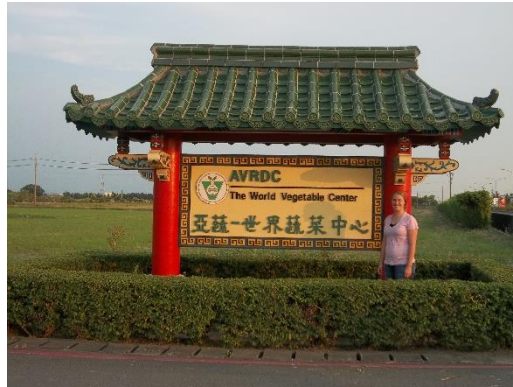


Voiding Malnutrition with Vegetables: My Summer at the World Vegetable Center in Taiwan



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Finally, I thank God for making this all possible. I have seen Him working here through my mentors and colleagues at AVRDC, my friends and family at home, and the incredible beauty of this world. With Him all things are possible.

Introduction

My heritage is deeply rooted in agriculture. All of my grandparents were farmers. Growing up, I rode in combines as my father's seed customers harvested their crops. I sold pumpkins, gourds, and squash at farmer's markets. I showed dairy heifers at my county fair and the Iowa State Fair. I have always known agriculture was important in my life, but I never considered its importance in the world until I attended the World Food Prize Global Youth Institute in 2011.

When I entered high school, my agriculture instructor encouraged me to write an essay and participate in the World Food Prize. In the process of writing my essay, I discovered the global nature of agriculture and the challenges faced by small-holder farmers in underdeveloped regions of the world. At the World Food Prize, I was inundated with information about world hunger, sustainability, and global agricultural policy. Participating in the World Food Prize Global Youth Institute opened my eyes to a broader view of agriculture.

I took this new perspective with me as I continued through high school. As an active FFA member, I had many opportunities to make an impact through agriculture, whether by sharing information in speaking events or by participating in service projects and food packaging events. When I enrolled at Iowa State University, I chose to combine my love of agriculture with my aptitude for math and science by majoring in Biological Systems Engineering.

At Iowa State, I have access to wonderful resources to enhance my education, including a superb lectures program. When I heard there would be a lecture in honor of Norman Borlaug on the campus of Iowa State University, I knew I wanted to go. When I heard the 2013 World Food Prize laureates would be speaking, I knew I needed to go. I was in the audience when Dr. Robert Fraley spoke these words: "The unique thing about biotechnology is that it takes the latest research in gene sequencing and puts it in a seed. And every farmer around the world knows what to do with a seed." This statement reminded me that delivering technology is just as important as developing technology. After attending this lecture, I remembered the impact the World Food Prize had on me the first time I attended.

Soon after this event, I decided to apply for the Borlaug-Ruan International Internship. I was excited to receive an invitation to interview for the internship and thrilled when I learned I had been selected as an intern! As I read my project proposal, finished my final exams, and learned more about AVRDC, the anticipation continued to build. Soon I was at the airport, hugging my family goodbye and embarking on an adventure greater than I ever could have imagined.

Before embarking on this internship, I knew I wanted to use my education and background in agriculture to make an impact on food security in the world. After this summer, I am positive that I want to be involved in meeting the challenge of feeding our growing world population. My experience as a Borlaug-Ruan International Intern has confirmed my passion for agriculture and opened my eyes to the vast opportunities available to make an impact in this field. Although I am more excited than ever to begin working on this immense challenge, I also have a better idea of just how difficult and complex it will be to improve food security in our world. That said, I am forever grateful to the World Food Prize and other organizations for dedicating time and resources to developing the students who will be instrumental in realizing the dream of a world free of poverty and hunger.

AVRDC – The World Vegetable Center

In 1971, Dr. Robert Chandler, Jr. recognized a need for research and development relating to vegetables, so he founded the Asian Vegetable Research and Development Center (AVRDC). Located in Taiwan, AVRDC focuses on reducing malnutrition and poverty in the world through increased production and consumption of vegetables. As the mission of AVRDC expanded to reach beyond Asia to the rest of the world, it was renamed The World Vegetable Center in 2002.

Today, AVRDC has regional offices across the globe including in Tanzania, Mali, India, Uzbekistan, Thailand, and Fiji. The dedicated staff at AVRDC conducts groundbreaking research in vegetable production, vegetable nutrition, plant breeding, disease and pest resistance and more. However, what makes AVRDC uniquely effective is their commitment technology dissemination around the globe. They believe it is not enough to simply create knowledge; AVRDC knows the importance of sharing and implementing knowledge where it is needed most. Through its devotion to research and development in all aspects of vegetable production and consumption, AVRDC is truly fulfilling its mission of providing “prosperity for the poor and health for all.”

Vegetables Go to School

The Vegetables Go to School project is working to reduce malnutrition among children through nutrition education and school garden programs. The project will monitor the specific impact of these programs in improving the knowledge and decision making related to nutrition among school aged children and their families. My task for the majority of my internship concerned the development of an educational resource for these programs. This resource will be utilized by school teachers and project partners in the target countries for the project. The overall project will stretch over nine years and reach six countries in Asia and Africa.

Development of Vegetable and Nutrition Messages for Public Awareness and Promotion in Bhutan, Burkina Faso, Indonesia, and Nepal

**Nutrition, AVRDC – The World Vegetable Center, Taiwan
World Food Prize Borlaug-Ruan International Internship**

Introduction

The World Health Organization has stated that malnutrition contributes to more than one-third of child deaths worldwide (2014). Malnutrition is the lack of proper nutrition in the diet, including not eating enough, deficiency of specific nutrients, or consuming nutrients in incorrect proportions. Aside from contributing to childhood mortality, malnutrition can also lead to increased risk of infection, decreased productivity, and increased risk of obesity later in life. The possible causes of malnutrition are numerous and varied, but most originate with food insecurity. Situations that can lead to malnutrition include low availability of nutritious foods, lack of accessibility to nutritious food, and poor utilization of food, among others. Each of these contributes to malnutrition, however in practice there is seldom one single factor that can be identified as the cause of malnutrition. Instead, it is generally a combination of low availability, lack of accessibility, and poor utilization that results in malnutrition of a population (Susilowati and Kuryadi, 2002).

Additionally, the factors that contribute to malnutrition are often interrelated. Food is not accessible because it is too expensive. Insufficient income is, among other causes, a result of poor education, which also contributes to a lack of knowledge of how to utilize nutritious food. Little education also results in little knowledge about producing nutritious foods, leading to low availability. And with low availability, food is more valuable, and therefore more expensive. In short, malnutrition is a tangled web that grows from issues in education, economics, agriculture, and nutrition.

In developing countries, undernutrition is a major problem as it is the leading cause of childhood death (Gibney et al., 2009). Undernutrition includes both protein-calorie malnutrition and micronutrient deficiency. Both these conditions are very serious and deserve attention, however ensuring sufficient micronutrient intake may be more effective in fighting malnutrition. Consider that a study of Indonesian children found those suffering from vitamin A deficiency, as evidenced by xerophthalmia, had four times the mortality rate of their peers with normal eye health (Sommer, 1983). This juxtaposition suggests that micronutrient consumption is important even when adequate energy is not available in the diet.

Consuming vegetables is an effective way to ensure consumption of essential micronutrients. In most areas of the world, including developing countries, vegetable consumption falls short of the global recommendation. However, in developed countries, there are other sources of micronutrients, such as supplements, available. Vegetables are the most available source of micronutrients for people in developing countries (AVRDC, 1992).

Objective

As there is no one factor that can be pinpointed as the lone cause of malnutrition, there is no single solution to this problem. In light of this limitation, this project chooses to focus on raising awareness of nutritious foods, namely vegetables. In developing countries where malnutrition is most prevalent, there is a lack of knowledge about vegetables, in terms of both agriculture and nutrition. The information available may be ill-suited for a specific situation, incomplete, or non-existent. The main objective of this project is to create a resource that fills this gap by providing a comprehensive view of vegetables, from production to consumption.

Approaches

Children, in particular, are in an advantageous position to learn more about vegetables, as many are attending school daily. In addition, children are the future of the countries in question, so any impact made on them can be seen as an impact on the future. School vegetable gardens have been used for some time to teach school children how to grow and utilize vegetables, but little is known about the impact these programs have in the long run. In addition, these programs are not commonly accompanied by nutrition education.

In order for a compilation of information to be effective, there must be an application where it will be used to educate people. The Vegetables Go to School project, led by AVRDC – The World Vegetable Center, will serve as this application. The information gathered will be published as a resource for the school garden programs in this project. Vegetables Go to School is working in four countries in Asia and Africa: Bhutan, Burkina Faso, Indonesia, and Nepal. This resource will aid teachers, non-governmental organization staff, and agriculture extension workers as they provide this education to students. This resource will be specific to the country where it will be utilized and transferrable to other applications such as for use by health workers and households. The development of such a resource is the subject of this project.

Initially the information to be included in this resource must be defined in order to know what data to collect. A summary of the nutritional issues in the country will be included to demonstrate the importance of the information in the resource. Information about when to sow and harvest vegetable crops suited to cultivation in a specific country will be provided to assist with the planning of gardens. The resource will provide general suggestions for how to care for the crops as they are growing. In addition, the resource will give information about the dietary guidelines and recommendations specific to that country in order to inform individuals about what constitutes a nutritious, balanced diet. The nutritional value of the suitable vegetables will be highlighted to empower individuals to make informed decisions about what foods they will consume. Food taboos in the countries' cultures will be addressed so the negative effect of any unfounded claims on the consumption of potentially nutritious foods will be reduced. Finally, the health and nutritional benefits of consuming vegetables will be included to further encourage their consumption.

This paper will address collection and presentation of information related to the nutritional benefits of vegetable consumption.

Methods

The countries where the interventions will take place were previously determined. They are Burkina Faso, Nepal, Bhutan, and Indonesia.

Before exploring the topic of the nutritional benefits of vegetable consumption, background information on the nutritional situations of the project countries was gathered. With a better understanding of nutrition in each country, the topic of vegetable nutrition was breached. As nutrition is a complex discipline, appropriate subtopics of importance to the audience were determined. The further research focused on these subtopics, which included defining vegetables, addressing nutrient content of vegetables, discussing the function of different nutrients, exploring the health benefits of phytonutrients, addressing the idea of bioavailability and discussing the overall importance of vegetable consumption.

Secondary data on these subtopics were collected through review of books, databases, and articles pertaining to nutrition and/or vegetables. The AVRDC Library catalog was searched using terms such as “human nutrition,” phytonutrients,” and “bioavailability” to obtain books pertaining to the nutritional content of vegetables. To determine the suitability of the sources, the introductory pages, table of contents, and indices of the books were browsed. Appropriate sources were read in further detail and relevant information was recorded by source.

Another search method was the use of Google Scholar to locate recent scientific studies on vegetable nutrition. Search terms included “vegetables and human nutrition,” “nutritional content of vegetables,” and “vegetable consumption in <country>.” Abstracts of promising articles were reviewed and full text was located in the AVRDC journal holdings or online through the Iowa State University Library, if necessary. Again, notes were taken upon the detailed review of suitable sources.

Databases, including the World Health Organization Global Infobase, FAOSTAT, and the United States Department of Agriculture National Nutrient Database, were searched for data relevant to the nutritional issues in the world and in the countries of interest. These data were copied into Microsoft Excel for later analysis and development of charts and graphs.

Upon finishing the literature review, areas lacking information were identified for exploration through interview. A qualitative questionnaire, presented in Appendix 3, was developed with the intention of interviewing nutritionists and health experts in the countries of interest. Subjects were contacted and the questionnaire was answered via email or Skype video/audio call. Food taboos and superstitions were also discussed with other individuals who live or have lived in the project countries to augment the collection of information. Notes from the interviews are included in Appendix 4.

Finally, the presentation of the information is essential to the success of the resource. Individual booklets which are customized to address the situation in each country will be produced. These booklets will present the compiled information in a manner that is comprehensible to individuals with little to no background in agriculture or nutrition. The messages in the booklet must convey the appropriate information in a simple manner.

Results and Discussions

As previously stated, the research was divided into several subtopics to be addressed in the promotional message. This section describes the importance of each subtopic and the collection of information. *Detailed information about each subtopic follows the dashes under the heading “Technical Information” and the simple messages to be included in the booklets can be found in brackets under the heading “Key Message.” The complete promotion message can be found in Appendix 1.*

I. Nutritional situation in the project countries

To best understand the context in which the booklets will be used, it was necessary to collect information about the current nutritional status of citizens of the project countries.

The main resources for this topic were online resources published by international organizations such as the World Bank and the World Health Organization. The information provided by these organizations was country specific data, which was very helpful for understanding each unique nutritional situation. In addition, recent scientific reports provided general information about the relatively new concept of a double nutritional burden. Charts were created with the use of Microsoft Excel from database information to aid visual comprehension.

Technical Information

According to nutritional publications by the World Bank, children in many developing countries suffer from the effects of malnutrition (2011). The conditions commonly affecting malnourished children under five years of age include Stunting – low height for age; Underweight - low weight for age; Wasting – low weight for height; Vitamin A Deficiency – consumption of insufficient amount of vitamin A; and Iron Deficiency Anemia – consumption of insufficient amount of iron.

The prevalence of each condition in the countries of interest is summarized in Figures 1 and 2. Figure 1 illustrates the improper growth of children in each country. Although it can be seen that Nepal has the highest incidence of two growth indicators, these countries are not considered peers and should not be compared. It is sufficient to say there are children in each country affected by malnutrition leading to improper growth. In Figure 2, it can be observed that all four countries also have incidence of micronutrient deficiency in children under five years of age.

Vitamin A deficiency can have significant consequences including night blindness, increased risk of infection, and permanent eye damage (King and Burgess, 1993). Sufficient vitamin A consumption is important even for those children who suffer from protein-calorie malnutrition. A study of Indonesian children found that the mortality rate for children suffering from xerophthalmia, an eye disease caused by vitamin A deficiency, was four times the rate of children who consumed sufficient vitamin A (Sommer, 1983). Consuming plentiful amounts of vitamin A should be a priority to ensure the health of young children in developing countries.

Iron deficiency anemia also affects vast numbers of children in developing countries. In addition to the immediate symptoms of fatigue and pale tongue and lips, nutritional anemia also slows the cognitive development of children (King and Burgess, 1993). The effects of iron deficiency

anemia are seen throughout life as nutritional anemia has been linked to a 2.5% loss of wages over the lifetime of an individual due to the fatigue and lack of productivity (The World Bank, 2011; King and Burgess, 1993). Thus, micronutrient deficiencies are not just nutritional problems; they have a negative effect on quality of life as well.

Figure 1

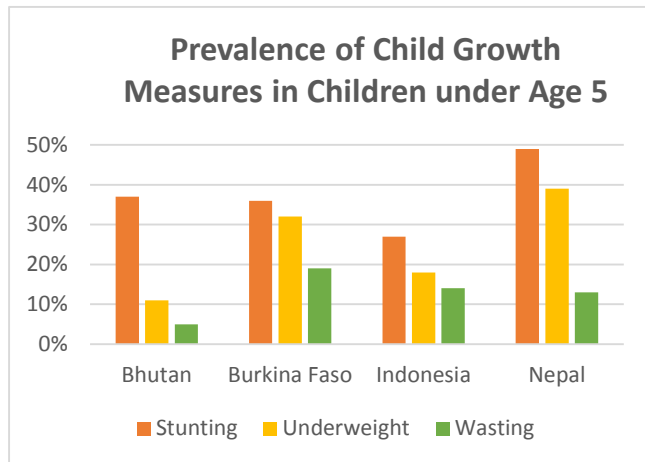
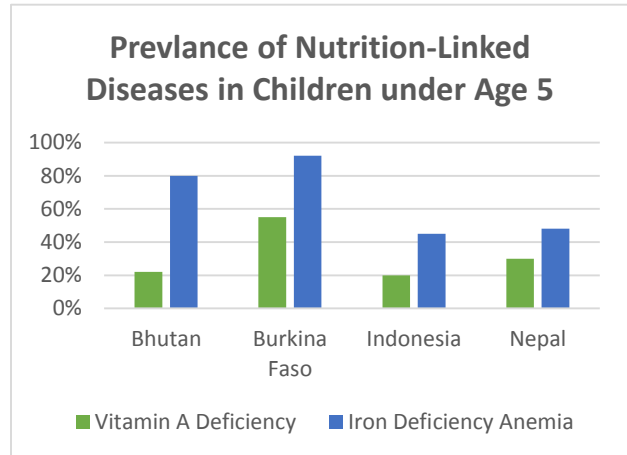


Figure 2



Data sourced from The World Bank, “Nutrition Country Profiles,” 2011

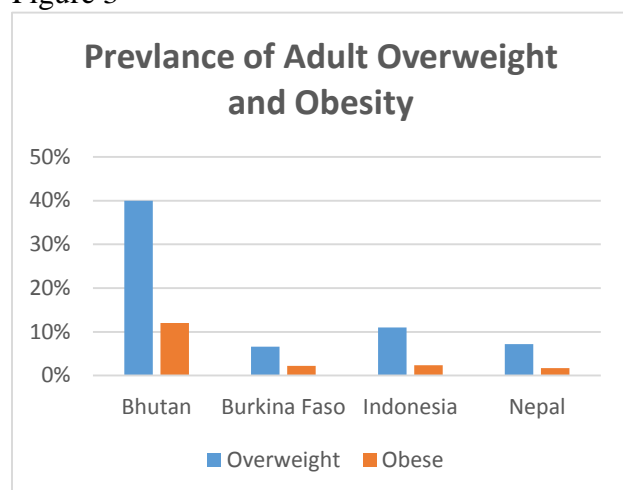
Unfortunately, it should not come as a surprise that young children in these developing countries have suffered the adverse effects of malnutrition. However, a few unexpected points should be noted. Conventional wisdom would likely conclude that poverty is the cause of this malnutrition because families aren’t able to afford sufficient, nutritious food. To the contrary, the World Bank publication for Indonesia indicates that undernutrition pervades all economic levels. While 30% of children whose families are in the lowest income bracket are underweight, around 20% of children in the highest income bracket also are underweight (The World Bank, 2011). A similar trend is observed in Nepal, with 62% of the poorest children and 31% of the richest children suffering from stunting (The World Bank, 2011). In these and other developing countries, malnutrition is not solely a condition of poverty, it is a potential reality for all children.

Another surprising feature of the nutritional status of these countries is the overweight and obese adult population. Adiposity is not a condition one would necessarily expect to see in a country with a major childhood malnutrition problem. However, this double nutritional burden is certainly present in these four countries. Figure 3 shows that Bhutan has by far the highest rate of overnutrition among the adult population.

In a recent report, Popkin, Adair and Ng, addressed the double nutritional burden in developing countries (2012). One clear contributing factor is the decrease in physical activity that may come with an improved economic situation. Another idea presented is that adult obesity stems directly from childhood malnutrition. When a child is malnourished, their metabolism adapts to use the limited nutrients effectively. However, this metabolic change is not reversed when adequate food is available. Therefore, the body continues maximizing the nutrition in the foods consumed which leads to overnutrition and eventually overweight or obesity (Popkin, Adair, and Ng; 2012). This phenomenon already has been observed in India and China as personal incomes

increased with the improved economies in those countries (Popkin, et al., 2001). With many developing countries working to improve their economic status, it is likely that this double nutritional burden will increase in the near future.

Figure 3



Data sourced from World Health Organization Global Infobase, 2011

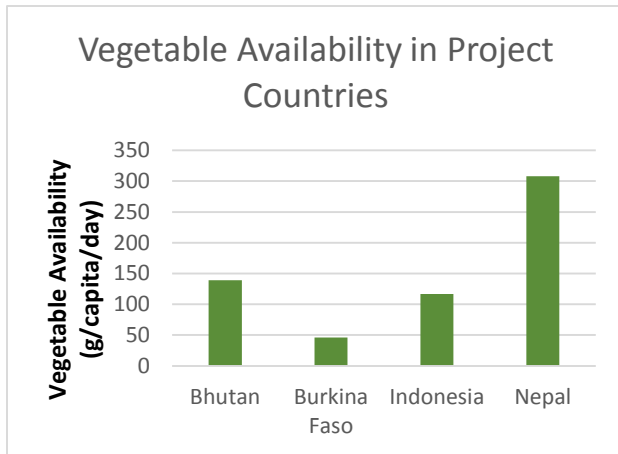
Note: Available data for Burkina Faso is for women only; age range differs by country

In a recent report, Popkin, Adair and Ng, addressed the double nutritional burden in developing countries (2012). One clear contributing factor is the decrease in physical activity that may come with an improved economic situation. Another idea presented is that adult obesity stems directly from childhood malnutrition. When a child is malnourished, their metabolism adapts to use the limited nutrients effectively. However, this metabolic change is not reversed when adequate food is available. Therefore, the body continues maximizing the nutrition in the foods consumed which leads to overnutrition and eventually overweight or obesity (Popkin, Adair, and Ng; 2012). This phenomenon already has been observed in India and China as personal incomes increased with the improved economies in those countries (Popkin, et al., 2001). With many developing countries working to improve their economic status, it is likely that this double nutritional burden will increase in the near future.

Vegetables are a natural source of micronutrients. Deficiency of micronutrients has been identified as a main cause of nutrition-linked problems in Bhutan, Burkina Faso, Indonesia, and Nepal. The World Health Organization recommends eating a minimum of five servings (400 grams) of fruits and vegetables daily (2003). If we assume this means eating about 200 grams of vegetables daily, then the people of these countries do not meet this minimum consumption level. Figure 4 demonstrates the availability of vegetables in the four countries of interest.

Only Nepal meets the minimum availability guideline set forth by the WHO, but this high availability may not directly translate to high consumption. A person in Nepal has 3.85 servings available daily, but only consumes 2.5 servings on average (WHO, 2011).

Figure 4



Data sourced from FAOSTAT, 2014

Simply increasing the availability of vegetables will not increase their consumption. For example, broccoli was introduced as a new vegetable in rural Bhutan several years ago. However, people in the communities did not receive any information about how to prepare and use broccoli, so they did not eat it (Lhamo, 2014). In contrast, informational campaigns in Nepal have effectively informed the public about the importance of eating vegetables. In the past 20 years, vegetable consumption has increased from 60kg per year to 105kg per year according to Ministry of Agriculture data (Bhattarai, 2014). These examples clearly show the importance of education in increasing vegetable consumption and improving nutrition as a whole.

Economics also plays in to the dietary decisions of many people in developing countries. For example, in Nepal the first priority when buying food is ensuring a sufficient supply of rice, the staple food. In addition, many poor people would likely prefer to sell the vegetables they produce to earn a little money than simply consume the vegetables themselves (Sharma, 2014). When resources are limited, the affordability of food may be more important than the nutrition.

Bhutan, Burkina Faso, Indonesia, and Nepal all have incidence of conditions and diseases linked to poor nutrition among their populations. However, these ailments are not simply superficial measures of the nutritional status of a country; they have real consequences. Children who suffer from malnutrition are more likely to drop out of school than their peers and subsequently earn lower wages throughout their adult lives (The World Bank, 2011). Consuming vegetables may help to reduce malnutrition, but the challenges to increasing vegetable consumption are significant. Malnutrition is not simply an issue of nutrition – it is an issue of human welfare.

Key Message

Vegetables are an important part of a healthy diet

As previously stated, people in <country> may be vulnerable to many, varied conditions resulting from eating a poor diet. Vitamin A deficiency can cause night blindness. Iron deficiency anemia may result in lower income over your lifetime. Malnutrition as a child can lead to overweight or obesity, and complications from those conditions, as an adult.

Consuming a healthy diet is essential to maintain health and productivity throughout your life.

II. Definition of a healthy diet

In a situation in which nutrition is a completely foreign topic, as with populations that have little previous exposure to the field of nutrition, it may be best to start with simple ideas. The concept of a healthy diet may be the most basic in the field of nutrition. It is necessary that the booklet audience understand this concept so they can appreciate the importance of vegetables in their diets.

Basic nutrition textbooks and other reference books were the main resources for this topic.

Technical Information

Food is the fuel for the human body and nutrition describes the quality of that fuel. We need nutrition for many reasons including growth and development, replacing and repairing cells, fighting infections, and providing energy for bodily functions (King and Burgess, 1993). Nutrients are the building blocks of nutrition and are found in all foods. Nutritionists have identified more than 50 nutrients that our bodies need, which can be classified into six groups: water, protein, carbohydrates, fat, vitamins, and minerals (Gibney, et al., 2003). However the quality of nutrition differs for every food source. No one food can provide the great variety of nutrients that the body needs daily. Therefore, it is important to include a variety of foods in the diet (Truswell and Wall, 2003). By consuming a wide array of foods, the body receives needed nutrients in correct proportions (Rubatzky and Yamaguchi, 1997). In addition to consuming a balanced diet, daily physical activity also is important to maintain good health (WHO, 2003).

Key Message

- What is a healthy diet?*
- Eating foods that provide the nutrients your body needs
 - *Nutrients* are compounds your body uses to function properly
 - Water, protein, carbohydrates, fat, vitamins, and minerals
 - Eat many different types of foods
 - Turn to page <#> for more information on foods to eat for a healthy diet
- Also include daily physical activity for a healthy lifestyle

III. Defining vegetables

For those who have no exposure to nutrition, food groups are a very new concept. It may be helpful to point out the similarities and differences between plant based foods, namely fruits and vegetables.

The main source consulted for this subtopic was the *Vegetable Production Training Manual* published by AVRDC, in an effort to remain consistent with AVRDC's definition of vegetables.

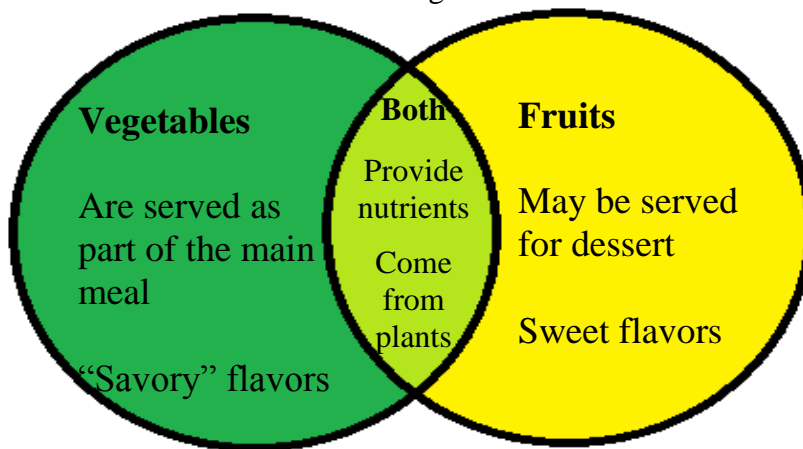
Technical Information

The distinction between fruits and vegetables is quite unclear. For example, tomatoes are classified as a fruit in a botanical context, but most people probably classify them as a vegetable. In fact, the difference often lies in the utilization of the food. Fruits generally are sweet in flavor and may be eaten for dessert. Vegetables, on the other hand, have more savory flavors and may be consumed as a main dish or accompanying the main meal. One good definition of vegetables found in a publication by AVRDC, the World Vegetable Center, state that “a vegetable could thus be defined as an edible, usually succulent plant or a portion of it eaten with staples as main course or as supplementary food in cooked or raw form” (*Vegetable Production Training Manual*, 1992).

Key Message

What counts as a vegetable?

The difference between fruits and vegetables is sometimes not very clear.



In short, a vegetable is any edible part of a plant that is eaten as a main part of a meal and provides nutrients. See page <#> for a list of vegetables that can be grown in <country>.

IV. Vegetable nutrition

The purpose of this promotion message is to provide information about the nutritional benefits of consuming vegetables, so naturally basic information about vegetable nutrition must be included.

Basic information about vegetable nutrition is available in scientific studies and reference books.

Technical Information

Vegetables are a rich source of micronutrients that our bodies need to function properly. Collectively, fruits and vegetables are the least expensive source of micronutrients available (Ruel, et al., 2005). Among these nutrients, vitamin A and iron attract the most attention from a nutritional perspective. These two micronutrients often are lacking in the diets of people

(especially children) in developing countries, including Bhutan, Burkina Faso, Indonesia, and Nepal. However, a proper balance of all nutrients is needed in a nutritious diet.

In order to receive this balance of nutrients, a variety of foods must be consumed (Truswell and Wall, 2003). Consuming a variety of vegetables will provide the body with a better balance of nutrients than consuming only one or two vegetables.

Key Message

Do all vegetables have the same nutritional benefits?

All vegetables provide nutrients to our bodies. However, the specific nutrients in each vegetable are quite different. Each vegetable contains a unique mix of vitamins and minerals. Page <#> explains what nutrients are in each vegetable.

Because not all vegetables have the same nutrients, eating different kinds of vegetables is very important. If you just eat one vegetable, your body will not get all the nutrients it needs. One easy way to be sure you are getting variety in your diet is to eat vegetables that are many different colors. Another idea is eating vegetables that come from different parts of the plant, such as the root, stem, leaf, fruit, or flower. Eating a wide variety of vegetables, in addition to other high energy foods, will help keep your body's nutrients in balance.

V. Nutrient function and vegetable sources

As the idea of nutrients may be relatively new to the target audience, it is helpful to include a simple description of the function of nutrients in the human body. In addition, a list of vegetables that contain relatively high concentrations of each nutrient will allow the users to make informed decisions about what vegetables they consume. These vegetable sources are customized for each country according to the list of popular vegetables provided by the Vegetables Go to School project. The symptoms of micronutrient deficiencies are also included so individuals can recognize when the body is not functioning correctly.

Many sources were consulted and combined to result in this mix of nutrition and health information. Print resources and scientific studies provided information about the function of nutrients and signs of deficiency. Text books and the USDA nutritional database were used to obtain the "good sources." The protein, vitamin and mineral contents of each vegetable was recorded and ranked from highest to lowest to determine which vegetables had the highest concentration of each nutrient.

Technical Information

Nutrients found in vegetables and their functions are described in Table 1.

Table 1: Vegetable-sourced nutrients and their functions

Nutrient	Function
Protein	Builds new cells, repairs wounds; provides energy
Water	Substrate for body processes to take place, cools the body

Vitamins	
Vitamin A	Prevents infection, promotes eye health, prevents heart disease
B Vitamins	Helps body utilize other nutrients
Vitamin C	Builds healthy bones and blood vessels; protects immune system
Folate	Helps red blood cells carry oxygen to the body
Minerals	
Calcium	Builds strong teeth and bones
Iron	Aids red blood cells to carry oxygen
Magnesium	Helps build strong bones, teeth; protects immune system
Potassium	Rehydrates body
Zinc	Helps children grow properly
Other	
Fiber	Improves digestion and nutrient absorption, provides feeling of fullness

Information from King and Burgess, 1993; Kader, Perkins-Veazie, and Lester, 2012

Table 2 displays a selection of vegetables that contain each nutrient.

Table 2: Selected vegetable sources of nutrients

Nutrient	Vegetable Sources
Protein	Amaranth, broccoli, spinach, cauliflower, peas
Water	All fresh vegetables
Vitamins	
Vitamin A	Sweet potato, spinach, amaranth, broccoli, pumpkin, carrot
B Vitamins	Chili, sweet potato, amaranth, okra, carrot
Vitamin C	Chili, sweet pepper, broccoli, cabbage, spinach
Folate	Spinach, amaranth, broccoli, okra, carrot
Minerals	
Calcium	Amaranth, spinach, broccoli, okra, lettuce
Iron	Amaranth, spinach, lettuce, garlic, peas
Magnesium	Spinach, amaranth, okra, sweet potato, peas
Potassium	Spinach, amaranth, garlic, broccoli, pumpkin
Zinc	Garlic, amaranth, okra, spinach, broccoli
Other	
Fiber	All unprocessed vegetables

Information from King and Burgess, 1993; Rubatzky and Yamaguchi, 1997; USDA, 2011

Table 3 describes the conditions that result from nutrient deficiency and their basic symptoms.

Table 3: Nutrient deficiencies

Nutrient	Condition	Symptoms
Protein	Stunting	Slow growth, prone to illness
Water	Dehydration	Very little urine, dark in color
Vitamins		
Vitamin A	Vitamin A Deficiency, Xerophthalmia	Night blindness
Vitamin C	Scurvy	Swollen, bleeding gums; swollen joints
Folate	Nutritional anemia	Fatigue; pale lips and tongue

Minerals		
Iron	Nutritional anemia	Fatigue; pale lips and tongue
Potassium	Dehydration	Very little urine, dark in color
Zinc	Stunting	Very short in stature
Other		
Fiber	Constipation	Hard stools

Information from King and Burgess, 1993; Gibney, et al., 2003

Key Message

Nutrient	Function	Signs of Deficiency	Bhutan Sources	Burkina Faso Sources	Indonesia Sources	Nepal Sources
Protein	Used to build new cells, repair wounds, for energy	Stunted growth, lack of energy, often sick	Amaranth, broccoli, cowpea, mustard green	Moringa, garlic, kale, cowpea leaves	Amaranth, broccoli, spinach, mustard greens, yardlong bean	Vegetable soybean, broad bean, garlic
Water	Needed for body processes and cooling; especially important with excessive sweating, diarrhea, fever	Dehydration; dark urine, small amount	All fresh vegetables	All fresh vegetables	All fresh vegetables	All fresh vegetables
<i>Vitamins</i>						
Vitamin A	Prevents infection; essential for eye health; important for growing children	Night blindness	Chili, Chinese cabbage, amaranth, broccoli, pumpkin	Sweet potato leaves, chili, kale, moringa, spinach	Sweet potato, chili, spinach, Chinese cabbage, amaranth	Sweet potato, chili, spinach, amaranth, broccoli
B Vitamins	Help body use nutrients		Chili, parsley, cowpea, amaranth	Chili, moringa, cowpea leaves	Chili, sweet potato, amaranth, broccoli	Chili, broad bean, soybean, sweet potato
Vitamin C	Needed for healthy bones, blood vessels; protects immune system	Swollen, bleeding gums	Chili, broccoli, cauliflower, mustard green	Chili, sweet pepper, kale, amaranth, moringa	Sweet pepper, broccoli, bitter gourd, cauliflower	Chili, sweet pepper, broccoli, bitter gourd, cauliflower
Folate	Helps red blood cells carry oxygen to the body; may prevent anemia	Anemia – fatigue, reduced productivity, slower learning	Parsley, beet, amaranth, Chinese cabbage	Spinach, kale, cowpea leaves, amaranth, okra	Spinach, chayote, amaranth, bitter gourd, broccoli	Spinach, soybean, broad bean, Malabar spinach, beetroot

Nutrient	Function	Signs of Deficiency	Bhutan Sources	Burkina Faso Sources	Indonesia Sources	Nepal Sources
<i>Minerals</i>						
Calcium	Strong teeth and bones; very important for growing children		Amaranth, mustard green, Chinese cabbage, broccoli	Amaranth, moringa, kale, spinach, okra	Amaranth, mustard greens, spinach, Chinese cabbage	Amaranth, dill, Malabar spinach, broad leaf mustard
Iron	Needed for red blood cells to carry oxygen; especially important for girls and women ages 10-55	Iron-deficient anemia – fatigue, reduced productivity, slower learning	Amaranth, chard, mustard green, lettuce, peas	Amaranth, moringa, spinach, cowpea leaves, kale, lettuce	Amaranth, spinach, mustard greens, bunching onion, lettuce	Amaranth, spinach, asparagus, soybean, broad leaf mustard
Magnesium	Needed for strong bones, teeth; protects immune system		Chard, cowpea, amaranth, okra	Moringa, spinach, amaranth, kale, okra	Spinach, amaranth, mustard greens, yardlong bean	Spinach, soybean, dill, amaranth, okra
Potassium	Needed to rehydrate the body; important with excessive sweating and diarrhea	Dehydration	Amaranth, garlic, chili, broccoli, mustard green	Yam, spinach, amaranth, kale, garlic	Spinach, amaranth, garlic, potato, chili, broccoli	Yam, dill, spinach, taro, amaranth
Zinc	Important for proper growth for children	Stunted growth	Cowpea, garlic, amaranth, okra	Garlic, amaranth, moringa, okra, kale	Garlic, amaranth, bitter gourd, chayote	Soybean, garlic, broad bean, dill
<i>Other</i>						
Fiber	Improves digestion and nutrient absorption; food has more bulk, gives feeling of fullness	Hard stools, constipation	All unprocessed vegetables	All unprocessed vegetables	All unprocessed vegetables	All unprocessed vegetables

Information from King and Burgess, 1993; Rubatzky and Yamaguchi, 1997; Gibney, et al., 2003; United States Department of Agriculture, 2011

VI. Supplements vs. vegetables

To the uninformed individual, vitamin and mineral supplements may appear to be a simpler, more affordable source of micronutrients. However the supplements available in these countries are likely single micronutrient supplements rather than all-in-one supplements found in

developed countries. Therefore, it is important to distinguish between the micronutrients found in vegetables and those found in supplements.

Information for this section was extrapolated from separate sources on vitamin supplements and vegetable nutrition. A simple comparison of this information is presented.

Technical Information

In developing countries, the main micronutrients that are lacking in diets are iron and vitamin A. Nutrition workers are trained to recognize these deficiencies and distribute supplements providing these micronutrients to those who need them (King and Burgess, 1993). However, because they are intended for use by people who are severely deficient in these micronutrients, the supplements generally are highly concentrated in one (vitamin A) or two (iron and folate) micronutrients. The supplements provide a high dose these micronutrients and very little, if any, other nutritional value (King and Burgess, 1993). They are utilized for “rescue treatment” rather than ongoing nutritional support.

As previously mentioned, vegetables are a good source of many micronutrients the body needs. A variety of vegetables can provide a well-rounded micronutrient profile (Rubatzky and Yamaguchi, 1997). For individuals who are not severely deficient in any one micronutrient, vegetable consumption may be preferable as vegetables are an affordable source of vitamins and minerals (Ruel, et al., 2005). Also, vegetables can be produced by the individual, whereas supplements are most available from nutrition workers.

Key Message

Can I just take a supplement?

Both vegetables and supplements are a good way to get micronutrients, but there are some differences.

Supplements

- One or two vitamins or minerals
- Provides high dose for severe deficiency
- Short term solution

Vegetables

- Many vitamins and minerals
- Provides continuous supply
- Long term solution

VII. *Phytonutrients in vegetables*

As economies change and improve, the incidence of obesity and overweight tends to increase. With these conditions comes increased risk of non-communicable diseases such as diabetes and heart disease. Awareness of health issues such as cancer will increase with improved economic situation and education. Therefore, it is important to include a discussion of the antioxidant activity in vegetables in these booklets so that they can remain relevant in a changing world.

Vegetables have only recently been studied closely for their health promoting qualities, so the majority of the resources consulted were recently published scientific journal articles.

Technical Information

The health benefits of consuming vegetables also have been acknowledged for quite some time. In an article in *HortTechnology*, the author asserts vegetables were originally grown for their medicinal purposes (Goldman, 2003). Therefore, it should come as no surprise that compounds in vegetables – today called phytonutrients – possess properties that reduce the risk of chronic diseases such as cancer, cardiovascular disease, and diabetes.

The most common category of phytonutrients are those with antioxidant activity, including carotenes, flavonoids, capsaicin, and anthocyanin, loosely termed “antioxidants”. Antioxidants reduce the risk of cancer development by scavenging free radicals in the body. Left unchecked, these free radicals cause oxidative damage to cell membranes and DNA. By neutralizing the free radicals, antioxidants reduce the risk of cancerous cells growing in the body (Duyn and Pivonka, 2000). Because free radicals also oxidize LDL cholesterol in the blood, antioxidant activity in vegetables also plays a role in reducing the risk of cardiovascular disease (Palafox-Carlos, et al., 2011).

Other phytonutrients may help prevent non-communicable diseases, including cancer and heart disease, through interactions in the human body. Diallyl sulfide, dithiolthiones, and terpenes activate enzymes that detoxify carcinogens. Glucosinates and indoles prevent estrogen dependent cancers such as ovarian and breast cancer. Sulphorophane and isothiocyanate are strong stimulants for detoxifying enzymes already present in the body (Duyn and Pivonka, 2000). All these phytonutrients are found in vegetables and can help prevent the development of non-communicable diseases.

By consuming vegetables high in antioxidants and other phytonutrients, individuals can reduce the risk of developing these diseases and improve their long-term health.

Key Message

What else can vegetables give my body?

In addition to all the necessary vitamins and minerals vegetables provide to your body, some vegetables also contain compounds called phytonutrients that may promote good health and even prevent disease. These compounds are not essential to a healthy life, nor are they a guarantee for good health. However, the activity of phytonutrients can be beneficial to your health.

The most common phytonutrients are called antioxidants and are found in most vegetables (and fruits as well.) They work by neutralizing harmful molecules called free radicals in our bodies. Left alone, these free radicals cause damage to cells and DNA. This damage may increase the risk for cancer, heart disease, respiratory disease, diabetes, or other chronic diseases. Antioxidants reduce the damage caused by free radicals and therefore reduce the risk of some chronic diseases. Antioxidants can be found in tomatoes, carrots, spinach, and amaranth, among other vegetables.

VIII. Bioavailability

When addressing vegetable nutrition, it is also important to acknowledge the idea of bioavailability. Bioavailability influences the nutritional value of the vegetables in comparison to other food sources. The basic concept of bioavailability must be presented in order to discuss how to effectively maximize the nutritional content of vegetable through preparation methods.

Textbook resources were first consulted for basic ideas on bioavailability. Journal articles then were reviewed for more recent information and research. Bioavailability is a topic of interest to many researchers, so scientific studies were a good source for this subtopic.

Technical Information

Not all the nutrients in vegetables are readily available for use by the body (Palafox-Carlos, et al., 2011). One reason for this is that the chemical form of the nutrient may be unsuitable for immediate absorption by the body. The bioavailability of iron is quite low in vegetables because it is in the non-heme form and the body needs the heme form of iron. Vegetables also have low bioavailability of calcium and zinc (Gibson, et al., 2006).

Fortunately, adding foods high in vitamin C to a meal with iron-rich vegetables can increase the bioavailability of the iron by reducing the charge on the iron cation in the non-heme structure (Gibson, et al., 2006). This process allows the body to absorb and utilize the iron more readily. Eating animal proteins with iron-rich vegetables and consuming plenty of vitamin A also help improve the absorption and usage of iron (Hurrell and Egli, 2010). Phytate, an insoluble plant compound, often is responsible for the low bioavailability of iron, zinc, and calcium. However, thermal processing can degrade the phytate sufficiently to increase the bioavailability of these minerals (Gibson, et al., 2006).

Other micronutrients, such as vitamins A and C already have high bioavailability in vegetables. However, processing can still affect the absorption in the body. Vitamin A is a fat-soluble vitamin, so for it to be absorbed in the body, fat also must be consumed. Carotenoids are the precursors of vitamin A. A study by Palafox-Carlos, et al. found carotenoid bioavailability increased when foods were cooked with oils, allowing the compounds to be passively absorbed in the body (2011). In contrast, vitamin C is a water-soluble vitamin. When vegetables containing vitamin C are soaked in water or boiled, the vitamin leaches out into the water. To retain the most nutrition, it is best to boil or steam at a high temperature for a short time. Using the cooking water in the meal will also allow for consumption of the vitamin (AVRDC, 1992).

Key Message

Does my body use all the nutrients in vegetables?

Not all the nutrients in vegetables are available to your body to be used. Bioavailability is the term that describes this characteristic of vegetables. High bioavailability means the nutrient is readily accessible and easily used by the body. Low bioavailability means a nutrient may not be in the best form to be used by the body and a portion of the nutrient content may not be used by the body.

How can I get the most nutrition from the vegetables I eat?

To get the most nutrition from vegetables, you should try to increase bioavailability by cooking or by choosing specific combinations of foods.

Micronutrient	Problem	Solution
Iron	Iron in vegetables is in the wrong form for our body.	Eat meat or high vitamin C fruit or vegetable with iron-rich vegetables.
Calcium	Plant structure traps calcium, compounds reduce digestion of calcium.	Cook vegetables to increase digestibility.
Zinc	Plant structure traps zinc, compounds reduce digestion of zinc.	Cook vegetables to increase digestibility.
Vitamin A	Fat is needed to absorb Vitamin A.	Cook vegetables in a little oil.
Vitamin C	Vitamin C is soluble in water and is lost when vegetables are soaked or boiled.	Use a high temperature for a short time, use the water in the recipe.

It is best to have diversity in the preparation methods, just as there should be diversity in the selection of vegetables. By preparing vegetables many different ways, more nutrients will be available to the body and meals will be more exciting.

Bioavailability of micronutrients and processing of vegetables both have a significant effect on the overall nutritional quality of vegetables. By using a variety of simple preparation techniques, you can maximize the nutrition you get from vegetables. Turn to page <#> for more tips on preparation and easy recipes for your vegetables.

IX. Benefits of vegetable consumption

This subtopic is a summary of all the information in a short analysis of the benefits of consuming vegetables. It is included to present a concise message about the nutritional benefits of consuming vegetables to conclude this section of the booklet.

This subtopic required the examination of all the resources used in gathering this information, especially reference book and scientific resources.

Technical Information

It has long been known that vegetables are a good source of nutrition. Different vegetables offer a variety of micronutrients, ranging from vitamin A to zinc (King and Burgess, 1993). These micronutrients often are lacking in the diet of people living in developing countries, including Bhutan, Burkina Faso, Indonesia and Nepal (Gibney, et al., 2009). Malnutrition pervades every area of life for these individuals, contributing to increased risk of infection and fatigue (King and Burgess, 1993). Consuming vegetables provides those micronutrients, reducing malnutrition.

Vegetable nutrition has a few different components, namely micronutrient content, phytonutrient activity, and bioavailability of nutrients. Each vegetable has its own unique micronutrient profile, but consuming a variety of vegetables can provide many of the micronutrients the body needs (King and Burgess, 1993). Phytonutrients such as carotenes, tannins, and more cause interactions in the body that can reduce the risk of non-communicable diseases including cancer and heart disease (Duyn and Pivonka, 2000). Bioavailability describes the portion of these compounds available for use by the body. For certain micronutrients, such as iron and zinc, the bioavailability is low, but can be increased through thermal processing and eating certain combinations of foods (Gibson, et al., 2006). Overall, vegetables are a great source of micronutrients that are essential for good health and phytonutrients that can promote good health.

Key Message

How will eating more vegetables help me?

Vegetables contain many of the micronutrients that are essential for good health. Eating more vegetables can prevent and treat conditions such as vitamin A deficiency and iron deficiency anemia. By eating more vegetables, you may even be able to prevent chronic diseases like cancer, heart disease, and diabetes. Developing healthy habits, like eating vegetables, at a young age will help you lead a healthy life.

Conclusion

A resource similar to this booklet, providing information related to all aspects of vegetables and targeting an inexperienced audience, is not readily available in these countries today. The information is all available, but it is scattered among a variety of sources, including reference books, textbooks, scientific studies, and online databases. To compile information addressing the nutritional benefits of consuming vegetables, it was necessary to consult all these sources, process this information, and arrange it in a logical manner.

As previously mentioned, the initial application for this resource is the Vegetables Go to School project by AVRDC. However, the design of the booklet will be suitable for use by further audiences including home gardeners, community garden organizers, and other interested in growing and consuming vegetables. Because of this, the booklet can have an impact beyond the Vegetables Go to School program.

By filling the gap in information about vegetables, an important step toward reducing malnutrition has been taken. If people are more informed about vegetables, they will likely be more inclined to make an effort to consume vegetables. By consuming more vegetables, they will receive the micronutrients that may be lacking in their diets. This improved nutrition will lead to improved health and productivity. Education, aided by the use of this new resource, will contribute to a reduction of malnutrition in Bhutan, Burkina Faso, Indonesia, and Nepal.

Learning Adventures

Some of the greatest experiences I had in Taiwan were the educational field trips arranged by the Nutrition group at AVRDC. We took two trips in the time I was there and both gave me a great new perspective on agriculture in Taiwan. The first trip visited Tainan to see a traditional market, two community gardens, and an organic vegetable farm.

Our first stop in Tainan was the traditional market where women shop every day for their vegetables, fruit, and meat. It opens at 3 AM every day so that people who sell food can get their products in plenty of time for their business hours. I am pretty sure every vegetable grown in Taiwan was available at that market - eggplant, bamboo shoots, peppers, tomatoes, giant carrots, cucumbers, water chestnuts, broccoli, cauliflower, lettuce, kale, okra, sweet potato leaves, yams, potatoes, onions, bitter melon, beans, avocados, and so many more! Some of my favorites were the yard long bean (literally a yard long!), "pumpkin" (it's actually squash), and corn! It was sweet corn, but had colorful kernels much like ornamental Indian popcorn. Jen told us that most of the vendors are just that - vendors. Some are farmers and do grow the produce they sell, but many sell the vegetables they buy from other sources.

In addition to the vast selection of vegetables, all kinds of fruit were available - watermelon, cantaloupe, honey dew, dragon fruit, wild bananas, pineapple, apples, mangoes, papaya, kumquats, plums, etc. - and there was also lots of meat. I was surprised to see that they were selling the meat with no way to keep it cold, for the most part. Some vendors did have ice for the fish especially, but most of the other meat was simply displayed in the open air. Also, I learned that the fruit of the lotus flower is used for cooking in Taiwan. That was new! In addition to all the food, there were the usual clothing vendors, a man selling potted plants galore, and so many flower vendors. The market was incredibly busy and more than once our driver had to move me out of the path to avoid being hit by a motor bike.

Next we went to a community garden in the city. This garden was made up of many individual plots that were tended by people living in the apartment buildings in the area. Each family had a plot that was between 4 and 10 square meters to grow whatever they wished! Most grew some sort of climbing vegetables - usually beans or bitter melon - over top of their plot and then other crops in the shade below. I found 20 corn plants in the garden and many crops that were new to me. Some interesting pest protection techniques included hanging CD's from strings to reflect light and deter bugs, covering plastic bottle with a sticky resin to trap insects, and placing homemade scarecrows in the garden.

After a very filling meal, we went to another community garden that was a bit different from the first one. This garden is planned out by the members of the community ahead of time, so they grow one or two crops in each little plot. Then they share all the produce among the people who work on the garden. It is mostly cared for by retired people, which makes sense because it was huge and would take a lot of labor. It had all different kinds of vegetables, as well as many fruit trees, flowers, and a few other crops such as quinoa. There was a small rest area where people can gather and the whole thing bordered a baseball field of all things! It was interesting to see such well-planned and productive agriculture surrounded by mile high apartment complexes.

Our final stop of the day was the Chi Mei organic farm. This farm is owned by an electronics company who uses the produce in the company cafeteria. They also do a lot of outreach and educational activities there, so it is very similar to agritourism in the U.S. They didn't have many vegetables growing because the weather hadn't been cooperating, but we did get to feed their goats. The goats, chickens, ostriches, horses, pigs, and rabbits were the first livestock I've seen in Taiwan and it was really fun!

Our second trip visited a mushroom farm, a food processing factory and an agricultural research institute. The first stop on our journey was a mushroom farm near Tainan. The bus wouldn't fit down the road to the farm so we walked there and stopped at a rice farm along the way. They told us that the farm uses a rice planting machine to plant the seedlings in the field. I didn't get a chance to see it, but it sounded very interesting! We also saw the dryers that they use to dry the rice after it is harvested.

I had no idea how mushrooms were grown, so the farm visit was a very interesting experience. The first unexpected thing was seeing many large bales of cotton outside at the farm. I was confused until they explained that cotton is the medium they use to grow the mushrooms. First it is fermented in a large pile outside to make nutrients and water available for the mushrooms. It is then transferred to benches in a dark building where the spores are planted (?) in the cotton. Two weeks later, they can harvest the mushrooms! Then they use the leftover cotton for fertilizer on the other vegetable and rice fields. All natural, short growing time, big harvest, and fertilizer to sell or use at the end.

As we were driving to our next stop, we got another view of agriculture in Taiwan, but it was animal agriculture this time. At a stoplight, we pulled up next to a truck that was transporting some pigs. It was nothing like our livestock trailers or semis in the U.S.! The truck was open in the back (no roof, slatted sides) and the pigs were milling around. To keep them from overheating, there were actually sprinklers that misted the pigs to cool them off! It was so neat to see this little snippet of animal agriculture!

Our next stop was the AGV Products Corporation factory. This company is very popular in Taiwan and produces many different products. Some of its products are traditional - like pickles and some drinks - but others are specifically developed healthy foods. It was neat to see the people and machines working from the viewing area. The area we saw was producing many different kinds of pickles. The jars full of product would be in hot water and then were doused with cold water to vacuum seal them. Then they were pushed forward to a series of conveyor belts. As they traveled along, a machine labeled all the jars and some people tapped each jar with a little mallet to make sure it was sealed properly. Apparently they make a different noise if they are not completely sealed.

During the presentation, I learned that AGV is very interested in producing healthier food products. They have been working with bitter melon and have developed a drying process that takes away the bitter flavor but leaves all the nutrients. Their products are all-natural, with no preservatives (the vacuum sealing keeps them fresh) or artificial sweeteners. One point I found interesting was that they have international safety certification. I was a bit surprised to see FDA and HACCP during the presentation!

Our last stop of the day was the Taiwan Agriculture Research Institute or TARI and visited the germplasm division. This group preserves seeds for crops from all over Taiwan, which includes tropical, subtropical, and temperate crops. I was amazed by the diversity in some of the crops - they had dozens of different pictures of eggplant. We also saw the area where they sort and package the seeds. In the past, they used aluminum cans but now they use aluminum packages to save space.

We got done early with that tour, so we also got to see an overview presentation of everything done at TARI. They work to develop more nutritious and flavorful varieties of staple, fruit, and vegetable crops. They also work with flowers and medicinal plants. One of the most interesting things they do is called the Farmer's Academy. Through this program, they give Taiwanese farmers the opportunity to learn more about the latest practices in agriculture. They offer seminars and short courses at different levels for amateur to expert farmers.

It was great to learn more about how nutrition can link with agriculture through these different stops. There are a few main differences between agriculture in the U.S. and in Taiwan that I've noticed. First, in Taiwan they produce a lot more vegetable and fruit crops, while Iowa is known for our corn and soybeans. Another difference is that the research in agriculture is primarily focused on improving nutrition rather than increasing production. Finally, most of the agriculture in Taiwan is on a small scale. The fields are small and the crops require intensive care, so the scale makes sense. All these aspects work together through marketing, which is usually done at the local markets.

Both these experiences were eye-opening and definitely great adventures to add to my list of opportunities in Taiwan!

Personal Conclusions

As I was about to leave Taiwan, I had a curious feeling. I realized that I may never see my friends at AVRDC again. I could keep in touch via social media, but it is quite unlikely that we will ever be in the same place again. And while I was excited to return to the U.S. and to Iowa State University, I wasn't sure how I would handle the transition back to the American lifestyle. At that time, I couldn't really put my finger on what exactly I was feeling, but I think this quote sums it up well: "You get a strange feeling when you're about to leave a place. Like you'll not only miss the people you love but you'll miss the person you are now at this time and place because you'll never be this way ever again." - Azar Nafisi

While the statement about missing the people I love is certainly true of my leaving Taiwan, I take the second part of this quote as a challenge. My experience abroad has truly changed my perspective on everything around me. Although it is true that the experiences and opportunities of this past summer are behind me, I believe I can still be the person I was in Taiwan because that person is me. Although my perspectives and ambitions for the future have changed, I am still essentially the same person I was when I said goodbye to my family in the Des Moines airport in June. And the same person I was when I moved into my dorm room in August. And the same person I was when I rode in combines and sold pumpkins and showed dairy heifers. This opportunity has not changed me as a person, but it has had an indelible impact on how I view myself and my place in this world.

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Appendix 1: Complete Promotion Message

Vegetables are an important part of a healthy diet

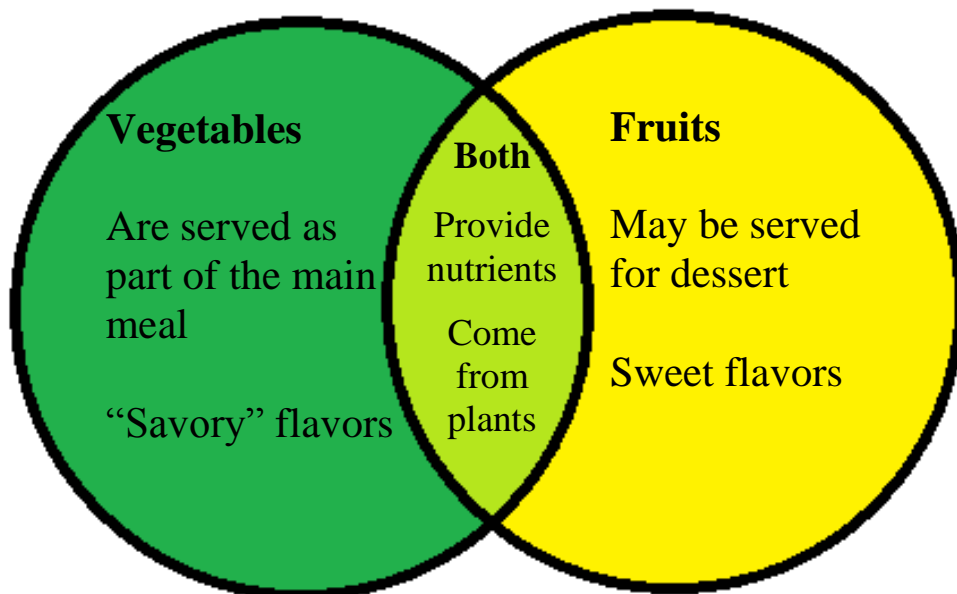
As previously stated, people in <country> may be vulnerable to many different conditions resulting from eating a poor diet. Vitamin A deficiency can cause night blindness. Iron deficiency anemia may result in lower income over your lifetime. Malnutrition as a child can lead to overweight or obesity, and complications from those conditions, as an adult. Consuming a healthy diet is essential to maintain health and productivity throughout your life.

What is a healthy diet?

- Eating foods that provide the nutrients your body needs
- *Nutrients* are compounds your body uses to function properly
 - Water, protein, carbohydrates, fat, vitamins, and minerals
- Eat many different types of foods
- Turn to page _____ for more information on foods to eat for a healthy diet
- Also include daily physical activity for a healthy lifestyle

What counts as a vegetable?

The difference between fruits and vegetables is sometimes not very clear.



In short, a vegetable is any edible part of a plant that is eaten as a main part of a meal and provides nutrients. See page _____ for a list of vegetables that can be grown in <country>.

Do all vegetables have the same nutritional benefits?

All vegetables provide nutrients to our bodies. However, the specific nutrients in each vegetable are quite different. Each vegetable contains a unique mix of vitamins and minerals. Page _____ explains what nutrients are in each vegetable.

Because not all vegetables have the same nutrients, eating different kinds of vegetables is very important. If you just eat one vegetable, your body will not get all the nutrients it needs. One easy way to be sure you are getting variety in your diet is to eat vegetables that are many different colors. Another idea is eating vegetables that come from different parts of the plant, such as the root, stem, leaf, fruit, or flower. Eating a wide variety of vegetables, in addition to other high energy foods, will help keep your body's nutrients in balance.

What nutrients can I get from vegetables?

Vegetables are a great source of vitamins and minerals, such as vitamin A, iron, folate, and more! These vitamins and minerals are sometimes called micronutrients. Micronutrients are very important for your body to function properly. The following table provides a short description of the function of nutrients found in vegetables and what vegetables are especially good sources for the nutrients.

<Insert table from Appendix 2 for appropriate country here.>

Can I just take a supplement?

Both vegetables and supplements are a good way to get micronutrients, but there are some differences.

Supplements

- One or two vitamins or minerals
- Provides high dose for severe deficiency
- Short term solution

Vegetables

- Many vitamins and minerals
- Provides continuous supply
- Long term solution

What else can vegetables give my body?

In addition to all the necessary vitamins and minerals vegetables provide to your body, some vegetables also contain compounds called phytonutrients that may promote good health and even prevent disease. These compounds are not essential to a healthy life, nor are they a guarantee for good health. However, the activity of phytonutrients can be beneficial to your health.

The most common phytonutrients are called antioxidants and are found in most vegetables (and fruits as well.) They work by neutralizing harmful molecules called free radicals in our bodies. Left alone, these free radicals cause damage to cells and DNA. This damage may increase the risk for cancer, heart disease, respiratory disease, diabetes, or other chronic diseases.

Antioxidants reduce the damage caused by free radicals and therefore reduce the risk of some chronic diseases. Antioxidants can be found in tomatoes, carrots, spinach, and amaranth, among other vegetables.

Does my body use all the nutrients in vegetables?

Not all the nutrients in vegetables are available to your body to be used. Bioavailability is the term that describes this characteristic of vegetables. High bioavailability means the nutrient is readily accessible and easily used by the body. Low bioavailability means a nutrient may not be in the best form to be used by the body and a portion of the nutrient content may not be used by the body.

How can I get the most nutrition from the vegetables I eat?

Micronutrient	Problem	Solution
Iron	Iron in vegetables is in the wrong form for our body.	Eat meat or high vitamin C fruit or vegetable with iron-rich vegetables.
Calcium	Plant structure traps calcium, compounds reduce digestion of calcium.	Cook vegetables to increase digestibility.
Zinc	Plant structure traps zinc, compounds reduce digestion of zinc.	Cook vegetables to increase digestibility.
Vitamin A	Fat is needed to absorb Vitamin A.	Cook vegetables in a little oil.
Vitamin C	Vitamin C is soluble in water and is lost when vegetables are soaked or boiled.	Use a high temperature for a short time, use the water in the recipe.

To get the most nutrition from vegetables, you should try to increase bioavailability by cooking or by choosing specific combinations of foods.

It is best to have diversity in the preparation methods, just as there should be diversity in the selection of vegetables. By preparing vegetables many different ways, more nutrients will be available to the body and meals will be more exciting.

Bioavailability of micronutrients and processing of vegetables both have a large effect on the overall nutritional quality of vegetables. By using a variety of simple preparation techniques, you can maximize the nutrition you get from vegetables. Turn to page ___ for more tips on preparation and easy recipes for your vegetables.

How will eating more vegetables help me?

Vegetables contain many of the micronutrients that are essential for good health. Eating more vegetables can prevent and treat conditions such as vitamin A deficiency and iron deficiency anemia. By eating more vegetables, you may even be able to prevent chronic diseases like cancer, heart disease, and diabetes. Developing healthy habits, like eating vegetables, at a young age will help you lead a healthy life.

Appendix 2: Nutrient Function Tables by Country

Bhutan

Nutrient	Function	Signs of Deficiency	Good Sources
Protein	Used to build new cells, repair wounds, for energy	Stunted growth, lack of energy, often sick	Amaranth, broccoli, cowpea, mustard green
Water	Needed for body processes and cooling; especially important with excessive sweating, diarrhea, fever	Dehydration; dark urine, small amount	All fresh vegetables
Vitamins			
Vitamin A	Prevents infection; essential for eye health; important for growing children	Night blindness	Chili, Chinese cabbage, amaranth, broccoli, pumpkin
B Vitamins	Help body use nutrients		Chili, parsley, cowpea, amaranth
Vitamin C	Needed for healthy bones, blood vessels; protects immune system	Swollen, bleeding gums	Chili, broccoli, cauliflower, mustard green
Folate	Helps red blood cells carry oxygen to the body; may prevent anemia	Anemia – fatigue, reduced productivity, slower learning	Parsley, beet, amaranth, Chinese cabbage
Minerals			
Calcium	Strong teeth and bones; very important for growing children		Amaranth, mustard green, Chinese cabbage, broccoli
Iron	Needed for red blood cells to carry oxygen; especially important for girls and women ages 10-55	Iron-deficient anemia – fatigue, reduced productivity, slower learning	Amaranth, chard, mustard green, lettuce, peas
Magnesium	Needed for strong bones, teeth; protects immune system		Chard, cowpea, amaranth, okra
Potassium	Needed to rehydrate the body; important with excessive sweating and diarrhea	Dehydration	Amaranth, garlic, chili, broccoli, mustard green
Zinc	Important for proper growth for children	Stunted growth	Cowpea, garlic, amaranth, okra
Other			
Fiber	Improves digestion and nutrient absorption; food has more bulk, gives feeling of fullness	Hard stools, constipation	All unprocessed vegetables

Sources: Nutrition for Developing Countries, Human Nutrition (Gibney), National Nutrient Database

Burkina Faso

Nutrient	Function	Signs of Deficiency	Good Sources
Protein	Used to build new cells, repair wounds, for energy	Stunted growth, lack of energy, often sick	Moringa, garlic, kale, cowpea leaves
Water	Needed for body processes and cooling; especially important with excessive sweating, diarrhea, fever	Dehydration; dark urine, small amount	All fresh vegetables
Vitamins			
Vitamin A	Prevents infection; essential for eye health; important for growing children	Night blindness	Sweet potato leaves, chili, kale, moringa, spinach
B Vitamins	Help body use nutrients		Chili, moringa, cowpea leaves
Vitamin C	Needed for healthy bones, blood vessels; protects immune system	Swollen, bleeding gums	Chili, sweet pepper, kale, amaranth, moringa
Folate	Helps red blood cells carry oxygen to the body; may prevent anemia	Anemia – fatigue, reduced productivity, slower learning	Spinach, kale, cowpea leaves, amaranth, okra
Minerals			
Calcium	Strong teeth and bones; very important for growing children		Amaranth, moringa, kale, spinach, okra
Iron	Needed for red blood cells to carry oxygen; especially important for girls and women ages 10-55	Iron-deficient anemia – fatigue, reduced productivity, slower learning	Amaranth, moringa, spinach, cowpea leaves, kale, lettuce
Magnesium	Needed for strong bones, teeth; protects immune system		Moringa, spinach, amaranth, kale, okra
Potassium	Needed to rehydrate the body; important with excessive sweating and diarrhea	Dehydration	Yam, spinach, amaranth, kale, garlic
Zinc	Important for proper growth for children	Stunted growth	Garlic, amaranth, moringa, okra, kale
Other			
Fiber	Improves digestion and nutrient absorption; food has more bulk, gives feeling of fullness	Hard stools, constipation	All unprocessed vegetables

Sources: Nutrition for Developing Countries, Human Nutrition (Gibney), National Nutrient Database

Indonesia

Nutrient	Function	Signs of Deficiency	Good Sources
Protein	Used to build new cells, repair wounds, for energy	Stunted growth, lack of energy, often sick	Amaranth, broccoli, spinach, mustard greens, yardlong bean
Water	Needed for body processes and cooling; especially important with excessive sweating, diarrhea, fever	Dehydration; dark urine, small amount	All fresh vegetables
Vitamins			
Vitamin A	Prevents infection; essential for eye health; important for growing children	Night blindness	Sweet potato, chili, spinach, Chinese cabbage, amaranth
B Vitamins	Help body use nutrients		Chili, sweet potato, amaranth, broccoli
Vitamin C	Needed for healthy bones, blood vessels; protects immune system	Swollen, bleeding gums	Sweet pepper, broccoli, bitter gourd, cauliflower
Folate	Helps red blood cells carry oxygen to the body; may prevent anemia	Anemia – fatigue, reduced productivity, slower learning	Spinach, chayote, amaranth, bitter gourd, broccoli
Minerals			
Calcium	Strong teeth and bones; very important for growing children		Amaranth, mustard greens, spinach, Chinese cabbage
Iron	Needed for red blood cells to carry oxygen; especially important for girls and women ages 10-55	Iron-deficient anemia – fatigue, reduced productivity, slower learning	Amaranth, spinach, mustard greens, bunching onion, lettuce
Magnesium	Needed for strong bones, teeth; protects immune system		Spinach, amaranth, mustard greens, yardlong bean
Potassium	Needed to rehydrate the body; important with excessive sweating and diarrhea	Dehydration	Spinach, amaranth, garlic, potato, chili, broccoli
Zinc	Important for proper growth for children	Stunted growth	Garlic, amaranth, bitter gourd, chayote
Other			
Fiber	Improves digestion and nutrient absorption; food has more bulk, gives feeling of fullness	Hard stools, constipation	All unprocessed vegetables

Sources: Nutrition for Developing Countries, Human Nutrition (Gibney), National Nutrient Database

Nepal

Nutrient	Function	Signs of Deficiency	Good Sources
Protein	Used to build new cells, repair wounds, for energy	Stunted growth, lack of energy, often sick	Vegetable soybean, broad bean, garlic
Water	Needed for body processes and cooling; especially important with excessive sweating, diarrhea, fever	Dehydration; dark urine, small amount	All fresh vegetables
Vitamins			
Vitamin A	Prevents infection; essential for eye health; important for growing children	Night blindness	Sweet potato, chili, spinach, amaranth, broccoli
B Vitamins	Help body use nutrients		Chili, broad bean, soybean, sweet potato
Vitamin C	Needed for healthy bones, blood vessels; protects immune system	Swollen, bleeding gums	Chili, sweet pepper, broccoli, bitter gourd, cauliflower
Folate	Helps red blood cells carry oxygen to the body; may prevent anemia	Anemia – fatigue, reduced productivity, slower learning	Spinach, soybean, broad bean, Malabar spinach, beetroot
Minerals			
Calcium	Strong teeth and bones; very important for growing children		Amaranth, dill, Malabar spinach, broad leaf mustard
Iron	Needed for red blood cells to carry oxygen; especially important for girls and women ages 10-55	Iron-deficient anemia – fatigue, reduced productivity, slower learning	Amaranth, spinach, asparagus, soybean, broad leaf mustard
Magnesium	Needed for strong bones, teeth; protects immune system		Spinach, soybean, dill, amaranth, okra
Potassium	Needed to rehydrate the body; important with excessive sweating and diarrhea	Dehydration	Yam, dill, spinach, taro, amaranth
Zinc	Important for proper growth for children	Stunted growth	Soybean, garlic, broad bean, dill
Other			
Fiber	Improves digestion and nutrient absorption; food has more bulk, gives feeling of fullness	Hard stools, constipation	All unprocessed vegetables

Sources: Nutrition for Developing Countries, Human Nutrition (Gibney), National Nutrient Database

Appendix 3: Interview Questionnaire

Vegetable Utilization in <country> - Interview

Vegetable Preparation

1. What vegetables are popular among families in <country>?
 - This question is meant to break the ice and direct the conversation toward vegetables and vegetable utilization.
2. How many meals in a day would usually include vegetables?
 - The food habits of people in the countries of interest are important when considering nutrition.
3. Can you describe common dishes with vegetables and how they are prepared?
 - Preparation of food has an impact on nutrition. It is also important to include culturally appropriate recipes for preparing vegetables in the booklet.

Challenges to Vegetable Consumption

4. Are there any taboos or superstitions about certain foods in <country>? (In Bangladesh, pregnant mothers are advised not to eat duck meat because they believe it will make their baby have a long neck.)
 - a. When you growing up, did anybody tell you should or should not eat certain foods? Why?
 - b. Is there any vegetable or other food that people believed that should be avoided by pregnant women or elderly or that is advised for them to eat? Why or why not?
 - These questions are meant to probe for information related to food taboos. These superstitions, generally based on avoiding certain foods, can have significant nutritional implications.
5. Are there any common views or ideas that would affect vegetable consumption? (Men in Kenya generally don't eat pumpkin because it is viewed as a vegetable for children.)
 - Cultural practices and perspectives can also influence dietary choices.
6. Aside from the reasons already mentioned, what other factors could affect people in <country> eating vegetables? (availability, affordability, education, geography, etc.)
 - When considering trying to increase vegetable consumption, it is important to take all potential influences into account.
7. What is the general attitude toward vegetable consumption in <country>? Do they want to eat more vegetables or do they have other diet-related concerns?
 - The general attitude toward vegetables can have a large impact on the response to this project in the countries.

Additional questions to gather appropriate information were asked as the interview progressed.

Appendix 4: Interview Notes

Dr. Dhruva Bhattarai, Nepal, 7/29/14

1. What vegetables are popular among families in Nepal?
 - Cauliflower, cabbage, tomato, green bean, broadleaf mustard, spinach, eggplant, radish, okra, pumpkin, potato
 - Most people eat those vegetables
 - More than 50 vegetables commercially cultivated
2. How many meals in a day would usually include vegetables?
 - Two meals with vegetables – lunch and dinner
 - Tea and snack in morning
 - 9-11 is lunch
 - 1-2 Light snack
 - 7-8 Dinner
 - People in Nepal usually eat more than 250g of vegetables per day
3. Can you describe common dishes that contain vegetables?
 - Dal, bhat, tarkari and achar – translated lentil, rice, vegetable curry, and pickle
 - Dal- lentil soup
 - Bhat – steamed rice
 - Tarkari – vegetable curry, or vegetables prepared many different ways
 - Achar – sour and spicy, ground tomatoes, sliced radish, gourd coriander, boiled potatoes
 - Semi processed in off-season – July to November
 - Gundruk – fermented vegetable leaves in soup, sour taste
 - Maseura – blackgram and colocossia tuber
 - Used in villages
4. Are there any taboos or superstitions about food in Nepal?
 - Nepali women forbidden to eat papaya and eggplant while pregnant because it may lead to miscarriage
 - Nepali women don't eat eggplant and taro during pregnancy because it causes itching
5. What other reasons could prevent people from eating vegetables?
 - Health conscious – people are wary of pesticide use in commercial production
 - Therefore they try to avoid commercial vegetables
 - Pesticide use has become an issue in the last two years
 - People practice home gardening, terrace gardening to provide vegetables instead
6. What is the general attitude toward vegetable consumption in Nepal?
 - Nepali consumers realize importance of vegetables
 - 105 kg/year/person, up from 60kg/person past two decades
 - Ministry of Agriculture data

Dr. Passang Lhamo, Bhutan, 7/31/14

1. What vegetables are popular among families in Bhutan?
 - Children – potatoes
 - Adults – mild chili peppers, green vegetables, Chinese cabbage, spinach, radish
 - Locally – sweet gourd, bitter gourd, eggplant
 - Wild vegetables – ferns, snake plant

2. How many meals in a day would usually include vegetables?
 - Lunch and dinner
 - Rice is staple, sometimes accompanied by spicy vegetable dish
 - Meal is about 1/10 vegetable
 - A large plate of rice with a small bowl of vegetables
 - Vegetable is usually not plain
 - Prepared spicy or with cheese

3. Can you describe common dishes with vegetables and how they are prepared?
 - Vegetable momo – dumpling filled with carrot, cabbage, onion
 - Side dishes
 - Meat with vegetables
 - Ema datshi – ema is chili, datshi is cheese
 - Made with fresh green chili or dried red chili
 - Split the chili, remove seeds
 - Combine chili with onion, tomato, salt, water and a little oil to cook
 - Cook for 10-15 minutes

4. Are there any taboos or superstitions about certain foods in Nepal?
 - New mothers (postnatal)
 - Don't eat green vegetables – cause diarrhea in infant
 - Don't eat hard/crunchy foods – mother could lose a tooth
 - Don't eat eggplant or potato – causes itching
 - Instead eat soft food, especially soup
 - Also drink fermented rice broth made with rice, yeast, egg, and butter
 - Pregnant women
 - Don't eat papaya – cause a miscarriage
 - They think she is always hungry so neighbors give her food and she eats more
 - Many animal products
 - Some follow recommendations and eat green vegetables
 - Usually don't drink alcohol

5. Are there any common views or ideas that would affect vegetable consumption?
 - No other restrictions on vegetable consumption
 - Everyone eats all vegetables

6. Aside from the reasons already mentioned, what other factors could affect vegetable consumption?
 - During the lean season – cold and dry in the north – farmers eat dry and preserved vegetables
 - During the rainy season in the south nothing can grow, so they use the dried vegetables
 - Education/Knowledge
 - Broccoli – when first introduced people didn't know what it was
 - Since they didn't know how to eat it, they didn't!
 - Agriculture extension has helped them learn how and people do eat it now
 - Moringa – eat fruit and flower, not leaves (don't know you can)
 - Sweet potato – eat root, not leaves (don't know you can)
 - In general, maybe people are comfortable with what is normal so they don't try new things and explore new vegetables that they don't know how to use.

7. What is the general attitude toward vegetable consumption in Bhutan?
 - In the past – people were not used to eating vegetables, so they didn't miss it
 - With increasing non-communicable disease recently – government is teaching people about vegetables
 - People are more economically stable, so they have increased literacy – read and see TV ads about vegetables – know more about them
 - As a result, more people are eating green salad and other vegetables
 - Some grow vegetables in flower pots

8. What are other ways they could increase vegetable consumption in Bhutan?
 - Government and agriculture extension have provided free seeds, maybe should switch to subsidies
 - Would like to see establishment of farmer groups
 - Preserve their own seeds
 - Share knowledge about vegetables – both wild and commercial
 - Promote local vegetables
 - Local vegetable production is good for environment too

9. What are the food based dietary guidelines used in Bhutan? Where could we find them?
 - They don't have any
 - In process of developing some based on Thailand and India
 - Bhutanese Food Guide Pyramid in the works
 - Could find consumption information from the Ministry of Agriculture
 - No established nutrition lab in Bhutanese government

Nabin Sharma, Nepal, 8/2/14

Mr. Sharma worked for extension through the Ministry of Agriculture in Nepal. He is currently a Ph.D. student in plant pathology at National Chung Hsing University in Taichung, Taiwan.

- 1) What vegetables are popular among families in Nepal?
 - Whatever can be grown is eaten

- 2) How many meals in a day usually include vegetables?
 - Simple answer – 2 meals
 - Food habits in Nepal:
 - 5-6 AM – tea or milk (especially for children)
 - 9-10 AM – lunch (Khana)
 - Rice at the center of the plate
 - Dal – lentil soup
 - Vegetable – ex: cauliflower, broccoli, potato, gourd, etc.
 - Saag – leafy vegetables
 - Pickle – spicy and salty; may be preserved or fresh
 - Yogurt OR milk; optional, not both
 - Papert – fried cracker – optional
 - Water to drink
 - 3 PM – snack (Khaja)
 - Chapati – millet, buckwheat, wheat, or maize flour
 - Maybe some vegetables or chutney
 - Roasted maize “popped” corn sometimes
 - 5-6 PM – tea or coffee with milk and sugar
 - 7-8 PM – dinner (Khana)
 - Essentially the same as lunch
 - Tea before bed
 - Meat once a week or more
 - Those who eat once a week eat more at one time – usually rural
 - Tends to be fresh meat – may be food safety concern
 - Depends on economic situation of family
 - People eat with their hands

- 3) Can you describe a common dish that contains vegetables and how it is prepared?
 - Vegetables are their own dish
 - Cooking is based on the vegetable
 - How you cut it up might influence how it is prepared

- 4) Are there any taboos or superstitions about certain foods in Nepal?
 - Some ideas, usually have justification
 - Pregnant women don’t eat yam – causes irritation
 - Brahman caste used to avoid mushrooms – collected wild, some were poisonous
 - Now cultivated, so no one really avoids it
 - Don’t eat too much eggplant at once – causes constipation

- 5) Are there any common views or ideas that would affect vegetable consumption?
 - Anyone can eat anything that you can grow or buy
 - Other interesting ideas:
 - If you point at a cucumber with your second finger it will spoil.

- You must break a snake gourd immediately after harvesting or there will be a snake inside when you use it later.
 - Pregnant women don't harvest bamboo shoots because it could lead to a need for surgery when the baby is delivered.
- 6) Aside from the reasons already mentioned, what other factors could affect people in Nepal eating vegetables?
- Availability is a major factor – off season there are very few vegetables available
 - Affordability – people don't buy vegetables in rural areas; also important for fruit
 - Poverty – producers would rather sell vegetables than eat them; rice is first food priority
 - Education – not a big issue because there is good access to information
 - Geography – transportation may have a small effect
- 7) What is the general attitude toward vegetable consumption in Nepal?
- Habits have a very strong influence on vegetable consumption
 - Rice needs to be a big part of the meal for fullness

Irene Kosasih Interview Notes, 8/7/14

Irene is a summer intern at AVRDC and studies agriculture science at National Chung Hsing University. She is from Indonesia, but her family is of Chinese heritage.

1. What vegetables are popular among families in Indonesia?
 - Chili pepper – used in most foods and recipes
 - Tomato, beans, cabbage, potato
2. How many meals in a day would usually include vegetables?
 - Two meals – lunch and dinner
3. Can you describe common dishes that contain vegetables and how they are prepared?
 - Martabak – corn and potato pancake
 - Potato is mashed, combined with corn, flour, sugar, salt, whole mixture is fried
4. Are there any taboos or superstitions about certain foods in Indonesia?
 - Taboos really depend on the area of Indonesia
 - Girls shouldn't eat cucumber because it causes more vaginal fluid to be excreted
 - Pregnant mothers should eat more katuk leaves
5. Are there any common views or ideas that would affect vegetable consumption?
 - Children are told if they don't eat all their rice, the rice is "crying"
 - Encouraged to finish all their food
6. Aside from the reasons already mentioned, what other factors could affect people in Indonesia eating vegetables?

- Mostly depends on personal preference
 - People eat more vegetables than meat because meat is more expensive
 - Vegetables grow quickly in Indonesia, so the supply is abundant and the price is low
7. What is the general attitude toward vegetable consumption in Indonesia?
- Vegetables are very inexpensive, so most people eat them regardless of personal preference

L. Yohannes Krisnadi and Evy Latifah Interview Notes, 8/7/14

Mr. Krisnadi and Ms. Latifah are from Indonesia and work with the Assessment Institute for Agriculture Technology.

1. What vegetables are popular among families in Indonesia?
 - Tomato, pepper, cassava leaf, cabbage, papaya leaf, carrot, amaranth, spinach, bok choy, bitter melon, onion, shallot, eggplant, kang kong and many more
2. How many meals in a day would usually include vegetables?
 - Two meals – lunch and dinner; sometimes at breakfast
3. Can you describe common dishes that contain vegetables and how they are prepared?
 - Soup – boil vegetables, mix with spices
 - Sambal – similar to salsa, chili and onion with salt and/or sugar
 - Gado gado – rice mixed with vegetables (carrot, sweet potato, chili and peanut sauce)
 - Fresh vegetable salad in West Java
4. Are there any taboos or superstitions about certain foods in Indonesia?
 - Pregnant mothers must cook vegetables – may have pesticide residue, dangerous for baby
 - Pregnant mothers should not eat Durian fruit, young pineapple – high alcohol in the fruit, also may cause premature birth because the mother has high blood pressure
 - Pregnant mothers should not drink alcohol
 - Babies can eat other food after 6 months of age
5. Are there any common views or ideas that would affect vegetable consumption?
 - Wealthy people don't eat many vegetables because they can afford meat, idea that poor people eat vegetables
6. Aside from the reasons already mentioned, what other factors could affect people in Indonesia eating vegetables?
 - Pesticides used in vegetable crops – needed to control pests (year round growing conditions are good for pests) but are dangerous for people to eat
 - Price fluctuation with chili, shallot and onion may affect consumption
 - Vegetables are very inexpensive so poor people eat many vegetables

- Vegetables can't be grown everywhere in Indonesia – poor soil, water, climate conditions
 - Many vegetables grown 600 meters above sea level and higher
 - Below that altitude, conditions are not as good
 - East Indonesia has poor climate, buys vegetables from Java
 - In the cities, people must buy vegetables at the market
7. What is the general attitude toward vegetable consumption in Indonesia?
 - Not everyone can buy meat because it is expensive, but everyone can afford vegetables
 8. How can vegetable consumption be increased in Indonesia?
 - Programs to help all people grow vegetables – more to consume, safer (fewer pesticides), can sell extra vegetables
 - School gardens and urban gardening especially important
 - Organic farming to avoid pesticide use, use Integrated Pest Management practices instead

Mr. Serge Rodrigue Email Interview, 8/27/14

1. Which vegetables are popular among families in Burkina Faso?
 - Leafy vegetables: sorrel, amaranth, baobab leaves, mallow mallow (bulvaka), spinach, onion leaves, bean leaves, potato leaves, kapok, eggplant leaf
 - Vegetables Fruits: Fresh tomatoes, fresh or dried okra, eggplant, zucchini, cucumber, cabbage, onion, green peppers, squash, carrots, sweet potatoes
2. Generally, how many meals a day include vegetables?
 - Two meals a day
3. Can you describe the common dishes (with vegetables) and how they are prepared?
 - Rice with fatty
 - Rice with peanut sauce tab
 - Rice with vegetables sauce
 - Te (corn dough or millet or sorghum) leaf sauce
4. Aside from the reasons already mentioned, are there any other factors that may affect people in Burkina Faso to eat vegetables? (availability, accessibility, education, geography, or other)
 - The availability because some vegetables are seasonal
 - The financial and geographical accessibility
5. What is the general attitude towards the consumption of vegetables in Burkina Faso? Do they want to eat more vegetables or do they have other concerns related to food?
 - There is not a strong attachment related to vegetables, the priority is the staple food.