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THE CHARACTERIZATION AND CALCULATION OF DIET QUALITY FOR A LOW-INCOME POPULATION IN QUITO, ECUADOR

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ABSTRACT OF THESIS

THE CHARACTERIZATION AND CALCULATION OF DIET QUALITY FOR A LOW-INCOME POPULATION IN QUITO, ECUADOR

Diet is an important factor in disease prevention and health promotion. According to Global Health, in 2006 four of the top five leading causes of death in Ecuador were heart disease, cerebrovascular diseases, diabetes mellitus and hypertensive diseases which are all associated with dietary intake. Knowledge of eating patterns enables the formulation of public policies directed toward health promotion and disease prevention. Studies using indices that measure dietary quality and summarize the main characteristics of healthful eating habits enables the evaluation of possible associations between health determinants and health indicators. Most studies using score-based approaches have generally shown more varied and healthful diets to be associated with higher income, higher education, lower obesity rates and reduced cardiovascular disease mortality. The purpose of this research was to characterize the health practices and diet quality of a low-income population in Quito, Ecuador. A diet quality index (MyPyramid Index) was developed to calculate diet scores for subjects and results show that the mean MPI was 34.1 out of a possible score of 70. Body Mass Index (BMI) was calculated using heights and weights recorded. The mean BMI was 27.2 which would indicate that this sample is categorized as being overweight.

KEY WORDS: diet quality, low-income, Ecuador, health indicators, physical activity

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THESIS

Rachel Ann Beyatte

The Graduate School

University of Kentucky

2010

THE CHARACTERIZATION AND CALCULATION OF DIET QUALITY FOR A LOW-INCOME POPULATION IN QUITO, ECUADOR

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Sciences
College of Agriculture
at the University of Kentucky

By

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Lexington, KY

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Chapter 1: Introduction

Diet is an important factor in disease prevention and health promotion (Fisberg et al., 2006). According to Global Health, in 2006, four of the top five leading causes of death in Ecuador were heart disease, cerebrovascular diseases, diabetes mellitus and hypertensive diseases, which are all associated with dietary intake (Waters, 2006). Ecuador is no exception to the growing prevalence of overweight and obese individuals in the world today. As of 2004, 40.4 percent of Ecuadorian women were overweight and 14.1 percent were obese (Waters, 2006). Overweight and obesity represents a critical feature of public health because it is associated with diabetes, heart disease, hypertension, and some forms of cancer (Waters, 2006).

Knowledge of eating patterns enables the formulation of public policies directed toward health promotion and disease prevention (Fisberg et al., 2006). Studies using indices that measure dietary quality and summarize the main characteristics of healthful eating habits enables the evaluation of possible associations between health determinants and health outcomes. Most studies using score-based approaches have generally shown more varied and healthful diets to be associated with higher income, higher education, higher energy intake, nutrient adequacy, high concentrations of serum nutrients, higher bone mineral density, reduced all-cause and cardiovascular disease mortality, and in some cases, reduced incidence of and mortality from certain cancers (Moeller et al., 2007).

The purpose of this research was to characterize the health practices and diet quality of a low-income population in Quito, Ecuador. Research already has established that an excess total energy intake (kcalories) compared to total energy expended will lead

to weight gain and thus a higher body mass index (BMI). Research is available that shows the relationship between higher BMI and excess weight gain and increased risk factors for specific diseases. Poor nutritional intake can lead to increased weight gain and inadequate intake of necessary vitamins and minerals. Increased BMI, excess weight, poor nutritional intake and inadequate intake of vitamins and minerals all increase health risks. Little research has been done to identify dietary practices and other factors associated with health outcomes with this population.

The objectives of the study are to analyze secondary data collected in Quito, Ecuador to: 1) characterize the health status of participants, 2) calculate diet quality for the population and 3) suggest where intervention is needed most in this low-income population. It is hypothesized that this low-income population will have low diet quality scores and a high rate of obesity.

Chapter 2: Review of Literature

Healthy Eating Index

The Healthy Eating Index (HEI) is an instrument developed by the United States Department of Agriculture (USDA) to measure the overall quality of individual diets. This index was created in 1995 to measure how well American's diets conformed to the recommendations of the Dietary Guidelines for Americans (DGA) and the original Food Guide Pyramid (Dixon, 2008). The USDA developed the DGAs to help Americans choose diets that will meet nutrient requirements, promote health, support active lives and reduce risks of chronic disease (www.health.gov). In 1980 the DGAs were first published. They are now revised every five years to reflect current dietary trends and new scientific research. The Food Guide Pyramid was first published in 1992 as a consumer friendly tool to express the DGAs and to help people apply the science to their everyday lives. MyPyramid was developed to reflect the updates made to the DGAs in 2005.

In 2005 new DGAs were released which prompted a revision of the original HEI which resulted in the Healthy Eating Index-2005 (HEI-2005). This index measures the intake of ten dietary components to provide a single score out of a possible 100 points. The new HEI-2005 is a standardized tool that can be used in nutrition monitoring, interventions, and research (Guenther et al., 2008). Updating the HEI has made it possible to use one universal score that all food and nutrition professionals can use and modify for different populations as needed. Potentially the HEI-2005 could be used to monitor the diet quality of the U.S. population and other sub-populations, and also to evaluate dietary interventions. Although, the validity for specific ethnic and cultural

groups whose dietary patterns are markedly different from the U.S. norms remains to be determined (Guenther et al., 2008).

Diet has an important impact on health and is one of a list of environmental factors that have the capability for modifying the prevailing morbidity and mortality profile (Fisberg et al., 2006). Certain dietary patterns and health indicator measurements have been linked to increases in health risks for chronic diseases. The health indicators that this study will focus on are: body mass index, blood pressure, and blood glucose. Healthful eating patterns along with other healthful lifestyle behaviors have the potential to reduce such risks of chronic disease.

Body Mass Index (BMI): Body mass index is a number calculated using a persons height and weight to represent body fatness and to screen for weight categories which may lead to health problems. An excess total energy intake compared to total amount of energy expended will lead to weight gain resulting in a higher BMI. Research has shown that there is a relationship between higher BMI, excess weight gain and increased risk factors for disease (Newby et al., 2003). Poor nutritional intake can lead to increased weight gain and inadequate intake of necessary vitamins and minerals which will also lead to increased health risks. Obese individuals are at an increased risk of cardiovascular disease, type 2 diabetes and certain cancers (Newby et al., 2003).

Lower HEI scores also have been associated with a higher BMI. A study by Guo and colleagues (2004) suggests that HEI, which is used primarily as a measure of overall diet quality, may also be used as a predictor of obesity. This study used information gathered from 10,930 individuals who participated in the Third National Health and Nutrition Examination Survey (NHANES III). Diet quality was assessed using data

collected from a 24 hour recall and an interactive interview. HEI scores and BMI's were calculated for each individual based on the data collected. The results show that the HEI scores are significantly lower among obese subjects when compared to those of normal weight.

The effects of increasing globalization and urbanization over the last few decades have influenced dietary patterns and lifestyles among different population groups throughout the world (Fisberg et al., 2006). The "Western" diet has become more prevalent throughout the world today. It is characterized by high levels of fat, saturated fat and sodium along with low levels of calcium and fiber. This type of diet is been associated with increasing rates of obesity (Fisberg et al., 2006). The Food and Agriculture Organization estimated that roughly 65% of the Ecuador's calories came from grains, fats, oils, sugars, and sweets. They also estimated that between 1989 and 2003 the average citizen's total caloric intake rose from 2,490 to 2,710 kilocalories and included 100 grams of fat per day (Bernstein, 2008).

Blood Pressure: According to the Center for Disease Control (CDC) the higher a person's blood pressure, the greater the chance of heart attack, heart failure, stroke, and kidney disease. A study by Karanja and colleges (2007) summarizes one of the most important studies done on blood pressure and diet which was the Dietary Approaches to Stop Hypertension (DASH)-Sodium trial test. Two experimental diets were selected for the DASH study and compared with each other, and with a third which was the control diet. The control diet was characteristically low in potassium, calcium, magnesium and fiber. The first experimental diet was an idealized diet consisting of fruits and vegetables but otherwise similar to the control diet (a "fruits and vegetables diet"), with the

exception of fewer snacks and sweets. The second experimental diet combined elements of the previous two (control and fruits-and-vegetables)—this diet has been called "the DASH diet". The DASH diet was also high in fruits, vegetables and low fat dairy foods, and also rich in fiber and protein. The DASH diet was also high in whole grains, poultry, fish and nuts while being low in fat and red meat content, sweets and sugar-containing beverages. There were 459 subjects that participated in the diet trial. Participants ate one of the three dietary patterns in three separate phases of the trial, including screening, run-in and intervention. In the screening phase, participants were screened for eligibility based on the combined results of blood pressure readings and a Stanford 7-Day Physical Activity Recall questionnaire. In the three week run-in phase, each subject was given the control diet for three weeks, had their blood pressure measurements taken on each of five separate days, gave one 24-hour urine sample and completed a questionnaire on symptoms. At this point the subjects were each randomly assigned to one of the three diets outlined above, to begin at the start of the fourth week. The intervention phase followed next; this was an eight week period in which the subjects followed the diet they had each been randomly assigned to. Blood pressures and urine samples were collected again during this time together with symptom and physical activity recall questionnaires.

The primary outcome of the trial was systolic blood pressure. The DASH diet lowered blood pressures by an average of 5.5 and 3.0 mm Hg for systolic and diastolic, compared to the control diet. The hypertensive subjects experienced a drop of 11.4 mm Hg in their systolic and 2.1 mm Hg in their diastolic phases. The fruits-and-vegetables diet was also successful, although it produced more modest reductions over the control diet (2.8 mm Hg systolic and 1.1 mm Hg diastolic) (Karanja et al., 2007).

Blood Glucose: According to the WHO, deaths in Ecuador from type 1 and type 2 diabetes complications rose from 8% to 18% in men from 1990-2000. Among women, the rates rose from 11% to 22% in the same time span. The rate of death from diabetes complications has almost doubled in the previous decade (Bernstein, 2008). With these increasing rates, diabetes should be a key concern of those developing intervention and prevention policies for Ecuador in the future.

Diabetes is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long term damage, dysfunction, and failure of different organs, especially the eyes, kidneys, nerves, heart, and blood vessels (Inzucchi et al., 2010). Type 2 diabetes is currently the most prevalent type affecting Americans in the United States and it accounts for 90-95% of cases. Most patients with this form of diabetes are obese, and obesity itself causes some degree of insulin resistance (Inzucchi et al., 2010). The risk of developing this type of diabetes increases with age, obesity (especially in the abdominal area) and lack of physical activity. Type 2 diabetes is frequently undiagnosed because glucose levels increase gradually over time and it make take years for the symptoms to be noticed. Screening blood glucose tolerance can help aid in early diagnosis, which can be helpful to reduce the risk of complications with early treatment and management.

The marked increase in the prevalence of overweight and obesity is presumably responsible for the recent increase in the prevalence of type 2 diabetes. Even moderate weight loss in combination with increased activity can improve insulin sensitivity and

glycemic control in patients with type 2 diabetes and prevent the development of type 2 diabetes in high-risk persons (Klein et al., 2004).

Physical Activity: There is compelling evidence that an active and fit way of life has many important health benefits and that sedentary habits are associated with an increased risk of numerous chronic diseases and decreased longevity (Blair et al., 2004). According to the U.S. Department of Health and Human Services there is a strong association between physical activity and a lower risk of early death, cardiovascular disease, stroke, type 2 diabetes, hypertension, hyperlipidemia and certain cancers. The Centers for Disease Control (CDC), the National Institute of Health (NIH), the American Heart Association (AHA), and the American College of Sports Medicine (ACSM) all recommend that adults accumulate thirty minutes of moderately intense physical activity throughout the day on most days of the week.

There are a number of reasons why people do not participate in the recommended amount of physical activity required. Environmental factors such as neighborhood safety and reliance on motorized vehicles for transportation have had an influence on the amount of physical activity acquired (Hampl et al., 2002). People may not be expending as much energy at work or around the home as in previous generations which may contribute to a decrease in physical activity and weight gain. The number of hours people spend in front of an electronic screen (computer, television or video games) each day may also have an effect on the amount of time spent exercising.

Dental Health: It is the position of the American Dietetic Association that nutrition is an integral component of oral health. Scientific and epidemiological data suggest a lifelong synergy between nutrition and the integrity of the oral cavity in health

and disease (Touger-Decker & Mobely, 2007). Oral health problems such as chewing or swallowing difficulty and mouth pain have been identified as indicators of high nutrition risk (Bailey et al., 2004). Some common causes of poor oral health include: tooth decay, tooth loss, periodontal disease, ill fitting dental implants and mouth sores. Diet and nutrition have a direct influence on the progression of tooth decay which is an oral infectious disease and can eventually lead to tooth loss. Periodontal disease is also an oral infectious disease involving inflammation and loss of bone and the supporting tissue of the teeth. Behavioral risk factors associated with periodontal disease include poor oral hygiene, tobacco use, and diet. Oral health problems have been associated with inconsistent energy intake, involuntary weight loss and inadequate energy and nutrient intake (Bailey et al., 2004).

Socioeconomic Status and Health

Research shows that it is easier for individuals to become overweight if they have a limited income, less education or are food insecure (Townsend et al., 2005). There is a newly appreciated paradox that has linked poverty, food insecurity, and malnutrition to obesity (Tanumihardojo et al., 2007). When food is available, people who are food insecure consume calories in excess to their energy requirements in case they are not able to access food at a later time. Individuals may begin to compromise the quality of their diets for quantity. Compromising diet quality often leads to a higher intake of energy from foods that are higher in fat and carbohydrate, but lower in nutrient density. These energy-dense foods are often less expensive than foods of lower energy density or higher nutrient density, such as fruits, vegetables, and whole-grains. Unfortunately, energy

dense diets generally lack the dietary quality needed to promote optimal health and prevent chronic disease (Tanumihardojo et al., 2007). Rapid economic and demographic changes in developing countries such as Ecuador may facilitate the replacement of low-calorie diets from predominantly plant-based sources with high-calorie diets rich in fat, sugar, and refined grains from predominantly animal-based sources (Bernstein, 2008).

A recent study was conducted by the USDA (2008) using the HEI-2005 and data from the National Health and Nutrition Examination Survey (NHANES) 2003-04 to measure diet quality for Americans living in the United States. Researchers compared HEI-2005 scores of Americans with higher incomes to those with lower incomes to see if there were any differences. In this study, low-income was defined as having a family income of less than 130% of the Federal poverty line. Although there was no significant difference in total HEI-2005 scores between the higher income and lower income families there were important differences in certain diet components. Results of this study did indicate that low-income families had significantly lower component scores for total vegetables, including dark green, orange and legumes, and whole grains than the higher income families.

Chapter 3: Research Purpose

The purpose of this research was to characterize the health practices and diet quality of a low-income population in Quito, Ecuador. The objectives of the study are to analyze secondary data collected in Quito, Ecuador to: 1) characterize the health status of participants, 2) calculate diet quality for the population and 3) suggest where intervention is needed most in this low-income population. It is hypothesized that this low-income population will have low diet quality scores and a high rate of obesity.

Chapter 4: Methodology

This study involves analysis of secondary data collected from interviews conducted at Pan de Vida in Quito, Ecuador. Pan de Vida is a local mission which offers meals along with basic medical care and health education to the less fortunate. The purpose of this study was to assess a group of individuals in Quito, Ecuador who have participated in the feeding program at the Pan de Vida mission in order to determine current health practices and health status. Data collected could be used in the future to develop an intervention targeted to this populations greatest needs. A sub-analysis was also conducted in order to determine associations between current health practices and health outcomes such as weight status, blood pressure, and blood glucose levels. This chapter describes the sample selection, data collection, instrument and procedures used to gather the data.

Sample Selection

The secondary data was from a convenience sample of adult male and female participants who came to Pan Di Vida for the feeding assistance program. The secondary data does not exclude pregnant women because the information collected added to the depth of the research. This data set excluded children as subjects because of the increased difficulty in obtaining accurate, usable data from interviewing children on nutrition intake. The interviews were conducted from June until July of 2008. No incentive was given for participating in the interviews which took approximately thirty minutes to complete.

Data Collection

The interviews were conducted by Spanish speaking medical and nutrition students from a local university. The participants completed the interview which enabled researchers to collect demographic, health and nutritional information. The interview questions can be seen in Table 4.1 which is at the end of this chapter. Height and weight were also measured in order to calculate body mass index.

The sample consisted of sixty males and females who agreed to participate in the interview and collection of medical information while at the Pan de Vida mission in Quito, Ecuador.

Measurements

Demographics: The demographics that this study focused on are age and gender. This information was collected during the personal interview with participants at the Pan de Vida mission.

Nutritional Intake & Scoring Instrument: The main objective of this study was to characterize the health and eating patterns of this population and to calculate a diet score based on this information. Nutritional intake was assessed by calculating a diet quality score based on answers given to interview questions in regards to normal food intake. The diet quality score used was designed specifically for this study. It is based on the recommendations from MyPyramid. After anthropometrics were recorded the Harris-Benedict equation was used to determine the appropriate calorie level to use for this population. The MyPyramid Index (MPI) was be based on a 1,800 calorie per day diet to best fit the calorie needs for these individuals based on their average needs. According to

MyPyramid (www.mypyramid.gov) those following a 1,800 calorie diet should consume: 1.5 cups of fruit, 2.5 cups of vegetables, 6 ounce equivalents of grains, 5 ounce equivalents of meat and beans, 3 cups of milk or dairy products and 5 teaspoons of oil. Table 4.2 shows the interview questions that were used in order to calculate a MPI for each individual. During the interview, participants were told what a serving size was for each group of foods. For example: "One serving of fruit is equal to ½ cup. How many servings of fruit do you eat in a day?" Interviewers were also given measuring cups in order to give respondents a visual of what a serving size looks like.

MyPyramid Index: The diet quality scoring system used for this research is the MyPyramid Index (MPI). This scoring system was developed to accommodate the questions asked at Pan de Vida Mission. The MPI is very similar to the HEI, which was discussed in length earlier. It is based on the recommendations of MyPyramid developed by the United States Department of Agriculture (USDA). The MPI may be more applicable to this international data set because it is based on the amounts of each food group that should generally be eaten and not based upon the specific nutritional guidelines set for Americans. MyPyramid emphasizes the healthful variety and moderation of foods that should be applicable to all nationalities.

Much like the HEI, the MPI has sections each worth up to ten points. The MPI has seven sections (fruits, vegetables, grains, meats, milk, oils and sweets & sodas) which are all worth ten points for a possible score of 70. Each section was scored according to the recommended servings for that food group according to MyPyramid. The maximum total for each of the seven categories was ten points. If a subject reported eating more than the recommended amount for that category, they still could only receive a maximum

of ten points. Also, there was no reduction in scores for consuming over what was recommended for each category.

Under the 1,800 calorie recommendation it shows that 1.5 cups of fruit should be consumed. A serving of fruit is ½ cup and therefore these individuals should eat three servings of fruit each day. Respondents were asked how many servings of fruit they eat each day. In order to get the full ten points for the fruit category, participants needed to consume all three servings. If they reported eating one serving each day, they got a third of the points (3.33).

Vegetable scores were calculated very similarly to fruit. The recommendation for vegetables is 2.5 cups. A serving of vegetables is considered ½ cup, therefore they need to consume five servings of vegetables per day. If they reported eating all 5 servings in a day, they received all ten points. That calculates to equal two points per serving of vegetables.

The grains group has recommendations in ounce equivalents. One ounce is equal to one slice of bread, one cup of ready-to-eat cereal, or ½ cup of cooked rice or pasta. Participants were told of these servings sizes and asked how many portions of grains they ate in a day. The recommendation for the grains group is six ounce-equivalents and in order to get the full ten points they had to consume all six servings. For each serving they reported, that individual would receive 1/6 of the points (1.66). MyPyramid recommends that half of the grain servings should be from a whole grain source. The interview questions on grains did not differentiate between whole or fortified grains.

The meat category was also based on ounce equivalents. It is recommended that individuals following the 1,800 calorie food pattern to have five ounce equivalents each

day. Individuals at Pan de Vida were told that three ounces of meat, seafood, fish and soy counted as one serving. All questions regarding this category were asked based on how many servings were eaten each week. To figure a score for this section the number of servings reported for all four questions were combined and multiplied by three to get ounces per week. Then that number was divided by seven to get an average amount of ounces per day. If participants reported consuming all five servings on an average day, they received the maximum of all ten points. For every serving reported they received two points. Unfortunately no questions were asked about legume consumption.

Respondents were told that a serving of dairy is equivalent to eight ounces of milk, one ounce of cheese or eight ounces of yogurt. They then were asked how many serving of dairy they consumed on an average day. MyPyramid recommends that three servings on dairy products be consumed daily. In order to get the full ten points for the fruit category, participants needed to consume all three servings. If they reported eating one serving each day, they got a third of the points (3.33).

The oils section of the MPI is calculated differently than the previous categories. Participants were asked what types of oils they used for cooking, but not the amount of oil used. Three responses were given: vegetable oil, butter and pork lard. MyPyramid recommends the use of vegetable oils over the use of solid fats such as butter and pork lard. To score this section, researchers designated a point to each of the three responses. If the subject responded using vegetable oil, they received the full ten points for that section. A response of butter earned them five points and pork lard received zero points. If they answered using two types, the average of the two scores was awarded.

The last section of the MPI assesses the amount of soda and sweets each of the subject consumed. The participants could answer a maximum of seven carbonated beverages and three servings of candy or sweets per week. The answers were then coded in reverse. Those who answered having seven sodas per week received zero points and those who reported zero sodas received the maximum of five points. As for candy and sweets, those who reported the maximum of three servings got a zero, and zero servings earned them five points. If a subject reported having no servings of soda or sweets they received the full ten points for this section. All answers in between were coded and given scores as well (soda: 7 servings = 0 points, 6=1, 5=1, 4=2, 3=3, 2=4, 1=4 and 0=5; sweets: 3 servings = 0 points, 2=2.5, 1=2.5 and 0=5).

Health Indicators: Health indicators included blood glucose levels, blood pressure and body mass index (BMI). Blood glucose levels were measured using a standard glucometer by a trained professional. Blood pressure was taken using a sphygmomanometer. BMI was calculated using the standard equation of: Weight in kilograms divided by height in meters squared (Weight (kg)/Height (m^2)). Categorical obesity status was calculated by using the criteria of the Centers for Disease Control and Prevention: normal weight, BMI < 25.0; overweight, BMI = 25.0–29.9 as overweight; and obese, BMI ≥30.0.

Physical Activity: Three physical activity questions were asked during the interview process. Participants were asked if they exercised which was a simple yes or no answer. Those who answered yes were asked to identify the type of exercise they participate in. All possible answers were coded as follows: 0 = walk, 1 = soccer, 2 = basketball, 3 = dance, 4 = lift weights and 5 = bike. And finally participants were asked

how many days they exercise each week. Unfortunately no questions were asked about the duration or intensity of the exercise.

Dental Health: Researchers were curious of the dental health of the participants because it has an impact on what foods can be eaten. Therefore one question was asked about the dental health of each participant. Each person was asked during the survey if they have any pain in the mouth or any mouth problem that affects the types of food that they eat. This was recorded as a simple yes or no answer.

Data Analysis

The Statistical Package for Social Sciences (SPSS version 17.0) was used to calculate category scores and the MPI. The total MPI was a summation of all seven categories and is based on a score of seventy. The maximum total for each of the seven categories was ten points. Category and MPI scores were rounded to the nearest decimal place. Participants who did not answer a particular question for one category were then not given a score for that category and therefore a total score could not be calculated for that person. Due to the small sample size, researchers decided to use the mean category score for those who did not have one in order to have a higher sample size. The number of missing responses for each MPI category will be later discussed in the results section.

SPSS was also used to analyze demographics, health indicators and physical activity data. Frequency statistics were used to examine gender, exercise type, exercise frequency and dental health questions. Descriptive statistics were used to evaluate age, BMI, blood pressure and blood glucose measurements.

SPSS was also used to run correlation tests to determine if there were any degrees of association between any of the health outcomes (BMI, blood pressure and blood glucose) and MPI scores. Bivariate, two-tailed, Pearson correlates were calculated. An alpha of 0.05 or less would be considered significant.

Table 4.1: Data Collection for Pan de Vida

Demographic Information
Gender Age
Medical Information
Blood glucose levels: Blood pressure: Height: Weight: Calculate BMI:
Dental Health
Do you have any oral pain or dental problems that affect the types of foods you can eat?
Nutritional Data Questions
How many portions of meat do you eat per week? How many portions of fish do you eat in a week? How many portions of seafood do you eat per week? Do you consume soy? How many times eat soy/week? How often do you consume vegetables/week? How many portions/day? How many days/week consume grains? How many portions of grains/day? How often do you eat fruit/week? How many portions/day? How often do you eat dairy products/week? How many portions/day? How many sodas or artificial juices/week? How many portions of sweets and candy/day? What types of oils do you use for cooking? How many sodas or artificial juices do they drink/day?
Physical Activity
If you work, does your job require physical labor? Do you engage in other types of physical activity, such as walking long distances to work, dancing, running or other? If yes, what kind of physical activity? How often ?

Table 4.2: Questions Used to Calculate MyPyramid Index Scores

Fruits
How often do you eat fruit/week? How many servings/day?
Vegetables
How often do you consume vegetables/week? How many servings/day?
Grains
How many days/week consume grains? How many servings of grains/day?
Meat
How many portions of meat do you eat per week? How many portions of fish do you eat in a week? How many portions of seafood do you eat per week? Do you consume soy? How many times eat soy/week?
Milk
How often do you eat dairy products/week? How many servings/day?
Oils
What types of oils do you use for cooking?
Sweets & Soda
How many sodas or artificial juices/week? How many portions of sweets and candy/day?

Chapter 5: Results

Sample Characteristics

Sixty subjects completed the interviews and anthropometric data collection at the Pan de Vida Mission in Quito, Ecuador. Five of the sixty subjects were male and the other fifty-five were female. The age of these individuals ranged from eighteen to seventy-three years old. The mean age of those who participated was forty-three. Mean heights and weights were calculated are shown in Table 5.3. Researchers also calculated mean BMI's, blood pressure and blood glucose levels which can also be seen in Table 5.3.

Diet Quality

MyPyramid Index scores were calculated for each of the sixty individuals. Scores ranged from 19.32 to 44.85 out of a maximum score of 70. The mean MPI score for this group was 34.1. Mean scores for each of the food categories were also calculated and are as follows: fruit 3.95, vegetables 2.40, grains 4.97, meats 3.23, dairy 3.52, oils 8.86 and soda and sweets 7.16. Total MPI mean scores and mean scores for each food category can be found in Table 5.4. The number of subjects missing data for each category is also show in Table 5.4.

Health Indicators

Blood pressure was taken during the interviews at Pan de Vida mission. Systolic blood pressures ranged from 90 – 180 millimeters of mercury (mmHg). The average systolic blood pressure was 112 mmHg. Diastolic blood pressures ranged from 46 – 101

mmHg. The average diastolic blood pressure was 66 mmHg. Therefore the mean blood pressure of this group was 112/66 mmHg.

Participants also had their blood glucose taken during the interview. Participants were not asked to be fasting at the time and these were recorded as non-fasting measurements. Only one of the sixty participants did not have their blood glucose measured. Blood glucose measurements ranged from 83 – 365 milligrams per deciliter (mg/dL). The mean blood glucose for this population was 132 mg/dL.

Participants were weighed and had their heights measured in order to calculate BMI. The BMI's ranged from 17.8 – 38.3. The mean BMI of the group was 27.2 which would indicate that this population is classified as being overweight.

Physical Activity

Physical activity questions were asked to the sixty participants at the Pan de Vida mission. Thirty-four reported that they do not exercise, twenty-two reported that they do exercise and four respondents did not answer the question. Six responses were reported from the 22 that answered that they exercised and were coded as follows: 0 = walk, 1 = soccer, 2 = basketball, 3 = dance, 4 = lift weights and 5 = bike. Participants were allowed to report multiple types of exercise and the results are as follows: walk 8, soccer 11, basketball 3, dance 3, lift weights 1 and bike 1. Those who indicated that they exercise said the frequency of exercise per week was as follows: 1 day per week = 7 people, 2 days per week = 3 people, 3 days per week = 4 people, 4 days per week = 1 person, 5 & 6 days per week – 0 people and 7 days per week = 9 people. Out of the 60 participants, 26 did not answer this question and 11 people said they exercise zero days per week.

Dental Health

One question was asked about the dental health of the participants. Of the 60 participants, 32 reported that they have no problems or pain, 23 reported that they do have problems or pain that affects the foods they eat and 5 subjects did not answer the question.

Correlations

After running statistical correlation test for each health outcome (BMI, blood pressure and blood glucose) with MPI scores, no correlations were found to be statistically significant (alpha < 0.05). The r value for the correlation between BMI and MPI was 0.014. Since this number is so close to zero, it means that in this case there is a weak correlation between the two variables. The sig (2-tailed) value was 0.918, which is much higher than 0.05 and also indicates no significant relationship. The r value between diastolic blood pressure and MPI was 0.035, and the r value between systolic blood pressure and MPI was 0.119. Both of these values are close to zero and therefore are show weak correlation. The sig (2-tailed) values for these variables were 0.794 and 0.370 respectively. They are both higher than our alpha which indicates statistical insignificance. And lastly, the r value between blood glucose and MPI was 0.000. This means that there is weak correlation between the two variables for this data set. The sig (2-tailed) value for these variables was 0.998 which is much higher than our alpha and also indicates statistical insignificance.

Table 5.3: Quito Data - Mean Anthropometrics (n=60)

Height (cm)	Weight (kg)	BMI	Blood Pressure (mm/Hg)	Blood Glucose (mg/dL)
147	61	27.2	112/67	133

Table 5.4: Quito Data – Mean MPI Score

Category	Possible	Before Without missing data	Number Missing	After Missing data filled in with category averages
Fruit	10	3.95	20	3.95
Vegetables	10	2.40	13	2.40
Grains	10	5.16	22	4.97
Meats	10	3.26	7	3.23
Dairy	10	3.52	24	3.52
Oils	10	8.86	5	8.86
Soda & Sweets	10	7.16	0	7.16
TOTAL:	**70**	**34.31**		**34.09**

These are the average scores before the missing data was filled in and after

Chapter 6: Discussion

The MyPyramid Index has been developed using current information and recommendations from MyPyramid to asses the relationship between diet quality and overall health status. BMI, blood pressure and blood glucose are the major health determinants used in this international research study. Limited statistical significance was found in regards to correlation of BMI, blood pressure, blood glucose and MPI scores, although the information gathered from this study was beneficial.

Very little research has been done with this low-income population in regards to diet quality and health status. This study has begun to identify current trends and eating patterns of the population. It has also been helpful to understand the breakdown of each individual category of the MPI. Many subjects scored high in the oils category by choosing healthier vegetable oils rather than saturated fats like lard. The lowest scoring category was the vegetable group. The average vegetable score was 2.4 out of ten. This may indicate and area for future public education. Knowledge of eating patterns enables the formulation of public policies directed toward health promotion and disease prevention. This type of preliminary study allows us to get an idea of how these people are eating on a regular basis. Also, baseline BMI's are helpful in determining an average weight status of these low-income individuals.

Diet Quality

The United States Department of Agriculture (USDA) Center for Nutrition Policy and Promotion (CNPP) recently calculated diet quality scores for Americans. The information used is from the Centers for Disease Control and Prevention (CDC), and the

National Center for Health Statistics (NCHS) which conducts the National Health and Nutrition Examination Surveys (NHANES). NHANES is the only national survey that collects extensive health information from both face-to-face interviews and medical examinations (www.cdc.gov). The information collected from the interviews of the NHANES 2001-2002 was then scored with the Healthy Eating Index-2005 (HEI-2005) to determine diet quality. This data set included information from 9,032 participants. The Healthy Eating Index is a tool developed by the USDA to measure compliance with the Dietary Guidelines for Americans (DGA's). The instrument was revised in 2005 when the DGA's were also revised. The DGA's are revised every five years and changes were made to the HEI to ensure that it continues to measure diet quality accurately. Some of the changes made include questions related to fruit juice, whole grain, dark green and orange vegetable, legume, oil and alcohol consumption. A total maximum score of 100 is used in the HEI-2005. The HEI-2005 was used to evaluate the diet quality of the NHANES 2001-2002's 9,032 subjects and the results are shown in Table 6.5.

The mean overall diet quality score using the HEI-2005 for the 9,032 participants of the NHANES 2001-2002 was 58.2 out of a total maximum 100. The instrument used to calculate diet quality in this research was created specifically for the project. The MyPyramid Index (MPI) was developed to best assess the diet quality of the Quito, Ecuador subjects based on questions asked during the interview process. Therefore comparing the two studies results will be difficult. Both the HEI-2005 and the MPI use similar questions to determine scores for food categories, but the questions are not exactly the same. Also, the HEI-2005 is out of a maximum score of 100, while the MPI has a maximum score of 70. The average MPI score for the Quito, Ecuador group was

34.1 out of 70. If you divide the average of 34.1 by the total score of 70, you get a score of 48.7% which can then be compared to the NHANES average score of 58.2. This might leave us to believe that the Quito, Ecuador group has a lower diet quality than the average Americans.

The USDA did a similar study in 2008 using NHANES 2003-04 data that compared diet quality of low-income families the diet quality of higher income families. In this study, low-income was defined as having a family income of less than 130% of the Federal poverty line. HEI-2005 was used again to express diet quality based on information gathered from the 8,272 participants during the NHANES interviews. The mean HEI-2005 score for the low-income group (n=3,293) was 56.5. The results for the individual HEI-2005 categories can be found in Table 6.6. Again, it is difficult to compare the HEI-2005 low-income scores with the MPI scores from the Quito data set because they have different maximum scores, questions and categories. But, if you divide the average Quito MPI score of 34.1 by the total score of 70, you get a score of 48.7% which can then be compared to the NHANES low-income mean score of 56.6. This might leave us to believe that the Quito, Ecuador group has a lower diet quality than the low-income Americans do too.

Although there was no significant difference in total HEI-2005 scores between the higher income and lower income families there were important differences in certain diet components. Results of this study did indicate that low-income families had significantly lower component scores for total vegetables (dark green and orange and legumes) and whole grains than the higher income families. The lowest scoring category for the Quito group was the vegetable category. The average vegetable score was 2.4 out of ten, which

represents consumption of only one of the recommended five vegetable servings. This information also ties in with data the World Health Organization (WHO) has found estimating that nearly 60% of the Ecuadorian population ate fewer than three servings of fruit and vegetables per day and nearly 90% ate fewer than five servings (Bernstein, 2008). According to the Quito data collected 73% of the participants reported consuming less than three servings of fruits and vegetables per day. All 100% of the subjects reported having less than five servings of fruits and vegetables per day. Figure 6.1 is a scatterplot graphing BMI to the fruit and vegetable servings per day of the Quito subjects.

Unfortunately no HEI scores were found for the Ecuadorian population to compare to our Quito MPI scores, but there is Brazilian data (Fisberg et al., 2006) that we can compare with. Ecuador and Brazil vary greatly in size and socioeconomic variables, but it may be more beneficial than comparing Ecuador to the United States diet quality scores. The data from this study was collected during the Household Health Survey. The study was based in Sao Paulo, Brazil and HEI scores were calculated based 24 hour recalls given by 3,454 subjects and can be seen in Table 6.7. The mean HEI score for this group was 60.4 out of 100. Comparing the mean HEI score of 60.4 to the Quito group MPI percentage of 48.7 (34.1/70) would indicate that the Quito population has a much lower diet quality. Again, as mentioned earlier the mean vegetable component score for the Brazil group was also the lowest component score, just like the Quito group. The Brazil mean vegetable score was 5 out of a possible 10 (50%). The Quito group had an even lower mean vegetable score of 2.4 out of a possible 7 (34%).

Health Indicators

Blood Glucose: According to the National Diabetes Information Clearinghouse (NDIC) which is a service of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDKD) a fasting plasma glucose of >126 mg/dL or greater on two or more occasions is a diagnosis of diabetes mellitus (www.diabetes.niddk.nih.gov). Subjects need to be fasting for at least eight hours before performing this test to get an accurate reading.

The CDC has estimated that in 2007 23.6 million Americans have diabetes, which is 7.8 percent of the population. This includes 17.9 million people who have been diagnosed and 5.7 million who have not yet been diagnosed. In 2006 the World Health Organization (WHO) ranked complications from diabetes as number three on Ecuador's causes of death list. Also according to the WHO deaths from diabetes complications rose from 8% to 18% in men from 1990-2000. Among women, the rates rose from 11% to 22% in the same time span. The rate of death from diabetes complications has almost doubled in the previous decade (Bernstein, 2008). The WHO has estimated that in 2000 the rates of adults with diabetes ranged from 4.1 to 5% of the populations of Bolivia, Paraguay, Ecuador, Panama, Costa Rica and Guatemala (www.paho.org).

Blood glucose was taken for 59 of the 60 Quito subjects. There were 23 participants who had a blood glucose of >126 mg/dL. This is 39.7 percent of the sample population. Unfortunately, the Quito subjects were not fasting before their blood glucose was drawn. Therefore it is hard to analyze the blood glucose levels for these individuals. A study done by El-Kebbi and colleagues (2004) was done to see if there was relationship between casual postprandial plasma glucose levels (1-4 hours postprandial) and HgbA1c

levels. HgbA1c is the main glycemic indicator used to determine success of diabetes treatment and intervention (El-Kebbi et al, 2004). The American Diabetes Association suggests that optimal glycemic control is reached when HgbA1c is ≤ 7.0%. This study identified a cutoff for casual plasma glucose of 150 mg/dL that may be used as an indicator of glycemic control (HbgA1c ≤ 7.0%) in patients with type 2 diabetes when home blood glucose monitoring records or current HgbA1c levels are not available. Since the Quito sample may or may not have been fasting, this research on casual postprandial plasma glucose levels may shed some light on the Quito results. There were 15 of the 59 Quito subjects who had blood glucose levels greater than 150 mg/dL. This could indicate that ~25% of the population had a HgbA1c of ≤ 7.0%, which would mean inadequate glycemic control. This comparison does have flaws, because we do not know which Quito subjects were or were not fasting and if they had eaten we don't know if it had been 1-4 hour since their last meal. Regardless, diabetes is a rising problem among people in Ecuador and we know this is one area that does need to be addressed.

Blood Pressure: High blood pressure is a serious condition that if not treated can lead to heart disease, heart failure, stroke and kidney failure and many other health problems (www.nhlbi.nih.gov). One in three (31.3%) adult Americans living in the United States have high blood pressure which is categorized into four sections. Table 6.8 shows the four categories of blood pressure and their requirements, which includes: normal, prehypertension and high blood pressure stages 1 and 2. These categories are based on systolic and diastolic blood pressure readings.

Subjects who participated in the Quito data collections had their blood pressure recorded (n=59). The systolic and diastolic measurements were then grouped into one of

the four blood pressure categories. Results are shown in Table 6.9. There were 37 systolic and 52 diastolic readings that fell into the normal category, however only 37 of those individuals had both normal systolic and diastolic readings. In the prehypertension category there were 18 individuals who met the systolic requirements and 4 who met the diastolic requirements. Prehypertension means that you will most likely have high blood pressure unless the necessary steps are taken to prevent it. Only 2 individuals were in the high blood pressure stage 1 category for both systolic and diastolic readings. For high blood pressure stage 2 there were 2 people who met the systolic requirement and only 1 person for the diastolic. With 4 systolic readings and 3 diastolic readings in the high blood pressure ranges, that comes to 6.9% and 5.2% of the Quito set having high blood pressure. The average blood pressure for the entire sample was 112/66 mmHg, which would be categorized as normal blood pressure.

Body Mass Index (BMI): Body mass index (BMI) is a tool used to calculate height to weight ratio's for individuals. The number can then be used to classify a person into a weight status category. BMI can also be used as an identifier for risk factors for excess weight and related health problems. The CDC uses BMI because it is one of the best and least expensive methods for a population's assessment of overweight and obesity (www.cdc.gov). Table 6.10 shows the CDC's classifications for the four groups of weight statuses which are: underweight, normal weight, overweight and obese.

In 2005 the WHO reported that 40% of men and 50% of women were overweight (BMI>24.9) in Ecuador. They also reported that 6% of men and 16% of women had a BMI greater than 30 which would classify them as obese (Bernstein, 2008). These numbers, like in many other countries have been on the rise in Ecuador. This of great

concern because BMI ranges are based on the relationship between body weight and disease and death. Overweight and obese individuals are at increased risk for many diseases and health conditions, including the following: hypertension, dyslipidemia (for example, high LDL cholesterol, low HDL cholesterol, or high levels of triglycerides), type 2 diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea and respiratory problems, some cancers (endometrial, breast, and colon) (www.cdc.gov). According to Global Health, in 2006 four of the top five leading causes of death in Ecuador were heart disease, cerebrovascular diseases, diabetes mellitus and hypertensive diseases which all are associated risk factors of overweight and obesity (Waters, 2006). According to the BRFSS conducted by the CDC, in 2008 36.6% of the United States population would be defined as overweight (BMI 25.0-29.9). Also in 2008, 26.6% of Americans living in the United States are obese (BMI>30).

Results for BMI from the Quito sample are shown in Table 6.11. Only one person was reported as being underweight (BMI<18.5) and 18 people were of normal weight (BMI 18.5-24.9). There were 40 people categorized as being overweight or obese in this sample of 59 which is 67.8% of the group. With 20 people being overweight and 20 people in the obese category which is 33.9% for each. The number of people that were classified as overweight seems to fit in close with the data that the WHO reported in 2005. However the number of people who had a BMI > 30 who were classified as obese was much larger than the national average reported by WHO. The number of obese individuals in this group was actually much larger than the amount of obese Americans too.

Physical Activity

The United States Department of Agriculture (USDA) and the Centers for Disease Control & Prevention (CDC) both recommend at least 150 minutes of moderate intensity aerobic activity per week and to engage in muscle strengthening exercises 2 or more times per week that work all major muscle groups (www.cdc.gov). The American College of Sports Medicine (ACSM) recommends that individuals under the age of 65 engage in moderately intense cardiovascular exercise 30 minutes a day, five days a week or vigorously intense cardiovascular exercise for 20 minutes a day, 3 days a week (www.acsm.org). The ACSM also recommends that individuals participate in strength training 2 days per week.

The following data on physical activity is from the Behavioral Risk Factor Surveillance System (BRFSS), a national telephone survey conducted by the Centers for Disease Control and Prevention (CDC) and state health departments. The BRFSS physical activity questions attempt to measure a person's physical activity in leisure-time, household, and transportation (www.cdc.gov). Data from the 2008 BRFSS is compared with the recommendations from the ACSM for physical activity and is broken down into three groups: met recommendations, insufficient physical activity and inactive. The national average for Americans who met the recommendations from the ACSM was 48.8 percent. Those who were categorized as having insufficient physical activity were Americans who did more than 10 minutes total per week of moderate or vigorous-intensity lifestyle activities, but less than the recommended level of activity. The national average for Americans engaging in insufficient physical activity was 37.7 percent in 2008. The inactive category is defined as less than 10 minutes total per week

of moderate or vigorous intensity lifestyle activities. The national average for this category in 2008 was 13.5 percent of the U.S. population.

The data that was gathered about physical activity in the survey at Pan de Vida mission does not give us much information about the amount of physical activity the subjects get. They were asked if they exercise, what type and how many days per week. Unfortunately participants were not asked about intensity or duration of exercise. This makes it hard to compare with the U.S. national averages and recommendations. If we look at the ACSM's guidelines for physical activity it does give us a days per week recommendation which is either five or three days per week depending on the intensity level. This recommendation also includes a duration of twenty or thirty minutes depending on the intensity. Therefore the only thing that can be compared is the frequency per week question and the days per week recommendation. If the responses for exercising frequency from 3 to 7 days are combined, that leaves 13 people who could possibly be getting the recommended amount of exercise needed for better health. This is 21.6 percent of the subjects which is less than half the amount of Americans (48.8%) who are engaging in the recommended amount of physical activity according to the BRFSS. That leaves 78.4 percent of the Quito subjects who may not be getting the recommended amount of exercise.

One of the objectives of this study was to analyze the data and suggest where intervention is needed in the Quito population. With results showing a low diet quality and the lowest category being fruits and vegetables, this is an area that can be targeted. Educating lower income Ecuadorians on inexpensive ways to incorporate fruits and vegetables into their diet would be one intervention. The community may also benefit

from community gardens. This may help people in the neighborhoods to increase their fruit and vegetable consumption at a low cost.

Limitations

Some of the major limitations to this study are due to the fact that this is an international data set. Although interviews were conducted by local, Spanish-speaking medical students, some of the ideas and thoughts of the researchers may have been lost in translation.

The MyPyramid intake patterns may not be an accurate representation of international diet patterns. The MPI was developed specifically for this research study and has not been tested for validity or reliability because it has slight differences than any other diet quality indices. Another limitation of the MPI is that it does not take certain differences within the food categories into consideration. For example, MyPyramid recommends that half of the grains consumed should be whole grains due to their added nutritional benefits. The MPI does not differentiate between enriched or whole grains. Another example of this is within the meat category. The type or leanness of the meat was not taken into consideration of this score even though MyPyramid recommends focusing on lean meats. Also, MyPyramid recommends low-fat diary consumption and there was no differentiation between fat content of dairy products in the MPI.

The method of obtaining height and weight for the subjects is unknown and may be seen as a limitation. Researchers are not sure if subjects were weighed on the same scale or if they were all weighed with their shoes on. The same goes for height

measurements. It is unknown if subjects were all asked to take of their shoes when their height was being measured.

Many of these limitations were due to the fact that this is secondary data and we could not go back and alter the questions that were asked. Some type of index had to be developed based on the information that was provided. The small sample size is of course another limitation. This study is a preliminary research study and regardless of the small sample, the researchers were able to learn a lot.

Table 6.5: Mean HEI-2005 Scores for U.S. from NHANES 2001-2002

Component Score (maximum score)	Mean Score
Total Fruit (5)	3.1
Whole Fruit (5)	3.4
Total Vegetables (5)	3.2
Dark Green and Orange Vegetables and Legumes (5)	1.4
Total Grains (5)	5
Whole Grains (5)	1
Milk (10)	6.3
Meat & Beans (10)	10
Oils (10)	6.8
Saturated Fat (10)	6.4
Sodium (10)	4.1
Calories from Solid Fats, Alcoholic Beverages and Added Sugars (20)	7.5
Total HEI-2005 Score (100)	58.2

Table 6.6: Mean HEI-2005 Scores for High & Low-Income U. S. from NHANES 2003-2004

Component Score (maximum score)	Higher Income	Lower Income
Total Fruit (5)	2.9	2.9
Whole Fruit (5)	3.2	2.8
Total Vegetables (5)	3.3	3.0
Dark Green and Orange Vegetables and Legumes (5)	1.2	1.0
Total Grains (5)	5.0	5.0
Whole Grains (5)	.9	0.8
Milk (10)	6.2	6.3
Meat & Beans (10)	10	9.9
Oils (10)	7.4	7.1
Saturated Fat (10)	5.8	5.9
Sodium (10)	3.8	4.4
Calories from Solid Fats, Alcoholic Beverages and Added Sugars (20)	8.0	7.8
Total HEI-2005 Score (100)	57.8	56.5

Table 6.7: Mean HEI Scores from Sao Paulo, Brazil 2001-2002 Data

HEI Components (maximum score)	Mean
Grains (10)	**6.76**
Vegetables (10)	**5.00**
Fruits (10)	**3.54**
Milk & Dairy Products (10)	**2.96**
Meat & Eggs (10)	**9.00**
Pulses (10)	**6.34**
Total Fat (10)	**5.21**
Cholesterol (10)	**8.21**
Sodium (10)	**6.44**
Food Variety (10)	**6.95**
Total HEI Score (100)	**60.4**

Table 6.8: Categories for Blood Pressure in Adults (mmHg)

Category	Systolic		Diastolic
Normal	Less than 120	*AND*	Less than 80
Prehypertensive	120-139	*OR*	80-89
High Blood Pressure Stage 1	140-159	*OR*	90-99
High Blood Pressure Stage 2	160 or higher	*OR*	100 or higher

Table 6.9: Quito Data – Blood Pressure Categories (n=58)

	Systolic	Diastolic
Normal	37	52
Prehyperstensive	18	4
HBP – Stage 1	2	2
HBP- Stage 2	2	1

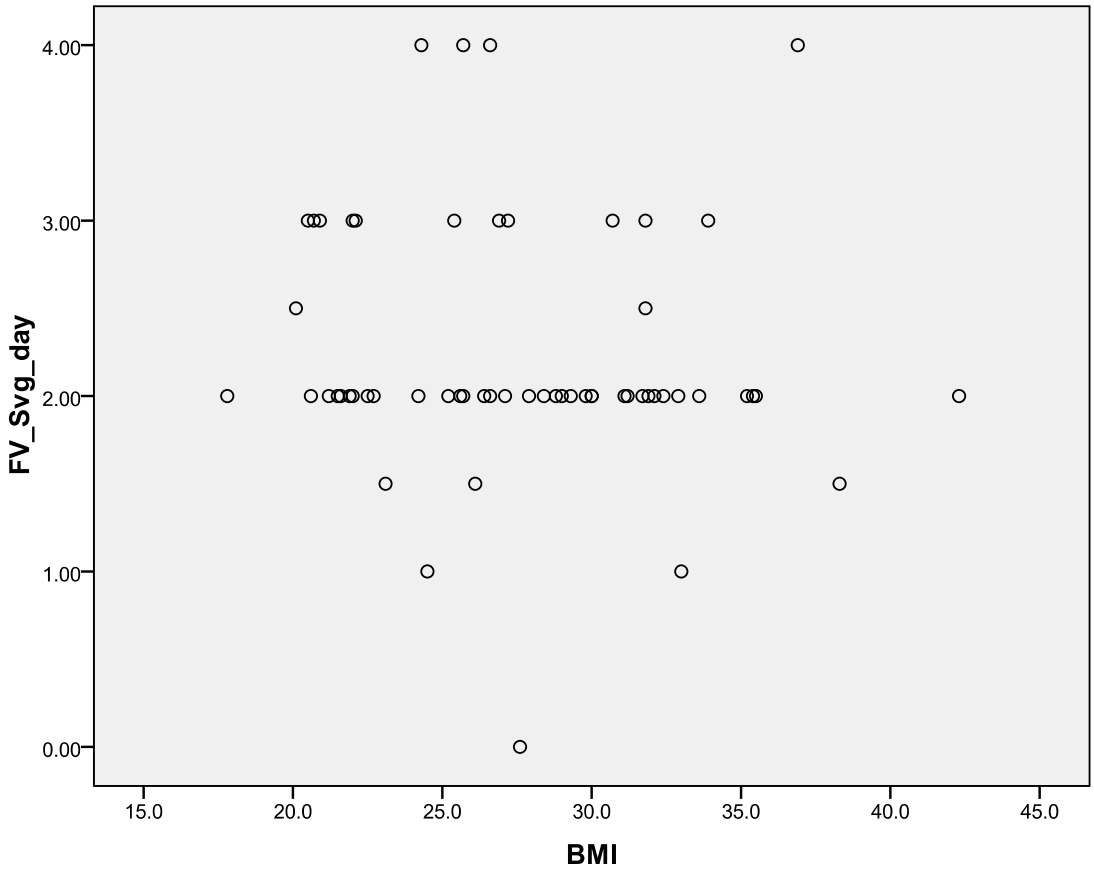
Table 6.10: Assessing BMI

BMI	Weight Status
Below 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30.0 and Above	Obese

Table 6.11: Quito Data - BMI's (n=59)

Weight Status	Number of Subjects	Percent of Quito Sample
Underweight (<18.5)	1	1.6%
Normal Weight (18.5-24.9)	18	30.5%
Overweight (25.0-29.9)	20	33.9%
Obese (>30)	20	33.9%

Figure 6.1: Quito Data – Scatterplot Fruit + Vegetable Servings per Day & BMI



Chapter 7: Conclusions & Recommendations

It is believed that the MyPyramid Index is an accurate assessment of the mixture of foods eaten by this international sample. The calculations for MPI food categories could be used to identify areas that need intervention among the population. Researchers recommend education and the utilization of community gardens to increase low-cost fruit and vegetable consumption of this population. Further research is needed to verify the validity and reliability of the MyPyramid Index. There are possibilities for further research to include the application of this tool in other low-income populations and to see how well it performs across ethnic and cultural groups whose dietary patterns may differ from U.S. norms.

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