large motor transports,
as well as pedestrian and bicycle traffic. Most village shops, schools and the two village dispensaries are located along this road. People who live close to the road have more access to employment, health care services, shops and schools although there are a couple of small shops and schools in remote areas. Only one new clinic (sponsored by BOCED) is located in one of the most remote areas. It has been identified that, in Buguruka people who live close to the road have relatively higher social economic status.\textsuperscript{46}

Males comprise 49.9\% of the population and are more likely to be designated the head of the household than female. It is a young population, 75\% of the people are under 30 years of age, 21\% are under five, and only 17\% are over 40.\textsuperscript{46} Buguruka is a subsistence level agricultural community. The average annual family income is $50 with an average family size of 5 (ranging from 1 to 17 members).\textsuperscript{46} Farming is the primary source of both income and family food, supplemented by fishing and small business. Most adults have basic level of education. About 80\% of adults have primary school education but less than 5\% completed high school. Women are less likely to attend school, and are likely not to go beyond standard seven.\textsuperscript{46}

The majority of people who can speak and write Kiswahili have been to primary school. English is taught as one of the subjects in primary school and becomes a major language of instruction in secondary school. English is not broadly used. Buguruka is typical of other rural areas in Tanzania, in that infants are given porridge/gruel as a first complementary food. Powders of peanuts, dried fish, or eggs are sometimes used, when the family can afford them.
This area was selected for intervention due to a previous relationship that the University of Connecticut Health Center (UCHC) had formed with BOCED. The mission for BOCED is to improve conditions in Buguruka by creating jobs, providing education to women and children, and developing a health clinic. UCHC assisted BOCED in the collection of demographic information through a household census in 1999. Over the following years UCHC students and a faculty conducted researches on family planning, malaria, and breast feeding/weaning. A study on breastfeeding and weaning identified the problem of low levels of exclusive breastfeeding as well as malnutrition due to lack of child nutrition knowledge and lack of money to buy nutritious weaning food. In addition, the author is originally from this area of Tanzania and thus had the required language and cultural skills to conduct this educational intervention study.

**EDUCATIONAL INTERVENTION STUDY**

Previous studies in Buguruka suggested that some of the causes of child malnutrition were early introduction of weaning food, limited nutrition knowledge and lack of money to buy nutritious processed weaning food. Based on the literature on successful interventions, it was clear that local resources were critical to sustain any program, therefore this approach was utilized. Between June and August, 2002 the author conducted the educational intervention with help from the major advisor and two medical students from UCHC.
Goals and Objectives

The purpose was to investigate whether teaching about breastfeeding and using locally available foods to make nutritious children and family meals could improve parents and caregivers’ knowledge of nutrition. To do so the project aimed at developing and implementing an appropriate, sustainable and effective nutrition educational intervention. The outcome was evaluated based on parents’ and caregivers’ knowledge of breastfeeding and food groups. There were three evaluation points; right before the intervention (pre), right after conducting the intervention (post), and after about ten months (follow-up) to assess knowledge retention. A group of people who did not attend the intervention was compared with the intervention group, to see if there were nutrition knowledge differences and/or if the messages from the intervention spread to people who did not attend the intervention.

Although it is well documented that the health of infants for the first two years of life is a determinant of their health as adults, it was not a good idea to only focus on child nutrition in Buguruka. The community does not think about child nutrition separate from family nutrition. Children’s food is prepared at the same time and in the same way as adults, also they all eat the same foods. To accommodate community practices and perspectives, the intervention focus was changed from child nutrition to family nutrition, although it still incorporated all the planned information about child nutrition.

Family nutrition included a concentration on children two years old and younger, women of reproductive age especially pregnant women, and breastfeeding. Topics for breastfeeding included exclusive breastfeeding for six months, complementary feeding after 6 months, starting with nutritious liquid foods, and frequency of breastfeeding.
Other topics that were discussed are selection and preparation of meals for children, pregnant women and family, feeding children and hygiene.

All members of the households were invited to join the intervention for two reasons; in Buguruka family members, including extended relatives, assist parents with childcare, and the intervention addressed family nutrition which involved everyone in the community. Local residents decided the most convenient intervention site in their village. People were asked to bring in only food items that they had enough of at home, so they did not have to buy food to bring to the intervention. Cooking methods were similar to what people were used to at their homes, the only differences were food combinations and shorter cooking time for vegetables. The next section provides detailed information on the intervention design, methods and evaluation.

Methods

Intervention Design/Preparations

Planning for the intervention began in the US using data from previous research in Buguruka and technical consultation with UCONN nutrition professors. Letters were sent to leaders in Buguruka asking for their thoughts on the importance of a child nutrition intervention in the community and whether they would cooperate with the intervention team. They agreed that there was a need for child nutrition education and the community would be interested in such a topic. Leaders also offered to assist the team with whatever help was needed. Eight most remote areas with lowest income were identified and considered to be in greatest need for the intervention. Actual village selection occurred in consultation with community leaders after the team arrived in
Drafts of pre and post surveys were developed for adaptation and pilot
testing in the village. Informational cards on exclusive breastfeeding and introduction
of complementary foods were designed, and then modified based on feedback from the
people of Buguruka.

Preliminary Field Work

After the team arrived in Buguruka, final preparations began. This period was
one and a half weeks during which the team met with village leaders to discuss the
intervention plans, were introduced to community members and visited some parts of
Buguruka. During this period the team stayed in a local household selected by the
leaders.

The intervention had to be limited to a few areas so that it could be done within a
period of five weeks, but anyone who was willing to travel to selected areas was
welcomed to join. The head of the village and other leaders recommended four most
remote areas from the eight sub-villages with lowest income that the team had identified.
Based on the government structure, Buguruka are is divided in four wards. Leaders felt
that it was very important to make sure that each ward be represented in the intervention.
The selected sub-villages were Rwija from Maruku ward, Kiizi from Bulinda ward,
Bulambizi from Butahyaibega ward, and Lwazi from Buguruka ward. Leaders notified
community members about the program, most of this was done by going from one
household to another and by posting notice on trees along the pathways.
Three group interviews were arranged and conducted during the first one and a half week: two groups with parents of young children and one with elders, traditional healers, birth attendants, and village health educators. These interview groups also participated in free listing and pile sorting of food items which enhanced the team’s knowledge of local food preferences. Village leaders assisted finding a local artist who designed educational posters, and five helpers from the community were identified for the intervention. The cards and the surveys were modified, translated into Kiswahili and then back-translated to English to ensure accuracy.

Training and Maintaining Helpers

During the period of the intervention in summer 2002, the helpers were three boys and two girls. Two had completed form six and three completed form four, but all could speak and write English, Kiswahili and Kihaya. Despite their years of formal education, helpers needed a full training on breastfeeding and food groups. To make sure that they translated the information right, the team taught them everything that would be taught during the intervention. They practiced translating with supervision from the author before the actual teaching. Two primary translators and two back up translators were selected. The fifth person left for school after finishing the first intervention area, so four helpers assisted with the final three areas. When not translating, the helpers set up cooking stations, assisted with preparations and other duties as needed. Helpers were paid $10.00 a week, the villages provided housing and food, and the intervention supplemented for food and paid for transport.
At ten month follow-up in spring of 2003, two new helpers were identified by the author as previous ones had left for school. These two girls were given educational material from the intervention to read and this was followed by a brief discussion. This time the selection and training was not as intense since the focus was mainly on evaluating knowledge retention within the intervention group, and assessing nutrition knowledge of the comparison group; women from areas that did not get the intervention. The author conducted all the educational sessions and the helpers assisted with survey distribution, completion and collection. They worked for two weeks and were paid $15 each, in addition to transportation and food.

All helpers were told to report any problems they encountered to the team, including explaining questions on the surveys. A good working relationship was formed between helpers and the core team. The money helpers earned was more than an average salary in Buguruka and none of them had a job prior to the intervention.

Enrollment in the Educational Intervention Study

The first and major intervention during summer 2003, took five days in each of the chosen areas, but during the follow up period in summer 2004, review sessions were conducted in one day for each participating area. Participation in the intervention and study was optional. People who chose not to participate in the survey(s) could still attend the intervention education sessions. Although the intervention was intended for people in most remote areas, all residents of Buguruka were invited to participate in the education sessions. Since village leaders posted signs around the village, others outside the designated area got the information. Leaders also made announcements at village
meetings. However, only people who lived within the intervention area came. This could have been due to the fact that most of these sub-villages were isolated by hills from the rest of Buguruka, therefore not easy to get to. There was no age or parenting role limitation for participation because in Buguruka people take care of each other's children. Another reason for not limiting participation was that the topic of family nutrition involves everyone.

Before participating in the study evaluations, an informed consent for both study and comparison groups was obtained by reading the consent statement to the participants, allowing time for the group to ask questions, and then asking each individual if they agreed to participate. People who could not read or write but wanted to participate were assisted. Intervention helpers read the questions for them and marked their response for each question. The majority could read and write Kiswahili, those who could not read and write were mainly older people, and most of these either had poor vision or did not go to school. Combining the intervention and the comparison groups there were about ten young women who were non-literate and most of them reported that they had been in school. All men who took the survey could read and write.

**Modifications to the Intervention**

Based on the focus groups, input from community leaders and educator observations, it became clear that child nutrition could not be taught separate from family nutrition. Nutrition was a problem for almost everyone in the community. In addition, families do not prepare food for children separately and it would be unrealistic to talk about child nutrition out of the context of family food preparation in Buguruka. The
focus of the intervention was changed to incorporate family nutrition with more attention to children two years and younger, and women of reproductive age especially pregnant and nursing women.

Initially the team had thought of teaching about child nutrition without incorporating cooking practices. Later when the community suggested that it would be helpful to practice what was taught, educators thought of buying food for the intervention. In the discussion groups, people who had attended previous nutrition education sessions stated that what they learned was hard to follow because of the following reasons: a) foods demonstrated/discussed were expensive so once the program ended participants could not afford them; b) foods were new to them, therefore once the program ended people returned to old practices; c) preparation methods were different from what people were used to, therefore it was hard for people to adopt them; d) education sessions were held at health service facilities and did not teach practical skills. Knowing that community interventions that have succeeded tried to empower participants and utilize local resources, the team responded to community requests. Instead of the program providing the food for demonstrations, participants brought in food that they grew and that they had enough of to be used for the intervention. On the second day of the intervention people signed up for food (type and amount), and supplies to bring the next day. The project supplemented this with foods that were lacking, for example beans because they were out of season. Prior to the cooking demonstrations, these food items were used as visual aids in the teaching sessions along with the posters. Because the curriculum was changed based on feedback from previous session(s), evaluation forms were modified to accommodate these changes.
Although lack of sanitation and hygiene is a major problem in Buguruka, the original plan had not incorporated these aspects in the intervention. Village leaders suggested setting up a separate teaching station to demonstrate using clean water for drinking, washing hands, cleaning fruits and vegetables and washing children's food containers.

Even though the teaching and evaluation tools had been adapted after arrival in Buguruka, more changes were necessary after the first intervention in Rwija. There were three stations for teaching (described in next section). In the first station people would learn about breastfeeding, the second was family nutrition, and the third was application of knowledge through games and exercise. After teaching in Rwija, the team noticed that people had a hard time understanding why certain weaning foods were important for children. It was decided that the family nutrition station should come first so that participants learn about food groups, then breastfeeding, followed by weaning foods, and the station for knowledge application stay at last, to create a logical flow of information.

Elements of the Intervention

Three major elements were used interchangeably for the intervention: 1) a colorful breastfeeding and weaning food card (Appendices 6 and 7); 2) posters with pictures of local foods divided in three groups; (body building foods/foods that are sources of protein, body protective foods/food that are sources of vitamin and energy yielding foods/food that are sources of carbohydrate and fat). There were supplemented by two additional posters to demonstrate food substitution, i.e., since meat was expensive one poster showed meat and had arrows pointing to substitute proteins such as beans and
small fish, the other poster depicted families eating balanced meals; and 3) local uncooked foods that participants brought in for learning purposes and for cooking demonstrations.

The card was colorful and eye-catching, as the goal was to get participants to like it and want to keep it. One side talked about exclusive breastfeeding and had a picture of an African origin woman breastfeeding an infant. The picture also showed the best way to position the baby during breastfeeding. The other side talked about introducing complementary foods and had a picture of another African origin woman feeding a child. Cards were designed to be attractive and sturdy (they were laminated so that they would stand up to harsh conditions), and so they could even be used as home decoration as well as a memory aid for participants. Graphics were selected pictures of happy and healthy women and babies of African origin so that participants could relate to them.

The information on the card was designed to be culturally appropriate and was reviewed for appropriateness by several people including a professor at the State University of New York, Stony Brook who is from Bukoba area. Words were translated into Kiswahili, then independently back-translated for accuracy by three natives. Messages directly addressed caretakers emphasizing the role they can play in keeping children healthy by following the guidelines on the card. The card was also used as a guide for teaching during the educational sections.

The posters elaborated on the themes of the intervention. Diagrams on the posters were large enough to be visible from a distance. A local artist designed the posters with foods and people that were colorful and familiar.
Local foods from participants' farms served as an important educational tool as it was instant for people to relate to their own crops. Since the team was not going to stay in the village for a long time, it was important to use resources that people could relate to and maintain when the educators left. In addition to involving the community in the planning of the intervention, the use of locally grown food also gave people control over the project. Besides fostering community ownership, the intervention also attempted to increase self-efficacy by showing participants that foods they already had could help prevent child malnutrition. The goal was not to create a completely new way of making meals, but to combine different food items already available for better nutritional value and to encourage more use of fruits and vegetables. People showed a lot of enthusiasm when learning that the food items they grew were valued and could provide good nutrition and keep their children healthy.

**Intervention Implementation**

**Setting**

The intervention was conducted in most remote and lowest income areas which local leader selected: Rwija, Kiizi, Bulambizi and Lwazi. In each area the villagers decided for the household where the team should stay and where they should set up temporary teaching stations. For most families cooking occurs in huts but these were too small, therefore cooking demonstrations had to take place in a yard near the house. Teaching sessions were held inside a house, under a temporary tent and/or under a shaded tree. Although the community was willing to provide room and board for the team, the
core team (the author and two medical students from the University of Connecticut) provided monetary support to all host families to assist with accommodations.

Activities

Participants in the intervention received education sessions from the team. Local helpers assisted with language translation for the two medical students, survey distribution and logistics. The intervention took a total of five days in each area, with day three being the major teaching day and day four providing practical food preparation and cooking demonstrations.

Intervention dates were proposed by the team and were confirmed by village leaders after agreeing with local residents. After arriving in each area, participants decided on the best time to meet, three areas (Rwija, Kiizi and Bulambizi) chose to start at 1pm and end at 4pm. Lwazi had chosen to meet in the morning 8-11am, but two deaths of one adult and one child, occurred on the evening of the second day. This necessitated stopping the sessions on the third day, and continuing teaching in the morning and afternoon on the fourth day.

Intervention Activities Summary

Day 1: Getting to know host families, area leaders, traditional healers and health educators, and conducting another focus group to compare local perspectives. Day 2: Introduce intervention, informed consent and pre-survey, initial overview of teaching and interactive questions, motivating people to come to the program, and finding out how the community would like to learn. This information was utilized to adapt teaching methods on days 3 and 4. Participants signed up to bring food and cooking materials. Day 3:
Teaching sessions at 3 stations: (a) General Family Nutrition and Hygiene, (b) Nutrition for Children, Pregnant and Nursing Women, Women of Reproductive Age and Hygiene again, (c) Application of Nutrition Information through exercise and games, sometimes included a cooking demonstration. Day 4: Review and emphasis of key points for children and family nutrition. Participants cooked, fed children, and sampled nutritious dishes. Post surveys were distributed. Participants were given the colorful designed cards with information on breastfeeding and weaning food to keep at home for reminding them what they learned. The team thanked people for participating and the intervention closed that evening. Day 5: Breakfast with the host family, thanked the host family; for appreciation, the core team gave clothes, writing pads, pens and pencils to the host family (these materials are valued in Buguruka). After farewells in late morning, the team left for a two days break, to prepare for next intervention site.

Activities for Major Teaching Day: Day Three

Station 1: GENERAL FAMILY NUTRITION. This station provided information about the nutritional components of different local foods and their contributions to functions of the body. Participants also learned how to make a nutritious meal for the family by combining different food items. Posters with pictures of locally grown food and actual uncooked food items that participants brought in were used for demonstration. Participants learned about the importance of combining foods rich in protein (body building foods), vitamins (body protective foods) with carbohydrates and fat (energy yielding foods) to create nutritious dishes for children and families. People were encouraged to use clean boiled water for drinking and for washing hands. A station
with clean boiled water was set up for demonstration and for all to use during the education sessions.

Station 2: NUTRITIONAL NEEDS OF CHILDREN, WOMEN OF REPRODUCTIVE AGE, PREGNANT AND NURSING WOMEN. This station reinforced the information from Station 1 including hygiene. People learned about the importance of exclusive breastfeeding for the first six months, starting complementary feeding at six months with nutritious fluids, and feeding mostly protein rich foods to infants while continuing to breastfeed. Recommended age to stop breastfeeding was two years but it was discussed that breast milk is always good for babies therefore those who were able to breastfeed longer than two years could do so. In addition people learned the importance of feeding beans, nuts, fruits and green leafy vegetables to children, pregnant women, nursing mothers and women of reproductive age. Since many people believed that it was not good to breastfeed when the mother or the child was sick, when the mother had been more than one day away from a child, or when the mother was pregnant with another child these beliefs were discussed in great detail. People gave their reasons for these beliefs, which usually concluded that if breastfeeding continued under these circumstances the babies would die. Women who had experience with breastfeeding after being more than a day away from an infant, when pregnant or when sick were called for testimony. Based on the experience of these community members as well as the education provided, participants became more amenable to changing their beliefs about breastfeeding.
Station 3: APPLICATION OF NUTRITION INFORMATION FROM STATIONS 1 AND 2. This station provided exercises to reinforce what was learned at previous stations. Participants were asked questions to test their knowledge of breastfeeding and meal preparations. Direct questions were asked about breastfeeding to see if participants understood the importance of exclusive breastfeeding for the first six months and that breastfeeding should continue to twenty four months. Group exercises had people combine available food items to demonstrate how to make a nutritious dish. People were asked to classify food by the group they belonged in (body building foods/foods that are sources of protein, body protective foods/food that are sources of vitamin and energy yielding foods/food that are sources of carbohydrate and fat). This station also discussed the disadvantages of drinking alcohol, local beers, and soda also showed people how to substitute these drinks with clean homemade fruit juice and clean boiled water which are beneficial to their health, and affordable. It was important to discuss this topic because people who participated in pile sorting argued that soda was more nutritious than water or locally made fruit juice. Men were seen drunk in the evenings which increased the necessity of explaining how alcohol can be a drain on the family income. When time allowed, cooking demonstrations followed Station 3, but most cooking practices took place on the following day (day four).

To better accommodate people and to save time, the first eight to ten people to arrive were called to Station 1, then to Stations 2 and 3. The group that arrived next followed the same flow. With teaching going on continuously, those who went through all 3 stations could join the cooking demonstrations or could choose to go back to either of the previous stations of their choice.
Intervention Second Phase/Follow up Assessment

To assess nutrition knowledge retention, the author returned to Buguruka at the end of May 2003 (about ten months after the first intervention phase ended). It was expected that the strongest effect of knowledge retention would be observed in women who attended the full course therefore, women who signed in all three days of the actual intervention were identified and invited for follow up. A new group of people from areas that did not get the intervention was added for a comparison group. Data was collected from people who had attended the intervention and from people who did not get the intervention (comparison group). This data was used to assess nutrition knowledge retention within the intervention group and to compare results with the comparison group.

After completing the surveys, both intervention and comparison participants were given a session reviewing important facts about breastfeeding, nutritious weaning food, and family nutrition. At the end of the follow up session, women were given a bar of soap each for washing or bathing as a way of thanking them for their participation. The follow up session took one day in each area.

Data Collection

Data was collected four times, as seen in Table 3 below. Pre data was collected before the intervention, post data; right after completing the first intervention phase, follow up and comparisons data was collected about ten months after the first intervention phase ended. Background information was not asked on the post survey because it had been assumed that the same people would complete pre and post surveys;
therefore only names and ages were asked for matching purposes. Since many people in 
Buguruka estimate their age, it was important to collect age on every survey so that the 
average age could be used. Copies of all four surveys are available in Appendices 
2,3,4,and 5.

### Table 3: Schedule for data collection

<table>
<thead>
<tr>
<th>Evaluation periods</th>
<th>Pre</th>
<th>Post</th>
<th>Follow up</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>July-August, 2002</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Pre-right before, Post=right after Intervention</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May- June, 2003</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>10 months after intervention</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pre intervention data was collected prior to conducting the intervention, and post intervention 
data was collected right after conducting the first phase of the intervention. Comparison and 
follow up data was collected 10 months after the first intervention phase ended.

The process started with a brief introduction of what was about to take place. This 
was followed by distributing the surveys among participants, then the consent statement 
was read out loud and explained. After reading the consent statement participants were 
given time to ask questions. People who did not want to take the survey were asked to 
stay quiet as not to distract those who were taking the survey. ID numbers were assigned 
for each person on the completed survey form. Names of each intervention area were 
placed on top of the completed forms. Completed surveys were sorted by participant and 
village names. New ID numbers were issued for people who joined the program later.
Data Analysis

SPSS (Statistical Package for the Social Sciences), Version 11.5 was used for data analysis. Statistical significance was set at confidence interval of 95% or p value equal to 0.05. Knowledge differences between the intervention and the comparison groups were measured by the Pearson chi-square statistic test ($\chi^2$). To measure the mean knowledge before and after the intervention a paired-t-test was used. An independent t-test measured the differences between the levels of the dependent measure as a function of the independent variables.

Since major changes were made in the survey after teaching in the first area (Rwija), many questions did not carry the same meaning. As a result, Rwija was not included in the pre and post intervention analysis. For the follow up analysis, eight people from the area that received the intervention were excluded because they had not attended the intervention and therefore had not taken pre or post surveys. These people were not eligible comparisons as they came from the intervention areas; adding them in the comparison group could have caused contamination and confounding. Four people from both the intervention and the comparison groups who gave mostly incomplete answers were as well excluded from the analysis.

Results

A total of 224 people (23 men and 201 women) from all four areas were recorded on the attendance sheet. Since signing in was optional, this total does not reflect the actual number of people who attended the intervention. Study results were only analyzed for women since very few men participated. Completing a survey was optional; there are
therefore less completed surveys than the actual number of participants. The total number of women participants who completed the surveys were: for the intervention group, 82 pre-session (excluding Rwija) and 71 post-session (excluding Rwija); for the follow-up group, 45; and, for the comparison group 42. There were fewer women at follow-up because invitations were sent only to women who attended all three days of the intervention.

Within the intervention and follow-up group women who completed surveys at two points of data collection were as follows; 35 women completed both pre and post surveys; 24 women completed pre and follow-up surveys; also post and follow-up surveys were completed by 24 women. There were 19 women who completed pre, post and follow-up surveys. The outcome measure was knowledge of breastfeeding and food groups. Knowledge outcomes were compared within the intervention groups (pre, post, follow-up) and for the comparison group. Relationships between socio-demographic factors and outcomes were analyzed.

**Demographic Characteristics**

Demographic characteristics of women in each group are shown in Table 4 below. The women are representative of the Buguruka community. Although the mean age, education and number of children is slightly different for each group, these differences were not statistically significant (Mann-Whitney U test).

Social economic status (SES) was calculated by combining responses for farm/shamba size and house type (floor and roof). Since most women reported no income and did not know the income of their husbands, the income variable was excluded.
For total study demographic information, the intervention and comparison groups were merged. This resulted in a total of 165 individuals: 79% were married, 9% were widowed, and 7% were divorced or separated. The mean age was 31 (range 15 - 70). Most of them were married to older husbands. The mean age for husbands was 37.7 (range 21-78). Age difference between husbands and wives (husband’s age minus wife’s age) ranged from -2 to 34 years (a negative age difference means the wife was older than the husband). Five percent of women participants had no children of their own, but were taking care of at least one child under the age of five. The average number of children was four (range 0-9). Note that the average age of women participant was 31, therefore the majority of these women were likely to have more children. Most (76%) had at least one child less than five years old, and 32% reported that one or more of their children had died before age five. Most (67%) had completed primary school (standard seven), 8% had less than standard seven education, 4% had greater than standard seven education, and 17% had no schooling. Farming was the primary source of income (82%); and 46% responded that their farms/shambas were small for their family’s farming needs. Most (84%) had dirt floor houses, 13% had cement floors, 42% had grass roofs, and 55% had tin roof.
Table 4. Participants’ Characteristics

<table>
<thead>
<tr>
<th>Mean, SD, and Range</th>
<th>Pre (n=82)</th>
<th>Post (n=71)</th>
<th>Follow up (n=45)</th>
<th>Control (n=42)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants’ Age</td>
<td>31.6</td>
<td>30.8</td>
<td>33.7</td>
<td>28.4</td>
</tr>
<tr>
<td>SD</td>
<td>12.8</td>
<td>13.0</td>
<td>12.8</td>
<td>8.5</td>
</tr>
<tr>
<td>Range</td>
<td>19 - 68</td>
<td>15 – 68</td>
<td>20 - 70</td>
<td>18 – 63</td>
</tr>
<tr>
<td>Husbands’ Age</td>
<td>38.3</td>
<td>-</td>
<td>41.6</td>
<td>33.2</td>
</tr>
<tr>
<td>SD</td>
<td>12.1</td>
<td>13.0</td>
<td>13.0</td>
<td>8.9</td>
</tr>
<tr>
<td>Range</td>
<td>21-76</td>
<td>-</td>
<td>23 - 78</td>
<td>24 – 54</td>
</tr>
<tr>
<td>Husband/Wife Age Discordance</td>
<td>7.5</td>
<td>-</td>
<td>7.1</td>
<td>5.3</td>
</tr>
<tr>
<td>SD</td>
<td>2.4</td>
<td>2.7</td>
<td>2.7</td>
<td>3.0</td>
</tr>
<tr>
<td>Range</td>
<td>-2* - 34</td>
<td>0 - 23</td>
<td>-1* – 14</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>5.7</td>
<td>-</td>
<td>6.2</td>
<td>5.6</td>
</tr>
<tr>
<td>SD</td>
<td>3.5</td>
<td>3.6</td>
<td>3.6</td>
<td>3.3</td>
</tr>
<tr>
<td>Range</td>
<td>0 - 16</td>
<td>0 -16</td>
<td>0 – 16</td>
<td></td>
</tr>
<tr>
<td>SES</td>
<td>4.5</td>
<td>-</td>
<td>4.6</td>
<td>4.7</td>
</tr>
<tr>
<td>SD</td>
<td>1.6</td>
<td>1.7</td>
<td>1.7</td>
<td>1.9</td>
</tr>
<tr>
<td>Range</td>
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<td>2 – 9</td>
</tr>
<tr>
<td># of Children</td>
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<td>-</td>
<td>4.0</td>
<td>3.0</td>
</tr>
<tr>
<td>SD</td>
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<td>2.2</td>
<td>2.1</td>
</tr>
<tr>
<td>Range</td>
<td>0 - 9</td>
<td>1 - 9</td>
<td>1 - 8</td>
<td></td>
</tr>
</tbody>
</table>

* A negative number in age discordance range indicates that, there were wives who were older than their husbands.

Breastfeeding and Food Knowledge Outcome

Although the surveys consisted of many questions (appendixes 2, 3, 4 and 5), due to constant adjustment of the intervention approach to meet the needs of the community, the evaluation tools had to be adjusted to meet these changes as well. This resulted in only a few questions that had the exact same wording in all four surveys. These were
three breastfeeding and six food questions. These questions are identified in the questionnaire forms, Appendixes 2, 3, 4 and 5.

Because the format of breastfeeding questions was different from that of food knowledge questions, analysis were conducted separately. Nutrition knowledge (breastfeeding and food knowledge) results are organized in four sections as follows: The first section presents the general nutrition knowledge scores. The second section compares nutrition knowledge findings before the intervention (pre) with nutrition knowledge findings right after the intervention (post). The third section compares nutrition knowledge of the comparison group to that of the intervention group at pre, post intervention, and at ten-month follow-up. The fourth section repots the mean nutrition knowledge of the follow up group in relation to the mean nutrition knowledge of pre and post intervention groups.

Section 1. General Nutrition Knowledge Outcome

Total Nutrition Knowledge

The Total Nutrition Knowledge Score was obtained by scoring the number of correct answers. Scores reveal that a after the intervention participants had higher breastfeeding knowledge than before the intervention. In Table 5.1 below, most of the participants had highest (3/3) breastfeeding knowledge score after the intervention (post = 59.6%, and follow up = 71.8%). Before the intervention, participants had none (0/3) or very little (1/3) breastfeeding knowledge scores.
Table 5.1. Total Breastfeeding Knowledge Scores by Intervention Group

<table>
<thead>
<tr>
<th>Total Score</th>
<th>Pre (n=82) %</th>
<th>Post (n=57) %</th>
<th>Follow up (n=39) %</th>
<th>Comparison (n=41) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0/3</td>
<td>63.4</td>
<td>3.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1/3</td>
<td>36.6</td>
<td>10.5</td>
<td>12.8</td>
<td>31.7</td>
</tr>
<tr>
<td>2/3</td>
<td>0</td>
<td>26.3</td>
<td>15.4</td>
<td>43.9</td>
</tr>
<tr>
<td>3/3</td>
<td>0</td>
<td>59.6</td>
<td>71.8</td>
<td>24.4</td>
</tr>
</tbody>
</table>

Table 5.2 below shows total food knowledge scores. Total food knowledge improved immediately after the intervention, with 39.4% of the participants identifying all the answers (6/6) correctly compared to before the intervention when only 14.3% of the participants identified all six correct answers. Unlike breastfeeding knowledge findings in table 5.1 above, food knowledge had diminished ten months after the intervention ended (follow up). Scores (tables 5.1 and 5.2) indicate that, comparison group participants were more knowledgeable about breastfeeding than food groups.
Table 5.2. Total Food Knowledge Scores by Intervention Group

<table>
<thead>
<tr>
<th>Total Score</th>
<th>Pre (n=77) %</th>
<th>Post (n=71) %</th>
<th>Follow up (n=42) %</th>
<th>Comparison (n=40) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0/6</td>
<td>7.8</td>
<td>0.0</td>
<td>4.8</td>
<td>2.5</td>
</tr>
<tr>
<td>1/6</td>
<td>13.0</td>
<td>4.2</td>
<td>4.8</td>
<td>5.0</td>
</tr>
<tr>
<td>2/6</td>
<td>10.4</td>
<td>5.6</td>
<td>16.7</td>
<td>15.0</td>
</tr>
<tr>
<td>3/6</td>
<td>19.5</td>
<td>19.7</td>
<td>19.0</td>
<td>17.5</td>
</tr>
<tr>
<td>4/6</td>
<td>15.6</td>
<td>12.7</td>
<td>26.2</td>
<td>37.5</td>
</tr>
<tr>
<td>5/6</td>
<td>19.5</td>
<td>18.3</td>
<td>14.3</td>
<td>20.0</td>
</tr>
<tr>
<td>6/6</td>
<td>14.3</td>
<td>39.4</td>
<td>14.3</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Section 2. Differences in Nutrition Knowledge Outcome, Before (Pre) and After (Post) the Intervention

Breastfeeding knowledge Outcome: Pre vs. Post

Statistical significance of the knowledge differences between pre- and post-intervention groups was determined by the Pearson chi-square statistic test ($\chi^2$). Results are summarized in Tables 6.1 and 6.2. Participants had lower breastfeeding knowledge before the intervention than immediately after (Table 6.1), and this was statistically significant. There was an increased knowledge of exclusive breastfeeding for the first six months ($\chi^2= 35.28, p<.001$); knowledge of breastfeeding when child is sick ($\chi^2= 115.33, p<.001$); and knowledge of breastfeeding when mother is sick ($\chi^2= 83.34, p<.001$).
Table 6.1: Differences in Breastfeeding Knowledge Outcome, Before and After the Intervention

Percent Correct by Knowledge Item

<table>
<thead>
<tr>
<th>BF Practice</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=82)</td>
<td>(n= 64)</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Exclusive breastfeeding</td>
<td>36.6***</td>
<td>85.7</td>
</tr>
<tr>
<td>Breastfeeding when infant is sick</td>
<td>0.0***</td>
<td>87.3</td>
</tr>
<tr>
<td>Breastfeeding when mother is sick</td>
<td>0.0***</td>
<td>70.3</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001

Food Group Knowledge Outcome: Pre vs. Post

As seen in Table 6.2 below, participants could identify food function better after the intervention, but the improvement was not strong comparing to breastfeeding knowledge findings. Food knowledge differences between pre and post surveys were statistically significant for all items except eggs. Although after the intervention, more people (70.4%) knew that eggs are a source of protein than before the intervention (58.4%), these findings were not statistically significant ($\chi^2 = 2.31$, $p=.089$). Statistically significant findings were knowledge of: beans as a source of protein ($\chi^2 = 3.51$, $p=.044$); greens and mangoes as sources of vitamins (greens $\chi^2 = 4.65$, $p=.023$; and mangoes $\chi^2 = 18.50$, $p<.001$); and rice and cassava as sources of carbohydrate ($\chi^2 = 5.77$, $p=.013$ and $\chi^2 = 8.77$, $p=.003$, respectively).
Table 6.2. Differences in Food Knowledge Outcome, Before and After the Intervention

Percent Correct by Food Item

<table>
<thead>
<tr>
<th>Knowledge Item for Food</th>
<th>Pre (n=77)</th>
<th>Post (n=71)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of Protein</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
<td>58.4%</td>
<td>70.4%</td>
</tr>
<tr>
<td>Beans</td>
<td>48.1*</td>
<td>63.4%</td>
</tr>
<tr>
<td>Knowledge of Protein</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greens</td>
<td>61.0*</td>
<td>77.5%</td>
</tr>
<tr>
<td>Mangoes</td>
<td>35.1*</td>
<td>70.4%</td>
</tr>
<tr>
<td>Knowledge of Carbohydrate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td>62.3*</td>
<td>80.3%</td>
</tr>
<tr>
<td>Cassava</td>
<td>72.7***</td>
<td>91.5%</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001

Differences in Mean Nutrition Knowledge Outcome, Before and After Intervention

A paired t-test was performed to see whether the means of the total nutrition knowledge were different before and after the intervention.

Mean Breastfeeding Knowledge Outcome; Pre vs. Post

Similar to the percent correct knowledge findings, the mean knowledge for breastfeeding was higher immediately after the intervention and it was statistically significant, t (31) = 14.5, p < .0001 (see Table 7.1 below). However, the individual level of breastfeeding knowledge at pre did not predict the level of breastfeeding knowledge at post since the correlation was not significant, r (32) = 0.01, p = .952.
Table 7.1. Mean Breastfeeding Knowledge Scores, Before and After Intervention

<table>
<thead>
<tr>
<th>Paired t-test</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n=32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0.3</td>
<td>2.6</td>
</tr>
<tr>
<td>SD</td>
<td>0.5</td>
<td>0.8</td>
</tr>
<tr>
<td>R</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>-14.5</td>
<td></td>
</tr>
<tr>
<td>Df</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>&lt;.0001</td>
<td></td>
</tr>
</tbody>
</table>

**Mean Food Knowledge Outcome: Pre vs. Post**

As seen in Table 7.2, the food knowledge mean was higher immediately after the intervention and this was statistically significant ($t=2.20$, $p=.034$). Similar to breastfeeding findings, food knowledge at pre and at post was not correlated ($p>0.05$, therefore the individual level of food knowledge before the intervention could not predict food knowledge outcome after the intervention.

Table 7.2. Mean Food Knowledge Scores, Before and After Intervention

<table>
<thead>
<tr>
<th>Paired t-test</th>
<th>Pre</th>
<th>Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n=35)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>3.5</td>
<td>4.5</td>
</tr>
<tr>
<td>SD</td>
<td>-2.0</td>
<td>1.6</td>
</tr>
<tr>
<td>R</td>
<td>-0.12</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>0.48</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>-2.2</td>
<td></td>
</tr>
<tr>
<td>Df</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>0.04</td>
<td></td>
</tr>
</tbody>
</table>
Section 3. Differences in Nutrition Knowledge Outcome for Intervention and non Intervention groups

Breastfeeding Knowledge: Pre, Post and Follow up vs. Comparisons

In Table 8.1a, the comparison group had more knowledge of breastfeeding when child and mother are sick than the pre-intervention group and both results were significant (p<0.05). Knowledge of exclusive breastfeeding was not significantly different between pre and comparison groups (p>0.05).

The post intervention group had more knowledge of exclusive breastfeeding than the comparison group, see Table 8.1b, ($\chi^2=17.58$, p.<.001). Knowledge of breastfeeding when mother is sick showed a trend for higher knowledge in the post intervention group ($\chi^2=3.0$, p=.08). Knowledge of breastfeeding when child is sick was not significantly different for post vs. comparison.

The follow up group also had more knowledge of exclusive breastfeeding than the comparison group and it was statistically significant ($\chi^2=13.22$, p.<.001), see table 8.1c. There was also higher knowledge of breastfeeding when mother is sick for the follow up group ($\chi^2=7.05$, p=.03). However knowledge of breastfeeding when child is sick was not statistically significant between comparison and follow up groups.
Table 8.1a. Differences in Breastfeeding Knowledge Outcome
Percent Correct Answers by Item and Intervention Status: Before Intervention and Comparison groups

<table>
<thead>
<tr>
<th>BF Practice</th>
<th>Pre (n=82)</th>
<th>Compariso n (n=41)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Exclusive breastfeeding</td>
<td>36.6</td>
<td>47.6</td>
</tr>
<tr>
<td>Breastfeeding when infant is sick</td>
<td>0.0***</td>
<td>90.2</td>
</tr>
<tr>
<td>Breastfeeding when mother is sick</td>
<td>0.0***</td>
<td>53.7</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001

Table 8.1b. Differences in Breastfeeding Knowledge Outcome
Percent Correct Answers by Item and Intervention Status: After Intervention and Comparison groups

<table>
<thead>
<tr>
<th>BF Practice</th>
<th>Post (n=64)</th>
<th>Comparison (n=41)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Exclusive breastfeeding</td>
<td>85.7**</td>
<td>47.6</td>
</tr>
<tr>
<td>Breastfeeding when infant is sick</td>
<td>87.3</td>
<td>90.2</td>
</tr>
<tr>
<td>Breastfeeding when mother is sick</td>
<td>70.3</td>
<td>53.7</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001
Table 8.1c. Differences in Breastfeeding Knowledge Outcome
Percent Correct Answers by Item and Intervention Status: Follow up and Comparison groups

<table>
<thead>
<tr>
<th>BF Practice</th>
<th>Follow up (n=41)</th>
<th>Comparison (n=41)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusive breastfeeding</td>
<td>85.4**</td>
<td>47.6</td>
</tr>
<tr>
<td>Breastfeeding when infant is sick</td>
<td>95.1</td>
<td>90.2</td>
</tr>
<tr>
<td>Breastfeeding when mother is sick</td>
<td>80.5*</td>
<td>53.7</td>
</tr>
</tbody>
</table>

*p <.05, **p < .01, ***p < .001

Food Knowledge: Pre, Post, Follow up vs. Comparisons

Tables 8.2a,b,c show the Relationship between food item knowledge and intervention status. Most of the knowledge differences between the pre and comparison groups were statistically significant, with two exceptions; knowledge of greens and cassava. Among the statistically significant findings, pre intervention group had more knowledge of mangoes and rice while the comparison group had more knowledge of eggs and beans (sources of protein).

There was a significant difference between the proportion of post and comparison participants who understood that rice and cassava are sources of carbohydrates (rice, $\chi^2=30.04$, p<.0001; cassava, $\chi^2=7.16$, p=.009) and that mangoes are a source of vitamins ($\chi^2=37.39$, p<.0001). The rest of the food items showed no significant differences in knowledge between post and comparison groups.
Follow-up participants (table 8.2c), had more knowledge of mangoes as a source of vitamins than that of the comparison group and this was statistically significant $(\chi^2=9.99, p<.01)$, but the comparison group had higher knowledge of eggs as a source of protein $(\chi^2=4.61, p=.032)$.

### Table 8.2a. Differences in Food Knowledge Outcome

Percent Correct by Food Item and Intervention Status: Before Intervention and Comparison groups

<table>
<thead>
<tr>
<th>Knowledge Item for Food</th>
<th>Pre (n=77) %</th>
<th>Comparison (n=40) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of Protein</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eggs</td>
<td>58.4**</td>
<td>85.0</td>
</tr>
<tr>
<td>Beans</td>
<td>48.1**</td>
<td>80.0</td>
</tr>
<tr>
<td>Knowledge of Vitamins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greens</td>
<td>61.0</td>
<td>77.5</td>
</tr>
<tr>
<td>Mangoes</td>
<td>35.1**</td>
<td>10.0</td>
</tr>
<tr>
<td>Knowledge of Carbohydrate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td>62.3*</td>
<td>27.5</td>
</tr>
<tr>
<td>Cassava</td>
<td>72.7</td>
<td>72.5</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001
Table 8.2b. Differences in Food Knowledge Outcome

Percent Correct by Food Item and Intervention Status: After Intervention and Comparison groups

<table>
<thead>
<tr>
<th>Knowledge Item for Food</th>
<th>Post (n=71)</th>
<th>Comparison (n=40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of Eggs</td>
<td>70.4%</td>
<td>85.0%</td>
</tr>
<tr>
<td>Knowledge of Protein Beans</td>
<td>63.4%</td>
<td>80.0%</td>
</tr>
<tr>
<td>Knowledge of Greens</td>
<td>77.5%</td>
<td>77.5%</td>
</tr>
<tr>
<td>Knowledge of Vitamins</td>
<td>70.4***</td>
<td>10.0%</td>
</tr>
<tr>
<td>Knowledge of Rice Carbohydrate</td>
<td>80.3***</td>
<td>27.5%</td>
</tr>
<tr>
<td>Knowledge of Cassava</td>
<td>91.5%</td>
<td>72.5%</td>
</tr>
</tbody>
</table>

*p <.05, **p < .01, ***p < .001

Table 8.2c. Differences in Food Knowledge Outcome

Percent Correct by Food Item and Intervention Status: Follow up and Comparison groups

<table>
<thead>
<tr>
<th>Knowledge Item for Food</th>
<th>Follow up (n=42)</th>
<th>Comparison (n=40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of Eggs</td>
<td>64.3*</td>
<td>85.0%</td>
</tr>
<tr>
<td>Knowledge of Protein Beans</td>
<td>73.8%</td>
<td>80.0%</td>
</tr>
<tr>
<td>Knowledge of Greens</td>
<td>71.4</td>
<td>77.5%</td>
</tr>
<tr>
<td>Knowledge of Vitamins</td>
<td>40.5*</td>
<td>10.0%</td>
</tr>
<tr>
<td>Knowledge of Rice Carbohydrate</td>
<td>38.1</td>
<td>27.5%</td>
</tr>
<tr>
<td>Knowledge of Cassava</td>
<td>69.0%</td>
<td>72.5%</td>
</tr>
</tbody>
</table>

*p <.05, **p < .01, ***p < .001
Section 4. Differences in Mean Nutrition Knowledge by Intervention Groups

Breastfeeding Knowledge at Pre and at Post vs. knowledge at ten months Follow up

Mean breastfeeding knowledge scores in tables 9.1a and 9.1b were calculated through a t-dependent test. There was more knowledge of breastfeeding at follow up than at pre and it was significant, \( t(22) = 14.42, p < .0001 \). However, there was no significant correlation between knowledge of breastfeeding for pre vs. follow-up, \( r(23) = 0.007, p = .975 \). This means that the level of breastfeeding knowledge before the intervention, did not predict the level of breastfeeding knowledge ten months after the intervention ended. Similar findings were observed for knowledge before the intervention (pre) versus knowledge right after the intervention (post) in section two.

The difference between the mean knowledge at post and at follow-up was not statistically significant \( t(19) = 0.25, p = 0.804 \), therefore breastfeeding knowledge was retained. In addition, there was a significant correlation between mean breastfeeding knowledge at post and at follow up, \( r(20) = 0.48, p = 0.03 \); indicating that the level of breastfeeding knowledge right after the intervention could predict knowledge outcome ten months later.

Table 9.1a. Differences in Means of Breastfeeding Knowledge by Intervention Status: Before Intervention and Follow up groups

<table>
<thead>
<tr>
<th>Paired t-test (n=23)</th>
<th>Pre</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.4</td>
<td>2.7</td>
</tr>
<tr>
<td>SD</td>
<td>-0.5</td>
<td>-0.6</td>
</tr>
<tr>
<td>R</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>0.97</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>-14.4</td>
<td></td>
</tr>
<tr>
<td>Df</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>&lt;.0001</td>
<td></td>
</tr>
</tbody>
</table>
Table 9.1b. Differences in Means of Breastfeeding Knowledge by Intervention Status: Right After Intervention and Follow up groups

<table>
<thead>
<tr>
<th>Paired t-test (n=20)</th>
<th>Post</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>SD</td>
<td>-0.5</td>
<td>-0.6</td>
</tr>
<tr>
<td>R</td>
<td>0.48</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>-0.2</td>
<td></td>
</tr>
<tr>
<td>Df</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>0.8</td>
<td></td>
</tr>
</tbody>
</table>

Food Knowledge at Pre and at Post vs. knowledge at ten months Follow up

The Mean food knowledge score for pre vs. follow up was not statistically significant (table 9.2a). There was higher food knowledge at post than at follow-up (t(23) = 2.51, p= .019), see Table 9.2b). These findings indicate that, while most participants retained breastfeeding knowledge, some people did not retain general food knowledge for ten months.

Table 9.2a. Differences in Means of Food Knowledge by Intervention Status: Before Intervention and Follow up groups

<table>
<thead>
<tr>
<th>Paired t-test (n=24)</th>
<th>Pre</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>3.2</td>
<td>3.3</td>
</tr>
<tr>
<td>SD</td>
<td>-2.0</td>
<td>1.9</td>
</tr>
<tr>
<td>R</td>
<td>0.31</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>-0.3</td>
<td></td>
</tr>
<tr>
<td>Df</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>0.79</td>
<td></td>
</tr>
</tbody>
</table>
Table 9.2b. Differences in Means of Food Knowledge by Intervention Status: After Intervention and Follow up groups

<table>
<thead>
<tr>
<th></th>
<th>Post</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>4.6</td>
<td>3.5</td>
</tr>
<tr>
<td>SD</td>
<td>-1.5</td>
<td>-1.7</td>
</tr>
<tr>
<td>R</td>
<td>0.19</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>0.36</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Df</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>0.02</td>
<td></td>
</tr>
</tbody>
</table>

**Association between Independent and Dependent Variables**

An independent t-test was performed to test the association between the independent and dependent measures. The dependent variables were knowledge of breastfeeding and knowledge of food groups while the independent variables were participants’ age, total number of years in formal education, number of children and social economic status. Results indicated no association, as the relationships were not strong or consistent.

**Association between Current Nutrition Knowledge and Previous Nutrition Education**

Before the intervention 31% of the participants reported that, they had attended other nutrition education sessions at the local dispensaries, therefore it was important to know if previous education had an impact on the outcome of the intervention. The chi-square ($\chi^2$) test results showed no significance; therefore previous nutrition education
had no influence on the intervention outcomes. Possible reasons for not getting a significant association are explained in the discussion section below.

Discussion

Previous studies in Buguruka identified lack of child nutrition knowledge as one of the cause of child malnutrition.\textsuperscript{46,47} Low knowledge resulted in the introduction of poor quality complementary foods such as cassava gruel to infants at an early age (as early as at one day of life). One study reported that most women stopped breastfeeding at two months of an infant life.\textsuperscript{47} Reasons for early cessation of breastfeeding included when the mother and/or child had an illness, when the mother had been away from the infant for more than a day, or when the mother became pregnant with another child (these last two reasons are based on the belief that mother's milk becomes poisonous to the infant in these circumstances).\textsuperscript{46,47} This project intended to improve child malnutrition by increasing parents’ and caregivers’ understand of child nutrition through an educational intervention that taught understandable facts and discussed inaccurate information. The intervention provided a welcoming environment for collaborative work with the community to identify teaching methods, content and priorities.

Other projects have documented that educating parents on how to use what they grow to make a nutritious diet can improve child malnutrition in farming communities.\textsuperscript{24,25,29,31} This project was the first of its kind in Buguruka: people who had attended other programs indicated that they liked the content and setting of this intervention better. The project outcomes were evaluated using pre, post, ten month
follow-up and comparison surveys that tested parents/caregivers’ nutrition knowledge (knowledge of breastfeeding and food groups).

The Effect of the Intervention on Breastfeeding Knowledge

Overall breastfeeding knowledge was highest right after the intervention and at ten month follow up, than prior to the intervention. Ten months after the first intervention ended, more participants knew that a mother should continue breastfeeding when she or her baby was sick than they knew immediately after the intervention. Since all people who participated ten months after the intervention (both in the follow-up and comparison groups) said that they had not attended any nutrition sessions in the preceding 10 months, the intervention may be credited for knowledge retention and dissemination. It is possible that people continued to discuss what was learned about breastfeeding and that is how they retained and shared knowledge. In Buguruka people visit each other often to socialize and since the majority of the people were trying to find out information on projects that BOCED was involved in, those who did not attend the intervention may have acquired some of the nutrition knowledge in this way. If this is the case, it could also explain why the comparison group which had not participated in the intervention had more knowledge 10 months after the intervention ended than the intervention group in the pre-survey. This concept of knowledge dissemination is possible because in the areas where breastfeeding knowledge was higher for the follow-up group it was also higher for the comparison group.
Another possible explanation for higher breastfeeding knowledge in the comparison group could be that people who were curious to find out what the intervention was all about, became interested in the topics and were more likely to respond to the invitation to participate in the 10 month discussion and survey.

**The Effect of the Intervention on Food Knowledge**

Total food knowledge was highest immediately following the intervention than prior to the intervention or 10 months later. The comparison group had more knowledge of sources of protein than the intervention groups; pre, post and follow up, but had inconsistent knowledge of sources of vitamins and carbohydrates. Knowledge of vitamins for the comparison group varied significantly, for example, many people (78.9%) knew that greens were a source of vitamins but did not know that mangoes were (10%). A majority of the comparison group knew that cassava was a source of carbohydrates, but only a few could identify rice (72.5% vs. 27.5%). The pattern for food knowledge was inconsistent. Overall the post-intervention group had more total food knowledge than other groups.

Similar to breastfeeding knowledge findings, areas where food knowledge retention was high for the follow-up group, knowledge was also high for the comparison group. These findings support the concept that the comparison group may have gained knowledge from interacting with people who attended the intervention.

Mangoes and rice had the lowest knowledge retention scores. Based on the information from the group interviews, people believed that mangoes cause malaria and therefore were not good for children. In addition, people did not classify mangoes as a
food item, rather identified them as non-foods with no nutritional value. Mangoes were commonly available in gardens/shambas and did not have monetary value. Mango trees were located in areas where there were long grasses, and many spoiled mangoes were usually lying around. These areas attract mosquitoes. It is possible that when children went to pick mangoes, they were bitten by mosquitoes and got sick. Probably this is why parents believed that mangoes gave their children malaria. This concept was discussed during the intervention but the malaria cycle was not covered in detail. People were told that as long as mangoes are washed with clean water they are a good source of vitamins. It is possible that people did not understand how malaria is spread, and therefore did not value the nutritional component of mangoes.

Rice was valued highly by many people. In addition to classifying rice as a source of carbohydrates, participants also tended to classify rice as a source of vitamins and protein. When asked for reasons, people said that rice is more expensive and has a good taste when seasoned and/or fried, and therefore it must have more nutrients. During teaching sessions, an effort was made to explain that rice has more carbohydrates than vitamins, and that unless it is combined with beans, it is not a good source of protein. Since rice is expensive, the intervention used other sources of carbohydrates that were locally grown such as cassava and yams for demonstrations. This may be the reason why at follow-up many people misclassified rice but not cassava, or it may be that the intervention was not effective at addressing the cultural beliefs about the value of rice.
Results from this study indicate that people were more likely to retain breastfeeding knowledge than food knowledge. This might due to the fact that breastfeeding information was based on simple concepts while food knowledge/classification required a greater understanding of nutrition and food groups. For example, prior to the intervention no women thought that a woman should continue breastfeeding when she or the child was sick, and it seems that the message about continuation of breastfeeding was accepted. However, classifying food items by their protein, vitamin and carbohydrate content required an understanding of these nutrition concepts and then applying them to specific foods. One reason the breastfeeding message was accepted faster could be the effectiveness of having local women who had breastfed their babies when they or their children were sick give testimonials. This way the participants could see that what was being taught had worked for people in the community. Participants liked these real life examples which did not exist for teaching food groups.

Association between Participants' Characteristics and Nutrition Knowledge

There were no consistent associations between sociodemographic characteristics and knowledge gained from the intervention. It is possible that these findings were due to the lack of sociodemographic variation since almost all participants came from poor families and had low levels of education. Almost all participants were from poor families and had low levels of education. This was one of the reasons these areas were chosen for the intervention in the first place.
Impact of Previous Nutrition Education on the Intervention Outcome

People who had attended previous child nutrition sessions did not show significant differences in knowledge at any evaluation point. One explanation for this might be that people forgot what they had been taught because the acquired knowledge was not reinforced. Another point to consider is that this intervention was different from the usual health education in the area because it provided an opportunity for people to practice what they learned. During interviews people who had attended previous breastfeeding and weaning food sessions reported that it was hard to use what they learned because they did not have money to buy the food that was recommended to feed their children and that they did not know how to prepare the food. This might have led to lower retention of information. Participants also reported that a health care provider had never told them to breastfeed exclusively for the first six months. The dispensaries recommend exclusive breastfeeding for three months. These comments were confirmed by talking to a medical assistant who was in charge of one of the village dispensary. This would make sense since the six months recommendation was relatively new, however the old recommendation was four to six months. It was not clear how the three months recommendation came about but the medical assistant insisted that three months was the new guideline.

Due to high incidence of HIV/AIDS in Kagera, exclusive breastfeeding for three to four months in HIV positive mothers would be advised, if people could manage to get appropriate substitutes for breast milk. But the studies that demonstrated this were not published at the time of the intervention. In consideration of the fact that most women in the village have not been tested, their HIV status is not known. In this context,
emphasizing three months exclusive breastfeeding is a concern, especially when infants
are more likely to die from eating other foods than from acquiring HIV from breast milk.

Conclusion

Overall this intervention was successful in improving caretakers' knowledge of
breastfeeding, weaning food and family nutrition. Knowledge of breastfeeding was
retained, and this information is very important for ensuring a healthy beginning for
children born in Buguruka. The fact that 10-months after the intervention ended, the
comparison group had more knowledge than the pre-intervention group, suggests that
community diffusion of information is an effective strategy for expanding and
maintaining health education. This seems particularly true when the information is
practical and locally based.

Findings indicated that, at ten months follow-up, general food knowledge gained
from the intervention had diminished but breastfeeding knowledge continued to improve.
Breastfeeding questions were easier to answer because they did not require an
understanding of food groups. It is hard to judge the retention of food knowledge because
of the greater complexity of the information, and the limitations in the evaluation tool.
During teaching sessions people practiced combining foods to make balanced weaning
and family meals, also most of them demonstrated that they understood what was being
taught. The survey evaluated only food group knowledge; there was no practical test for
people to demonstrate what they learned from the intervention. It became apparent that
surveys were an unfamiliar format for the adults in Buguruka because they have been out
of school for some time and are not used to reading. Based on these observations the
survey did not provide an adequate measure of knowledge or skills for good nutrition. This suggests that an evaluation tool that incorporated visual aids rather than only written words might have been more effective.

In Buguruka, some causes of malnutrition could be due to HIV/IDS, infections and other preventable illnesses.\textsuperscript{40,44} A demographic study from one section of Buguruka in 1999, found that 74\% of the population (2,571 total population) was between 0-29 years old, age 30-39 represented 10\%, while age 40-49 represented 5\%, and age 50-59 also represented 5\%.\textsuperscript{46} These findings may explain why most of the participants were between the ages of twenty and thirty while all residents were encouraged to join the intervention.

HIV/AIDS spread fast in this area of Tanzania and many people in Kagera have died. The loss of the middle and older adult population, who have the greatest knowledge of community traditions, including nutrition, may have contributed to the ongoing increase of malnutrition in Buguruka. A Lutheran nun from Germany who has lived and worked in Bukoba for more than thirty years pointed out that in the 1970s a variety of vegetables and legumes were part of the local diet, but that today eating village people consider eating vegetables low class. She thought because of the generation gap, this knowledge was not passed on and therefore today people pay more attention to foods that fill them up quickly such as yams and cassava. Many young people who are now mothers and fathers lost parents before they had a chance to learn how to care for children and or learn about nutrition. Most of them were left to take care of the younger ones and they struggled to find farm foods to satiate hunger. The nun thought that those surviving grandparents were old and too tired to teach village culture, including food
values, to grandchildren. This means that even those who grew up with grandparents might not have adopted old ways of preparing food. In addition to the generation gap, a reduction in young and productive adults results in a struggle to produce enough food for those who survive. The intervention did encourage people to grow more fruits and vegetables but its maintenance will depend on the availability of energetic people to invest in food production. Even with a reduction in production, there are still fruits and vegetables growing naturally that are wasted because people don’t pick or eat them. These foods could improve nutrition in Buguruka to a certain percent without additional production.

Many farming communities in developing countries suffer from malnutrition, which makes it critical for programs that attempt to improve health conditions to collaborate and combat the underlying causes of malnutrition and death. For instance a collaboration between programs that deal with HIV/AIDS and interventions that focus on reducing malnutrition, may enhance the success of each program by helping participants to see the connection for health related issues while minimizing expenses for each project.

This intervention proved that nutrition knowledge can be improved through demonstrating how to combine locally grown food to make nutritious meals for children and families. The best way to educate participants who are not used to reading is using visual aids such as food items that are grown locally and letting people practice how to combine these foods.
Since malnutrition problems have remained unchanged in Sub-Saharan Africa for the past two decades\textsuperscript{1,2,3}, it is necessary to adopt new ways of dealing with malnutrition. Locally grown foods are cost effective and yet familiar to participants. As this intervention proved that the use of local food can improve nutrition knowledge and practice, it is important to try this approach in other farming communities. Cultural and environmental factors require adaptation of teaching techniques to the local situation. Knowing the needs of the targeted audience and available resources are the keys for attempting to use locally grown food to improve malnutrition.

**Difficulties Encountered During the Intervention**

Although many children looked weak and malnourished, and village leaders thought that child nutrition education was needed, local people were comfortable with how children looked. Of course this was not a surprise, that is what they see everyday, they did not know any better. When people did not mention malnutrition as one of the problems affecting children's health, the team had to find a way to explain the problem to local people so that they could visualize it. In focus groups the team linked problems that people mentioned with malnutrition, this way people understood that by solving malnutrition they could reduce illnesses in children. The team had to refer to findings from previous studies to alert the community of malnutrition problems. It was important to get local views and to make sure that the community and the team agreed on the problem(s) and solution(s) before finalizing the topic.
As the idea of using and cooking locally grown foods developed after the team arrived in Buguruka, the team had to strategize how to improve local dishes during the time set aside for getting to know people and to conduct interviews (which was a week and a half).

Lack of electricity in the villages meant that all preparation was limited to daylight creating a lot of time pressure. All foods had to be prepared from scratch; getting food from the farm, selecting food items for cooking, washing, etc. With just one day (from when the food was brought in) to do all the cooking and teaching preparations, the time seemed too short.

On the other hand being involved in food collection and preparation gave the team a better understanding of the work that it involves to get the food ready in Buguruka. For instance the village woman, who has to work in the field, take care of the babies, fetch water, etc, has even a shorter time to prepare the meal. The team emphasized cooking more than one item in the same pot to save time, firewood and water. For example fish was steamed on top of the cooking cassava, yams or bananas, and later a layer of spinach or another vegetable was added on top. Cooking more than one item was not new to people in Buguruka, the team encouraged it while it demonstrated the best food combination and cooking vegetables for less time.

Each village area was different in unpredictable ways. For instance, Rwija and Bulambizi both had a very long hilly walks to get water. In Rwija community leaders had requested primary school pupils to fetch water for the intervention, while in Bulambizi there was no such plan, and therefore the team had to fetch water with the help
of participants. A lot of water was needed for washing hands, food, dishes, cooking, and for drinking (boiled water).

A few children refused to eat food that was new to them, so parents had to try different dishes to see what they would like best. When this happened the team had to think of new dishes or how to change the recipe and still maintain a healthy diet.

It was very hard to keep men motivated to attend the intervention, although malnutrition was addressed as a problem for everyone. Men who attended cooking sessions did not accept participating in cooking the food, they watched women cook. Culturally men in Buguruka are not supposed to cook, especially those who are married. The team, therefore, had to respect that. The team still encouraged men to be involved in their children and family diets by asking them to share what they learned with the person in charge of preparing food at home.

In Buguruka most people know the year when they were born but not their exact age or birth date. They also use whichever last name they choose. Most of the time married women use their husband’s first name as their last name and children use their father’s first name for their last name. This means for most families the husband will still be using his father’s first name as his last name but his children and wife are using his first name. However, women who are widowed, separated or divorced, can decide to either use their own given second name as their last name, their first son’s name (especially if they are widowed) or take back their father’s name. This meant that someone might have had a different last name ten months after the first intervention. Also, people were not consistent with spelling their names (including first name spelling), which required a lot of clarification to be able to match names on the attendance sheet.
with names on pre, post and follow up surveys in order to assign identification numbers for merging the data. For accuracy, personal names were matched with village name, participant’s age, education level, husband’s name, and number of children.

Limitations

● The samples were relatively small providing limited evidence of statistical significance, especially when using chi square test.

● The majority of the participants were between age 20 and 30 this meant that the influence of age and life experience could not be examined.

● Since the intervention group was expected to be its own control, using pre and post intervention data, the original plan had not included a comparison group. When the comparison group was added data could only be collected once; ten months after the first intervention ended, therefore their nutrition knowledge before the intervention is not known.

● The evaluation tool needed a practical section in which people could have demonstrated their ability to make nutritious dishes that they learned during the intervention.

● There is no way of knowing the exact impact of the intervention in improving child malnutrition since only parents’ knowledge was evaluated. It could have been best if children had been weighed and measured before the intervention and at ten months follow up to assess any changes.

● Even though only locally grown and available foods were used and people were given a nutritional card to keep as a reminder about infant feeding, it would have been helpful if there had been resources for providing long term reinforcement and monitoring.
Malnutrition is a very complicated issue because it is in a cycle where the causes are also the effects: for example; poverty, diseases, food security, lack of nutrition knowledge etc. There is no simple way of solving malnutrition unless all these aspects are addressed. This intervention was unable to address all these problems, but it did address some aspects of poverty and food security by educating about locally grown and available foods knowing that most people could not afford to buy food. Since the main goal was to give people the best education, the content of the intervention was updated throughout based on the feedback and evaluation of previous sessions. To reflect these changes, some questions were added or removed from the survey so that questions were relevant to what was taught. This resulted in inconsistency in the survey questions and only few common variables that could be analyzed.

**Factors that Contributed to the Success for the Intervention and Recommendations for Future Interventions/Studies**

1. Establish a relationship with the community and key people in advance.

2. Involve local people in both the planning and the implementation stages.

3. Try to follow implementation methods that are favored by community.

4. Try to stay flexible on the schedule and the curriculum, especially when important discoveries are made the curriculum might need to change.

5. Welcome ideas from everyone.

6. Used tools and materials that people can relate to.

7. Show respect, genuine concern, and welcome questions from people; that way all can be comfortable and give their true opinions.
8. Use local testimonials, for instance letting women from the community tell their success story about breastfeeding.

9. Living with host families in the study/intervention areas versus living at a nearby center or outside the village. Living with people gives educators the opportunity to observe local behaviors at the same time local people become comfortable with the team.

10. Set aside time for participants to practice what was taught.

Concluding Summary

Even with limited funds, it may be possible to improve parents/caretakers’ nutrition knowledge. In subsistence level farming communities, locally grown/available legumes, fruits and green leafy vegetables should be enforced for improving nutritional value of weaning food. Although it is not possible to address all aspects of malnutrition, it is important to discuss hygiene, breastfeeding, weaning food, family nutrition, and food security when teaching about child nutrition. Collaborating with local organizations and the community is the key to improving nutrition knowledge, while maintaining a low cost for the program. This intervention succeeded in increasing participants’ nutrition knowledge due to several key factors; partnering with the community, a local NGO, a university, nutrition experts and input from people who had experience in developing countries.
Appendix 1: Map of Tanzania
Appendix 2: Pre Intervention Survey

Section one:

Full name _______________________________ Age ______

2. Never married □ Married □ Divorced □ Separated □ Widowed □

3. Husband's full name ___________________________ Age ______

4. What Level of education did you complete? ________________

5. Select all areas where your family gets income
□ no specific income □ business □ home economics
□ farming □ relatives □ other _______________________

6. Are there times when your family does not get lunch or dinner because of not having food?
   Yes □ No □

7. What kind of floor does your house has?
□ dirt □ cement

8. What type of roof does your house has?
□ grass □ iron sheet □ tiles □ other _______________________

9. How big is your shamba (garden/farm)?
□ small □ average □ big

10. Were you forced by your parents or relatives to marry your current husband?
    Yes □ No □

11. How many children do you have? ______

12. Do you have a child who is under five years old? Yes □ No □

13. Please list the ages of your children. ________________________________

14. Have you ever been told by a medical doctor or a healthcare provider that your child has:
Kwashiorkor; Yes □ No □ Malnutrition; Yes □ No □
Worms; Yes □ No □ Is growing slowly; Yes □ No □

15. Did any child you took care of die before reaching five years of age?
   Yes □ No □
   If yes, What did the child die of? ________________________________
Section two:
How much money does your family use to buy food in one week? _____

Does your husband smoke? Yes ☐ No ☐ May be ☐

Does your husband drink alcohol? Yes ☐ No ☐ May be ☐

How much money does your family use to buy sugar in one week? _____

How much money does your family use to buy fish in one week? _______

How many hours or minutes does it take to get to the place where you buy food? _____

Please list the availability of the following food:

1 = it is very easy to get 
2 = it can be found 
3 = it is very expensive but can be found 
4 = it is expensive 
5 = it is very expensive

Small fish ______ Fish ______ Eggs ______
Beans ______ Millet ______ Ugali (corn or cassava flour meal) ______
Green leafy vegetables ______ Fruits ______
Carrots ______ Avocados ______ Bananas ______
Ground nuts ______ Peanut ______ Milk ______

Section three:
Have you ever attended education session(s) on breastfeeding?
Yes ☐ No ☐

If yes, please give the location where the session(s) was held ________________

For how long did you attend the session(s)? ________________________________

* Is it good to feed the baby breast milk alone for the first six months?
  Yes ☐ No ☐

When a woman gets pregnant while breast feeding she should stop breast feeding.
  Yes ☐ No ☐ Sometimes yes ☐ I am not sure ☐

* When a child who is breastfeeding gets sick, should the mother stop breastfeeding?
  Yes ☐ No ☐ Sometimes yes ☐ I am not sure ☐

* Do you think that if a women gets sick apart from breast diseases she should stop breastfeeding her baby?
  Yes ☐ No ☐ Sometimes yes ☐ I am not sure ☐

Have you ever attended teachings on child nutrition?
Yes ☐ No ☐

If yes, where was the session(s) held? ________________________________

For how long did you attend the session(s)? ________________________________
* Please mark foods that are source(s) of:

<table>
<thead>
<tr>
<th></th>
<th>Carbohydrate food (energy yielding foods)</th>
<th>Protein food (body building foods)</th>
<th>Vitamin food (body protective foods)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beans</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cassava</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mangoes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Can a child eat and be full but still suffer from malnutrition related illnesses?
Yes [ ] No [ ] May be [ ]

Please identify diseases that are caused by malnutrition:
- malaria [ ]
- kwashiorkor [ ]
- worms [ ]
- anemia [ ]
- weight lose [ ]

Please list the importance of the following food items in young children’s growth:

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Provides the least nutrients for children</th>
<th>Provides some nutrients for children</th>
<th>Provides the most nutrients for children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uji (porridge) made with fish flour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uji (porridge) made with fish flour and papaya</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uji (porridge) made with cassava or corn flour only</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Children will have good health and will not get sick often if they eat the foods that are appropriate to them. Yes [ ] No [ ] I am not sure [ ]

Who do you ask advice about breastfeed?
- Male relatives who are older than me [ ]
- Female relatives who are older than me [ ]
- Relatives who have more education [ ]
- Village health workers [ ]
  - Local healer or birth attendant [ ]
  - Other [ ]
  - I don’t ask questions about breastfeeding [ ]
Who do you ask questions about children nutrition?
Male relatives who are older than me □
Female relatives who are older than me □
Other relatives who are more educated □
Village health workers □
Local healer or birth attendant □
Others □
I don’t ask questions about nutrition □

**Section Four:**

In my family decisions about what crops to grow in our farm are made by:
My self alone □
My husband □
My husband and I □

In my family when needed to buy food decisions about what food to buy are made by:
My self alone □
My husband □
My husband and I □
My relatives □

In my family decisions about what food to feed the children are made by
My self alone □
My husband □
My husband and I □
My relatives □

**Section Five:**

Would you feed your baby breast milk alone for the first six months?
Yes □ No □ May be □
What do you think about the believe that says a pregnant women should not breast feed is
wrong □ correct □
Would you use money to buy nutritious foods that are good for the health of your
children?
Yes □ No □ May be □

Would you talk to your husband about buying foods that are good for your children’s
health?
Yes □ No □ May be □

Would you talk to your husband about the importance of growing more beans, nuts and
vegetables?
Yes □ No □ May be □

Would you add beans, peanuts, and vegetables in your family diet?
Yes □ No □ May be □

*Questions that have similar meanings in all four surveys, and were used for analysis*
Appendix 3: Post Intervention Survey

Full name ________________________________ Age ________

From what was taught what did you like the best?

From what was taught what didn’t you like?

Please provide your opinion on how these lessons can be improved?

Do you think the educators were knowledgeable?
Yes [ ] No [ ] I am not sure [ ]

Do you think you can improve your children’s health by providing them with good nutrition?
Yes [ ] No [ ] May be [ ]

Do you think the education that you got through this intervention will help you to best breastfeed your child?
Yes [ ] No [ ] May be [ ]

Which of the following symptoms are due to malnutrition?
Losing appetite [ ] a big round stomach [ ] weak hair [ ]
Body rash [ ] swollen legs [ ] growing slow [ ]

*Please mark foods that are sources of:

<table>
<thead>
<tr>
<th></th>
<th>provide energy (starchy food)</th>
<th>builds the body (protein food)</th>
<th>protects the body (fruits and vegetables)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice</td>
<td></td>
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<td>Beans</td>
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<tr>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Mangoes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Is tea good for a young child?
Yes □ No □ I am not sure □

Is sugar nutritious?
Yes □ No □ I am not sure □

Please circle a number that matches your response:
1 = I already know this 4 = I didn’t care
2 = I have heard of it but I was not sure 5 = I don’t agree at all
3 = I agree

*It is good to continue breastfeeding when the mother gets pregnant? 1 2 3 4 5

It is good for a mother to continue breastfeeding after being away from her child for more than one day. 1 2 3 4 5

*It is good to breastfeed exclusively for the first six months. 1 2 3 4 5

*It is good to continue breastfeeding when a child gets sick. 1 2 3 4 5

When a mother gets sick, she can still continue to breastfeed her baby. 1 2 3 4 5

From this list which food items grow easily in your shamba?
Beans □ Carrots □ Ground nuts □ Mchicha/green leafy vegetables □
Pineapples □ Cassava leaves □ Njugu mawe/ground beans □ Mangoes □
Papaya □ Pumpkin leaves □ Avocados □ Millet □ Pepper □

Are you ready to talk to your husband about increasing production of crops that provide protein and vitamins? Yes □ No □ May be □

Are you ready to grow more body building food? (e.g. beans and ground nuts) and body protective food (fruits and vegetables) in your shamba?
Yes □ No □ May be □

Are you ready to talk to your husband about buying food that will provide good nutrition to your children? Yes □ No □ May be □

Do you think your husband can reduce (smoking, drinking and buying sugar), and instead buys food that are more nutritious and less expensive such as (local fish, beans, fruits and green leafy vegetables)?
Yes □ No □ May be □

Are you ready to increase nuts and green vegetables in your family meals? Yes □ No □ May be □

* Questions that have similar meanings in all four surveys, and were used for analysis
Appendix 4: Follow up Survey

Section one:

1. Full name __________________________ Age ______

2. Never married ☐ Married ☐ Divorced ☐ Separated ☐ Widowed ☐

3. Husband’s name __________________________ Age____

4. What Level of education did you complete? __________________________

5. Select all areas where your family gets income
   ☐ no specific income      ☐ business    ☐ home economics
   ☐ farming               ☐ relatives   ☐ other __________________________

6. Are there times when your family does not get lunch or dinner because of not having food?  Yes ☐ No ☐

7. What kind of floor does your house has?
   ☐ dirt               ☐ cement       ☐ other __________________________

8. What type of roof does your house has?
   ☐ grass        ☐ iron sheet   ☐ tiles       ☐ other __________________________

   How big is your shamba (garden/farm)?
   ☐ small          ☐ average     ☐ big

10. Were you forced by your parents or relatives to marry your current husband? Yes ☐ No ☐

11. How many children do you have? ______

12. Do you have a child who is under five years old? Yes ☐ No ☐

13. Please list the ages of your children. __________________________

14. Have you ever been told by a medical doctor or a healthcare provider that your child has:
   Kwashiorkor; Yes ☐ No ☐ Malnutrition; Yes ☐ No ☐
   Worms; Yes ☐ No ☐ Is growing slowly; Yes ☐ No ☐
15. Did any child you took care of die before reaching five years of age?
   Yes ☐ No ☐
   If yes, what did the child die of? ________________________________

Section Two:

16. Last summer, we taught about child nutrition, what do you remember from the sessions?

17. List three things that you think are important about child nutrition

List three things that you think are important about family nutrition

Since the end of the last intervention have you attended any education session(s) on nutrition or breastfeeding?
   If yes, where was the session(s) held?
   What did you learn from the session(s)?
   How long was/were the session(s)?

Have you used the brochure that was given to you at the end of the last intervention?
   Yes ☐ No ☐

Below, select all signs of malnutrition.
   Losing appetite ☐ a big round stomach ☐ weak hair ☐
   Body rash ☐ swollen legs ☐ growing slow ☐

*Please circle the food items that are good sources of protein (body building food):
   Eggs ☐ Mangoes ☐ Cassava ☐
   Rice ☐ Beans ☐ Green leafy vegetables ☐

*Please circle the food items that are good sources of starchy food (provides energy):
   Eggs ☐ Mangoes ☐ Cassava ☐
   Rice ☐ Beans ☐ Green leafy vegetables ☐

*Please circle the food items that are good sources of vitamins (body protective food):
   Eggs ☐ Mangoes ☐ Cassava ☐
   Rice ☐ Beans ☐ Green leafy vegetables ☐

Is tea good for young child?
   Yes ☐ No ☐ I am not sure ☐
Is sugar nutritious?
Yes ☐ No ☐ I am not sure ☐

Is it okay for a pregnant woman to continue breastfeeding?
Yes ☐ No ☐ I am not sure ☐

Is it good for a mother to continue breastfeeding when she comes back even if she was away from her baby for more than one day?
Yes ☐ No ☐ I am not sure ☐

* It is good to breastfeed exclusively for the first six months?
Yes ☐ No ☐ I am not sure ☐

* Is it good to continue breastfeeding when the baby gets sick?
Yes ☐ No ☐ I am not sure ☐

* Is it okay to continue breastfeeding when a women gets sick?
Yes ☐ No ☐ I am not sure ☐

Since last summer do you feed your children any different foods? Yes ☐ No ☐
If yes, please list these foods, and please check if you grow or buy them
Food ☐ Grow ☐ Buy ☐

How much time do you spend preparing family meals now compared to before the intervention?
The same time ☐ More time ☐ Less time ☐

Have you talked about your family’s food and nutrition with your husband since the last intervention?
Yes ☐ No ☐
If yes, what did you discuss?

Since the intervention have you had a new child? Yes ☐ No ☐
If yes, how old is your baby?
What do you feed the baby?
From morning to evening how many times does the baby eat?

* Questions that have similar meanings in all four surveys, and were used for the analysis
Appendix 5: Comparison Survey

Section one:

1. Full name ________________________________ Age ______

2. Never married □  Married □  Divorced □  Separated □  Widowed □

3. Husband’s name ________________________________ Age ______

4. What Level of education did you complete? ________________________________

5. Select all areas where your family gets income
   □no specific income  □ business  □ home economics  □ farming  □ relatives  □ others ______________

6. Are there times when your family does not get lunch or dinner because of not having food?
   Yes □  No □

7. What kind of floor does your house has?
   □ dirt  □ cement  □ other ______________

8. What type of roof does your house has?
   □ grass  □ iron sheet  □ tiles  □ others ______________

9. How big is your shamba (garden/farm)?
   □ small  □ average  □ big

10. Were you forced by your parents or relatives to marry your current husband?
    Yes □  No □

11. How many children do you have? _______

12. Do you have a child who is under five years old?  Yes □  No □

13. Please list the ages of your children. ________________________________

14. Have you ever been told by a medical doctor or a healthcare provider that your child has: Kwashiorkor; Yes □  No □  Malnutrition; Yes □  No □  Worms; Yes □  No □  Is growing slowly; Yes □  No □

15. Did any child you took care of die before reaching five years of age?
    Yes □  No □
    If yes, what did the child die of? ________________________________
Section Two:

16. List three things that you think are important about child nutrition

17. List three things that you think are important about family nutrition

Have you ever attended education sessions on nutrition or breastfeeding?  
If yes, where was/were the session(s) held?  
What did you learn from the session(s)?  
How long was/were the session(s)?

Below, select all signs of malnutrition.
Losing appetite ☐ a big round stomach ☐ weak hair ☐
Body rash ☐ swollen legs ☐ growing slow ☐

*Please circle food items that are good sources of protein (body building food):
Eggs ☐ Mangoes ☐ Cassava
Rice ☐ Beans ☐ Green leafy vegetables

*Please circle food items that are good sources of starch (provide energy):
Eggs ☐ Mangoes ☐ Cassava
Rice ☐ Beans ☐ Green leafy vegetables

*Please circle food items that are good sources of vitamins (body protective food):
Eggs ☐ Mangoes ☐ Cassava
Rice ☐ Beans ☐ Green leafy vegetables

Is tea good for young children?
Yes ☐ No ☐ I am not sure ☐

Is sugar nutritious?
Yes ☐ No ☐ I am not sure ☐

Is it okay to continue breastfeeding when a women gets pregnant?
Yes ☐ No ☐ I am not sure ☐
A woman should continue breastfeeding when she comes back even if she was away from her baby for more than one day.
Yes ☐ No ☐ I am not sure ☐

*Is it good to breastfeed exclusively for the first six months?
Yes ☐ No ☐ I am not sure ☐

*Is it good to continue breastfeeding when the baby gets sick?
Yes ☐ No ☐ I am not sure ☐

*Is it okay for a woman to continue breastfeeding when she gets sick?
Yes ☐ No ☐ I am not sure ☐

Please list foods that you feed your children and identify if you grow or buy them.

<table>
<thead>
<tr>
<th>Food</th>
<th>Grow</th>
<th>Buy</th>
</tr>
</thead>
</table>

Do you talk about your family’s food and nutrition needs with your husband?
Yes ☐ No ☐

*If yes, what do you discuss?

Do you have a child who is under two years old? Yes ☐ No ☐

*If yes, how old is your baby?

What do you feed the baby?

From morning to evening how many times does the baby eat?

*Questions that have similar meanings in all four surveys, and were used for analysis
Breastfeeding Cards

Exclusively for 6 months

- Breastfeed your baby often, at least 5 times a day
- Hold your baby so you and your baby can look at each other during breastfeeding—make it a special time
- Your baby doesn’t need water or other foods—your breast milk is enough—If you do give your baby water only use boiled water
- Nothing is better than your milk to protect your baby against worms and malaria (and other infections)
- Keep your breast skin from drying out by applying cooking oil
- The common problems of breastfeeding (swollen breasts, not enough milk) will improve if you continue breastfeeding
- Your breast milk can never hurt your baby, even if you get pregnant, your baby gets sick or you skip a day breastfeeding

Maziwa ya mama peke yake kwa miezi sita (6) ya mwanza

- Mnyonyeshi mtoto wako mara nyungi kwa ujumiliana anayonyesha angalia mtoto lako kwa siku
- Uduka unangonyeshi mtoto hakikisha unamshika vizuri mtoto liangaliwe na mwanzo—hitu ni wakati muhimu kati yako wewe na mwanzo
- Mito wako habari maj au vyakula virunge—maziwa yako ya nyanzisha—likue babadi kumnyonyeshi mtoto maj, mtale maj yakipocharisha
- Hakuna kito bora zaidi ya maziwa yako. Maziwa ya mama yanamninga mtoto dhidi ya ma goriwa kama minyoo, malara na magoyu na gine mengi
- Zuja ngopo ya mati kusaha kwe kusapa mafula ya kupika
- Matalazo yanonyo wakati kusaha wekati ukumnyonyeshi kuomba kwa mtiti, kutoka na maziwa ya kuzoja, yasikua yatazasonga kwa ukuza athenie kumnyonyeshi mwanzo
- Maziwa yako hayawazi kumdhuri mtito, hati kama humano, mtito akawa
Complementary Foods Card

English and Swahili
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