

**An Exploratory Study of Food and Nutritional Beliefs and Practices in
Pohnpei, Federated States of Micronesia**

By

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Abstract

Background: Non-communicable diseases (NCDs) such as Type 2 diabetes, cardiovascular disease and certain cancers, have been recorded in the Pacific at some of the highest global rates. Pohnpei, a Pacific island-state within the Federated States of Micronesia (FSM), bears this increasing disease burden. Without interventions, it is projected that almost half of Pohnpei's current population will become diabetic in the next quarter century. Pohnpei is in the midst of a nutrition transition: a shift from a traditional, high fiber, low-fat diet to a diet consisting of imported foods high in saturated fat and sugar accompanied by a more sedentary lifestyle. These factors in addition to economic, social and cultural changes have led to increased lifestyle diseases. Intervention strategies to promote healthy food consumption are required to counteract this trend. Programs reintegrating the local food (defined as locally grown, carbohydrates) have shown to decrease the risk of non-communicable diseases. Necessary to the adaptability, sustainability and cultural appropriateness of these interventions is the data to determine current dietary patterns and the factors influencing food decision-making behavior. The data collected in this study will inform health prevention programs. In addition, the networks created with collaborators around this project serve as future platforms and social capital for follow up research and health intervention delivery.

Objectives: The objectives of this exploratory study were: 1) To describe the food patterns and trends of a Pohnpei adult sample population; 2) To gain insight into the knowledge, attitudes, beliefs, and practices relating to health and food consumption among the Pohnpei adult sample population; 3) To recommend communication channels and strategies for interventions.

Methods: Both quantitative and qualitative methods were employed. A 52-item structured survey including a 7-day Food Frequency Questionnaire was delivered to 293 participants. The study sample was women between the ages of 15 and 64 attending a children's educational screening program. The survey was integrated into an island-wide education testing program targeting five sites that covered the island's six municipalities. An ethnographic approach consisting of in-depth interviews, informal focus groups and observation was also utilized to capture the factors related to food-decision making and consumption.

Results: Findings from this research conclude that certain less nutritious, imported foods are popular and consumed frequently. However, there still exists frequent consumption of local food items. Factors including availability, affordability, convenience, and status of food items were found to determine food-decision behaviors.

Discussion: Due to a trend towards increased consumption of less nutritious foods this is a critical period within the nutrition transition. Innovative strategies that take advantage of existing resources to promote local foods by utilizing existing channels, key individuals and local organizations are necessary. In addition, an Information, Education and Communication strategy to encourage local food consumption is required.

Table of Contents

List of Abbreviations	vii
List of Maps	viii
List of Tables	viii
List of Figures	ix
Introduction	1
Chapter One: Literature Review	5
Background on Pohnpei.....	5
Local Food versus Imported Foods.....	7
Nutrition and Epidemiologic Transition.....	10
‘Healthy Diet’ Interventions.....	13
Chapter Two: Methodology	18
Research Design.....	18
Quantitative Methodology.....	21
Qualitative Methodology.....	28
Data Analysis.....	30
Chapter Three: Findings and Results	31
Food Patterns.....	31
Factors Affecting Dietary Intake.....	46
Chapter Four: Discussion and Recommendations	57
References	65
Appendices	
Appendix A: Pohnpei Food and Nutrition Survey.....	69
Appendix B: Factors Affecting Food Behavior Survey Results.....	73
Appendix C: Interview Guide for Key Informants/Focus Groups.....	75

List of Abbreviations

BMI	Body Mass Index
COM	College of Micronesia
CDC	Centers for Disease Control and Prevention
FFPN	Family Food Production and Nutrition
FFQ	Food Frequency Questionnaire
FSM	Federated States of Micronesia
GDP	Gross Domestic Product
IEC	Information, Education, Communication
IFCP	Island Food Community of Pohnpei
MODFAT	Micronesia One Diet Fits All Today
NCD	Non-communicable Disease
SIDS	Small Island Developing States of the Pacific
STEPS	WHO Stepwise Approach to NCD risk factor surveillance
TTPI	Trust Territories of the Pacific
UNICEF	United Nations Children's Fund
US	United States
USDA	United States Department of Agriculture
WHO	World Health Organization

LIST OF MAPS

Map 1: Map of the Federated States of Micronesia..... 5

LIST OF TABLES

Table 1: Characteristics of the sample population..... 33

Table 2: Reported consumption of selected items by female Pohnpeian adults
0 days, 1-2 days, or 3-7 days in the 7-day Food Frequency Questionnaire (FFQ)..... 36

Table 3: Reported consumption of selected imported starch foods on at least
one day by female Pohnpeian adults in the 7-day FFQ..... 38

Table 4: Reported consumption of imported versus locally grown vegetables
on at least one day by female Pohnpeian adults in the 7-day FFQ..... 40

Table 5: Reported consumption of selected imported and local fish and other
seafoods on at least one day by female Pohnpeian adults in the 7-day FFQ..... 41

Table 6: Reported consumption of selected imported and local meats on at
least one day by female Pohnpeian adults in the 7-day FFQ..... 41

Table 7: Reported consumption of selected fat-containing foods on at least one day
by female Pohnpeian adults in the 7-day FFQ..... 42

Table 8: Reported consumption of drinks with sugar on at least one day by female
Pohnpeian adults in the 7-day FFQ..... 43

Table 9: Reported consumption of selected foods containing sugar or salt on
at least one day by female Pohnpeian adults in the 7-day FFQ..... 44

Table 10: Reported levels of consumption and places of acquisition of local food by
female Pohnpeian adults (n=293)..... 47

Table 11: Reported household member (male versus female) who purchases and
prepares food by female Pohnpeian adults (n=293)..... 48

Table 12: Reported cooking behavior by female Pohnpeian adults (n=293)..... 49

Table 13: Reported receipt of healthy food information and avenue of receipt by
female Pohnpeian adults (n=293)..... 54

Table 14: Reported knowledge on cause of diabetes by female Pohnpeian adults (n=293)..... 54

LIST OF FIGURES

Figure 1: Pohnpei in Transition.....	17
Figure 2: Research Design.....	19
Figure 3: Average number of days that female Pohnpeian adults reported consumption of selected food groups in the 7-day FFQ.....	37
Figure 4: Average number of days that female Pohnpeian adults reported consumption of the common local foods in the 7-day FFQ.....	39
Figure 5: Average number of days that female Pohnpeian adults reported consumption of local versus imported vegetables and fruits in the 7-day FFQ.....	39
Figure 6: Average number of days that female Pohnpeian adults consumed local and imported fish and meat in the 7-day FFQ.....	40

INTRODUCTION

Non-communicable diseases (NCDs) including Type 2 diabetes (adult onset, otherwise known as diabetes mellitus), cardiovascular disease and certain cancers have been recorded in the Pacific at some of the highest global rates and continue to be a major cause of morbidity and mortality in this region (WHO, 2003). Specifically, Type 2 diabetes has reached epidemic proportions within the Federated States of Micronesia (FSM) (Shmulewitz *et al.*, 2001).

Pohnpei, an island-state within FSM, bears this increasing disease burden experiencing both individual and institutional health and economic challenges. Once considered a model of health, early studies indicate FSM had minimal obesity and hypertension with a diet based on local food consumption (Coyne, 1984). Today, 84% of Pohnpei's population in the 35-54 age group is overweight, with similar health statistics in other age groups (Diabetes Today, 2000). Overweight is defined as a Body Mass Index (BMI) ≥ 25 kg/m² and obesity as a BMI ≥ 30 kg/m² (WHO, 2004). According to the CDC, with an estimated 5,473 Type 2 diabetes cases in 2000 and a projection of 12,639 cases by 2030, almost half of Pohnpei's current population (34,714) will have this disease in the next quarter century (Diabetes Today, 2000; CDC, 2000).

Pohnpei is in the midst of the nutrition transition, catalyzed by modernization and resulting in the epidemiologic transition (Popkin *et al.*, 2001; Martorell & Stein, 2001). Change is not foreign to the people of Pohnpei. With a history of colonization by Spain, Germany, Japan and the United States, this Pacific island-state has undergone tremendous transition within the past fifty years similar to other developing countries. After World War II, modernization in the form of increasing economic growth has resulted in the following: a shift from a subsistence to a cash economy, changes in family structure from extended to nuclear, occupational changes

including more women in the formal work force and migration patterns such as increased urbanization from the outer islands to the main island (Figure 1.0) (Hezel, 2001; Englberger, 2003). The Compact of Free Association, a US aid agreement signed twenty years ago (1980), has contributed significantly to accelerate these changes that might have otherwise taken place gradually. While there have been some positive effects, negative health, economic, and cultural consequences have also resulted.

The Pohnpeian diet has shifted from a diet once reliant on vitamin-, mineral- and fiber-rich traditional starchy staples (defined generally as ‘local food’), and fish and seafood, to a ‘westernized’ diet comprised of imported foods such as rice, flour, sugar and other refined foods, and fatty meats and oils highly saturated in fat. This transition is accompanied by a change from high energy expenditure activities (working in the taro patches, harvesting food by climbing coconut and breadfruit trees, canoeing and walking) to a low energy lifestyle (office jobs and automobiles) (WHO, 2003).

Not all imported foods lack nutrition, and some add diversity to the local diet. However, many of the imported foods, such as turkey tails¹ canned or frozen meats and refined foods are high in fat or lack important nutrients which exist in many of the local foods and are associated with a decrease in non-communicable diseases and Vitamin A deficiency (Ford et. al, 1999; Englberger 2003).

Diet, genetics, increased sedentary lifestyle and other societal changes have potentially increased NCDs, specifically Type 2 diabetes in the Pacific Islands (Popkin & Doak, 1998). This study addresses diet patterns and food consumption behavior.

Reliance on curative services and off-island referrals for diabetic care is costly; therefore, preventative programs in the form of culturally appropriate health promotion campaigns are

¹ Turkey tails are literally the tails of turkeys.

needed (Zimmet, 2001). Recognizing existing assets is essential to the sustainability of these programs and will empower communities to use their own resources. Such assets include Pohnpei's fertile land, which serves as an inexpensive and culturally appropriate resource to produce nutritious crops (Elymore *et al.*, 1989). Preventative programs based on the reintegration of the indigenous local foods into the Pohnpeian diet are needed as a cost-effective health intervention strategy. As stated by Popkin *et al.* (2001), "indigenous food interventions are necessary to prevent late stages of the nutrition and epidemiological transitions before the traditional agricultural and food systems disappear and a heavy reliance on domestic supply has been replaced by an internationalized food supply." With limited financial resources, this food-based strategy is economically feasible and targets NCDs as well as vitamin A deficiencies. Important to the success and adaptability of promoting indigenous local food is the insight into how and why food decisions are made.

The overall aim of this thesis is to identify food consumption patterns and to gain insight into the factors affecting decision-making within a sample population of Pohnpeian female adults (ages 15-64). These factors include, the connection between diet, disease and health, beliefs about certain foods, food practices such as the use of sugar and salt, food intake patterns, consumption of local versus imported foods, and other factors relating to food choices. This research will offer a baseline study to assess future trends in food behavior and to inform future intervention programs focused on increased consumption and production of local foods.

The objectives to achieve this aim are as follows.

1. To describe the food patterns and trends of the Pohnpei adult sample population
2. To gain insight into the knowledge, attitudes, beliefs and practices relating to health and food consumption among the Pohnpei adult sample population
3. To recommend communication channels and strategies for interventions

This thesis is divided into four chapters. Chapter one includes Pohnpei background information, defines and describes local food versus imported foods, presents historical information on the nutrition and epidemiologic transitions and addresses nutrition as it relates to Type 2 diabetes and past and current interventions. Chapter two describes the mixed methodologies utilized to address each objective. Chapter three presents the quantitative and qualitative findings. Chapter four describes the results with recommendations for future intervention strategies based on this formative research.

CHAPTER ONE: LITERATURE REVIEW

Pohnpei, Federated States of Micronesia (Map 1)



Pohnpei State includes one main island (120 square miles) and eight surrounding atolls (15 square miles total), six of which are inhabited. Pohnpei represents approximately one-half of the total land area of FSM, and contains one-third of the national population. Mountainous peaks and lush vegetation in a tropical climate characterize its environment (Elymore *et al.*, 1989).

Pohnpei's main island consists of Palikir, FSM's capital, and six municipalities with varying ethnic groups due to the inland migration from the outer islands, Mokil, Pingelap, Sapwafik, Nukuoro and Kapingamarangi. Several languages are spoken on the outer islands but on the main island, Pohnpeian is the main language while English is the official language used by the government (Elymore *et al.*, 1989; CIA, 2004).

With 34,714 inhabitants, Pohnpei's population density is 261 per square mile. Forty-two percent of the population is less than 15 years of age. The birth rate is 26.47 births/1,000 population and the total fertility rate is 3.5 children born/female (CIA, 2004). Infant mortality in 2002 was estimated at 40 deaths/1000 live births. Life expectancy at birth is 66.5 years, with a family average household size of 6.0 (FSM Statistics, 2002).

Following World War II, the islands of FSM came under US administration as part of the Trust Territories of the Pacific Islands (TTPI). In 1986, FSM gained independence. For the past twenty years, Pohnpei has depended greatly on the Compact of Free Association, an agreement allocating a large amount of aid from the US to FSM. Compact I, providing the majority of the public sector economy, has created an artificial increase in ‘lifestyle per capita’ from \$300 per person to \$2000 per person (Elymore *et al.*, 1989). Dependence on this aid, while useful in many areas including healthcare, is also a concern as Compact I will be replaced over the next 20 years with Compact II. This new agreement encourages a self-sustained economy and is decreasing aid annually.

FSM is a democratic republic with a government system similar to the US consisting of a president, vice-president and congress. Within this national government, Pohnpei has a state government and governing municipalities (Abbott 2004). Pohnpei also has a traditional system still in place which includes five kingdoms on the main island each headed by its own high chief and under chief (Hezel, 2001).

Pohnpei is categorized in the relative poverty category as determined by the Asian Development Bank Report (2004), which includes a lack of basic services, adequate resources (including cash) and opportunities to participate fully in the socio-economic life of the community. The Pohnpeian population has FSM’s highest per capita annual income, \$6,793 in 2000, and greatest number of earners per household, 1.9. Most people are employed by the public sector, which is highly dependent on US aid. However, the high cost structure of the FSM economy creates a heavy burden on those not employed by the government sectors leading to a high incidence of income poverty (Abbott, 2004). Access to basic utilities and sanitation is poor.

Only 31.4% of the population has access to improved sanitation facilities. Electricity is available in 67.9% of the households (Abbott, 2004; FSM Statistics, 2002).

Commercial agriculture represents 1% of GDP each year with fish and copra as the main exports (1994-2002). In a survey among low-income households in Pohnpei, 71.6% of the households produced some of their own food for household food consumption (Abbott, 2004; FSM Statistics, 2002). Most people have small farms or land where foods grow abundantly, except for the proportion of people who migrate to the more urban centers where access to land and local foods is decreased (Abbott, 2004).

FSM's leading causes of hospital admissions are diseases and conditions related to pregnancy, respiratory, endocrine and metabolism, infections and parasites (Rodgers *et al*, 2003). The 20-23% prevalence rate of diabetes in FSM leads to a mortality rate of 31.58 per 100,000 (Diabetes Prevention, 2004; Diabetes Today, 2000). Type 2 diabetes is the third leading cause of death, which results in an average loss of 10.2 years of life. Disease trends show few changes in the demographic and health indicators for the FSM since the 1990s. Morbidity and mortality for all NCDs: obesity, diabetes, hypertension, heart disease, cancer, stroke and lung disease continue to increase (Rodgers *et al*, 2003).

Local Food versus Imported Foods

The 'local food' of Pohnpei generally refers to the main carbohydrate staple food including breadfruit, giant swamp taro, dryland taro, banana, yam, pandanus, sweet potato and cassava. A great diversity of these nutritious local starchy foods and food cultivars (a variety produced by cultivation) grow abundantly with little aid (Elymore *et al.*, 1989; Englberger 2002). For example, there are 131 different breadfruit, 55 banana, and 24 giant swamp taro cultivar names documented (Raynor, 1991). Historically, a 'meal' was comprised of 'local food'

accompanied by cooked or raw fish. Less starchy vegetables were not part of the diet and fruits were usually a 'snack' rather than part of the meal (Englberger, 2003; Pollock, 1992). Therefore, 'local food' is defined only as these starchy staples.

Studies demonstrate that unrestricted consumption of the traditional local food has a major impact on weight loss and reducing cardiovascular risk factors. As Shintani *et al.* (1991) found in their Wai'ane Hawaiian Diet study, 20 participants (native Hawaiians) consumed unlimited amounts of local food consisting of common taro, sweet potato, yams, breadfruit, greens, fruit, seaweed and limited amounts of fish and chicken comprising a low fat (7%) and high complex carbohydrate (78%) diet. The result was a weight loss of 7.8 kg and a decrease in serum cholesterol and in blood pressure within 21 days. It is interesting to note that these results include a low drop out rate and high acceptability of the diet. Reasons cited for the success of this study include the fact that local food has large amounts of vitamins and contains high amounts of fiber, leading to smaller portions with increased satiety (Shintani *et al.* 1991; Englberger, 2003).

According to the literature, white rice and other less nutritious foods are replacing local food in the Pohnpeian diet. Popkin *et al.* (2001) describes this shift from bulky, local starch food to low-fiber, energy-dense refined grains such as rice as one of the primary causes of increased overweight and obesity resulting in chronic diseases. Typically, today a Pohnpeian meal can consist of rice and meats high in saturated fats that are often fried in oil (Englberger, 2003; Pollock, 1992). Although refined rice is not considered a significantly bad food, the behavior of consuming rice in the same quantities as local food can cause a shift in energy balance. Rice is an energy-dense refined carbohydrate lacking in fiber. When consumed in similar portions to the more nutrient dense and fiber rich local food, it is more likely to lead to over consumption of

energy requirements. According to Popkin *et al.* (2001), starchy root consumption in the Small Island Developing States (SIDS) of the Pacific (a reference name for 41 island states including FSM, by the United Nations) has decreased from 307.4 kg per capita consumption annually in 1962 to 208.1kgs in 1996. Animal fats and added sugar have also increased annually since 1962. The decreased demand and consumption of locally grown staples, has therefore led to a waning traditional food supply.

The US Department of Agriculture's School Lunch Program in Pohnpei (1960-1990) has heavily influenced the Pohnpeian diet by supplying surplus commodities such as white rice, flour items and canned meats to Pohnpeian children. Food is now the largest category of FSM imports (\$20 million in 1990) mostly from US, Australia or Japan, demonstrating high consumer demand and increase of energy dense foods (Hezel *et al.*, 2003; Englberger, 2003).

As part of the fabric of society, local food has played a cultural role in Pohnpeian life. Various foods, not just used for nourishment, were also prized as status symbols at one time and used to honor respected leaders. Yams in particular are carefully grown using secret family methods, and are still prized for the cultivation of their large size. 'Sharing', a common cultural trait, served as an informal avenue of local food distribution to support the extended family and to consume foods before they spoiled. Today, freezers and refrigerators allow foods to be stored, thus limiting distribution needs. A cash economy replaces the food barter system and the high status associated with store bought foods motivates those to work within this monetary system. Families are becoming more nuclear and autonomous with monetarization, as the increased demand of high cost foods creates challenges to support a larger family (Hezel, 2001). In addition, the younger generations prefer imported foods over local food resulting in a loss of the traditional cultivation techniques, which are passed orally through generations (Lee *et al.*, 2001).

Additional cultural barriers to food consumption changes include the public perception in many of the Pacific Islands that larger body size is associated with beauty and higher status (Snowden & Schultz, 2001). In addition, many people consider sickness a result of supernatural forces intervening in times of conflict, which leads to difficulties in teaching the links between diet and nutritionally-related diseases (Pollock, 1992).

Nutrition and Epidemiologic Transition

In order to comprehend the severity of these implications, one must regard the global health consequences. According to the World Health Organization (WHO), “the rapid rise of non-communicable diseases (NCDs) represents a major challenge to international development both health-wise and economically.” It is estimated that by 2020 over 70% of the global burden of disease will be caused by NCDs. Undernutrition of essential vitamins and minerals are concurrently present within these populations (WHO, 2003).

The Western Pacific comprised of the Pacific islands, Australia and New Zealand totals approximately one-fifth of this burden (Diabetes Today, 2000). According to Speigel (2004), “Rates of many NCDs are double and triple those of the U.S. population and are responsible for more than 50 percent of the surgeries performed in many Pacific Island hospitals.” In addition, inadequate screening and healthcare resources have led to underreported and underestimated cases in this region (Diabetes Today, 2000). Economically, the cost of treating Type 2 diabetes is a strain on many healthcare systems. The US, with approximately 40% of the population overweight between the ages of 35 and 55 and 7% prevalence of Type 2 diabetes, spends an estimated \$98 billion on health care costs for this disease (CDC, 2004). FSM, with 80% of its population overweight in the same age group, has 20% prevalence of Type 2 diabetes (Hezel, 2003). The cost to the Western Pacific will be double or even triple that of the US cost. As a

result, developing nations in the Western Pacific with limited resources within this region are already experiencing a financial burden to their health care systems (WHO, 2003).

Health-wise, studies describe the nutrition transition as taking place with ‘extreme rapidity’ in the Small Island Developing States (SIDS), including FSM. Common characteristics include increased urbanization, changes in income patterns, the role of women, household food-preparation technology, food production and processing technology and family/household composition (Popkin *et al.*, 1998). As countries increase in income levels and development, they begin to simulate developed country characteristics by increasing the consumption of processed foods and decreasing levels of physical activity. Popkin *et al.* (1998) explains “evidence demonstrates that some diet-related diseases become epidemic at a speed that is a function of the velocity of demographic and nutrition transitions, and that they emerge as epidemics in a predictable sequence.”

This transition from a subsistence to a cash economy within the Pacific region is illustrated in the research comparing the Pacific diets of the Chamorron people living a traditional lifestyle on the island of Rota of the Commonwealth of the Northern Mariana Islands to the diets of Chamorrans living in Guam and California who are dependent on a cash economy. Research found that although the Chamorron people on Rota had a greater total daily energy intake, the Chamorrans in California and Guam had a significantly higher proportion of total energy from high saturated fat foods (Hankin *et al.*, 1970). The island population of Pohnpei has experienced new and different environmental circumstances based on outside influences occurring over the past 40 years. Studies demonstrate the effect of populations with a common genetic heritage living under new and different environmental circumstances such as the increased age-standardized prevalence of obesity (>60% in men and women) of the Naurians

in Micronesia and the Polynesians in Western Samoa that was found to have a direct relationship to the change in diet and lifestyle. In another example, the Pima Indians living in the US are on average 25 kg heavier than Pima Indians living in Mexico (Kopelman, 2001). Similar trends within the western Pacific include Nauru, where diabetes was virtually unknown 50 years ago, but is now present in approximately 40% of adults (Zimmet, 2001).

Previously considered a model of health, early studies indicate FSM had minimal obesity and hypertension when the majority of their diet was based on local food consumption (Kincaid, 1973). Research (1948-50) by the Medical Statistics Division (of TTPI) reported an average weight for females ranging from 51-52 kilograms. In 1987/88, a follow up study in FSM after the introduction of imported foods, reported a considerable increase of the mean weight of women 67.9 kgs with average height remaining the same (Kincaid, 1973). Further indicators of the nutrition and epidemiologic transition are exhibited in a 1970 study that found increases in average diastolic and systolic blood pressures coinciding with increasing westernization (Patrick *et al.*, 1983).

Additional evidence from the National Nutrition Survey, one of the few surveys on the island of Pohnpei assessing dietary intake, illustrates the growing risk and prevalence of obesity, diabetes and hypertension. This survey was based on a systematic, random design using the village as the selection unit and the 1985 census, municipal and hospital records. With a sample size of 3588 women aged 15 to 49 years, weights and heights were measured. Overweight was defined as BMI ≥ 25 and <30 with obesity defined as BMI ≥ 30 . In Pohnpei, over fifty percent of the women aged 40 to 49 years of age were obese with all age groups in the overweight range with a mean BMI of 28.5kg/m² (Elymore *et al.*, 1989). An NCD screening for 8% of the adult male and female residents was carried out in the mid-1990s for obesity, hypertension and Type 2

diabetes (Auerbach, 1995), indicating that NCDs were an existing serious problem.

Furthermore, a STEPS survey was conducted in FSM in 2002, in conjunction with the FSM Department of Health, World Health Organization, the Fiji School of Medicine and other organizations also measuring the prevalence of NCDs among male and female adults (analysis is still underway). This STEPSwise surveillance approach provides evidence-based standards and data to target at-risk communities for interventions (Diabetes Prevention, 2004; WHO Meetings, 2003). However, the dietary intake data collected was minimal. Therefore, further research including this thesis is needed to capture current dietary trends and the knowledge, attitudes, beliefs and practices on food behavior to contribute to the STEPS results and to create culturally appropriate and effective interventions.

These studies illustrate the underlying epidemiologic transition and increasing risk factors such as overweight and obesity contributing to Type 2 diabetes and the ensuing public health problems.

“Healthy Diet” Interventions

Unhealthy lifestyle behavior relating to eating habits is cited as one of the major causes of Type 2 diabetes. It is estimated that 70% of premature deaths can be prevented through the promotion of healthy lifestyles and behaviors (Alto, 1994). At the Diabetes and Other NCDs Meeting of the Ministers of Health for the Pacific Island Countries in Tonga, March 2003, research was presented that demonstrates the effect of a ‘healthy lifestyle’ on diabetes patients. A randomized clinical trial of 3234 high-risk adults for Type 2 diabetes tested the effect of lifestyle changes and metformin – a medication used to control blood sugar – and placebo on incidence levels. After three years, the lifestyle group (as defined as a healthier diet with increased vegetables and fruits and reduced fat combined with increased physical activity) had a 58%

lower incidence of diabetes than the control group, and the lifestyle intervention was twice as effective as the metformin medication (31%) (Knowler *et al.*, 2001). The Finnish Diabetes Prevention Study, a randomized controlled trial of 523 subjects, found that changes in lifestyle (both diet and exercise) after four years reduced the incidence of diabetes by 58% in the intervention group. (WHO, 2003; Zimmet, 2001). Although both diet and exercise were addressed by these studies, O’Dea (1984) confirms the significance of the diet as, “a healthy diet can reverse the deterioration in glucose tolerance commonly seen with diets high in fat and low in carbohydrate and fiber”.

Successful nutrition intervention programs necessitate certain key components for adherence and adaptability including sustainability, cultural appropriateness, and the utilization of existing resources (Braun *et al.*, 2003). The following two models present lessons to learn from and they emphasize the importance of obtaining the objectives of this thesis in order to create effective interventions.

The Wai’anae Diet Program reintroduced in Hawaii is both an example of a successful diet utilizing traditional foods similar to those found in Pohnpei and a scientifically validated demonstration of the healthy effects of local food consumption. Described as the ‘pre-contact Hawaiian’ diet, its success stemmed from its cultural appropriateness with use of existing resources. Englberger (2003) describes the significance of this diet as a public health approach to reintroduce the traditional Pacific starchy fruit and root crop type of diet as a preventative measure and a model for Pohnpei.

In 1994, MODFAT (Micronesia One Diet Fits All Today), created for FSM, is a version of the Wai’ane diet. (FSM Department of Health, 1999). The local foods of Pohnpei are promoted as the main foods to be consumed and the detrimental foods containing high saturated

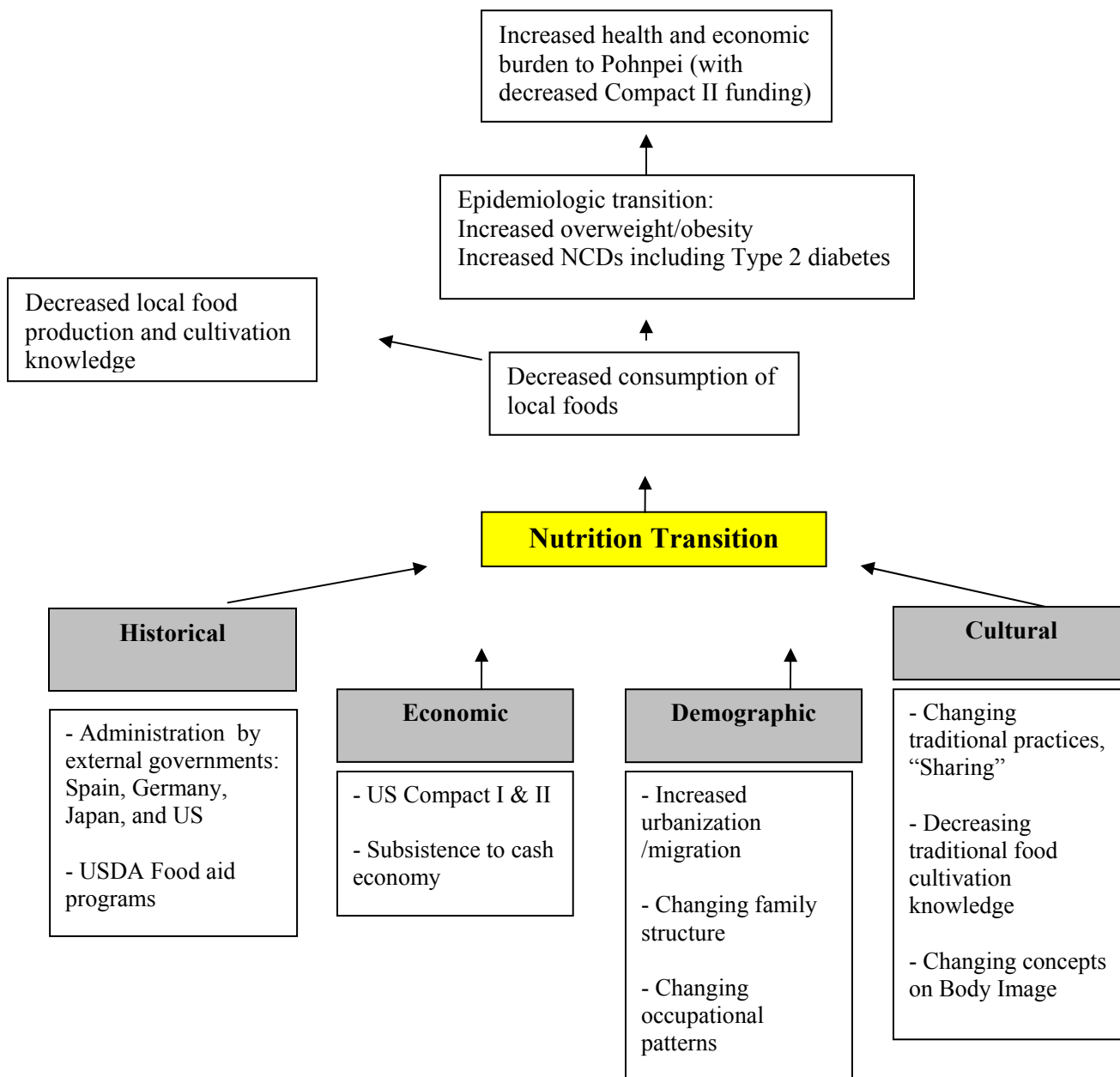
fats and sugar are more restricted. The purpose of this diet is to increase health and in turn, increase local food consumption and production. This diet is promoted in FSM as a preventative measure against NCDs. While this diet has been proven effective, research is still needed on how to obtain adherence of this diet in the population.

Contrary to the success of MODFAT, the 16-year Family Food Production and Nutrition (FFPN) program (1984-2000) supported by United Nations Children's Fund (UNICEF) had limited success with its focus on vegetable promotion. The reasons for its limited success were due to introduction of new vegetables that were unfamiliar, more difficult to grow, and therefore less acceptable (Barker, 1996). As Englberger (2003) states, "poorer families were already growing local food on their lands with minimal effort." This program introduced a new farming method using seeds rather than utilizing the already existing cultivation methods passed down through the generations, and the primary vegetables promoted were dark green leaves, which are often viewed usually as pig food. Therefore, this intervention was neither accepted nor adopted and lacked sustainability.

Studies demonstrate that working with existing resources, especially in a low resource setting, allows greater adaptivity to health programs (Braun *et al.*, 2003). Local food, an existing nutritious resource of the Pohnpeian culture, is decreasing because of reduced consumer demand, cultivation knowledge and practice. However, while it is still available today in Pohnpei, local food is useful for health prevention strategies to combat NCDs and to alleviate vitamin A deficiency. Health prevention campaigns require an understanding of the factors motivating food decisions in order to be successful. Difficult to measure, behaviors are based on intangible items such as belief systems and perceptions. The complexity of behavior involves understanding the individual decision-making components, tastes, beliefs, availability, as well as the

environmental, economic, political, social and cultural factors influencing these decisions. This thesis will identify important factors that may aid in the creation and in the approach or delivery design of these programs.

Figure 1: Pohnpei in Transition



CHAPTER TWO: METHODOLOGY

This chapter describes the research design, sample description and selection, study site, interviewer training, data collection instruments and approaches, lead researcher's role, and data analysis.

Research Design

The study design, an island-wide cross-sectional survey, used a 'mixed methods' strategy (Figure 2). Both qualitative and quantitative approaches were employed to achieve the study objectives. A quantitative approach provides numerical, objective information to understand the measure or 'reality' of a situation. A qualitative approach allows the researcher to explore the factors that contribute to decision-making behavior in a non-numerical fashion. Kelle (2001) describes the benefits of combining these research methods in his three definitions of triangulation, "as the mutual validation of results obtained on the basis of different methods; as a means toward obtaining a larger, more complete picture of the phenomenon under study and as a combination of methods necessary to gain any picture of the relevant phenomenon at all."

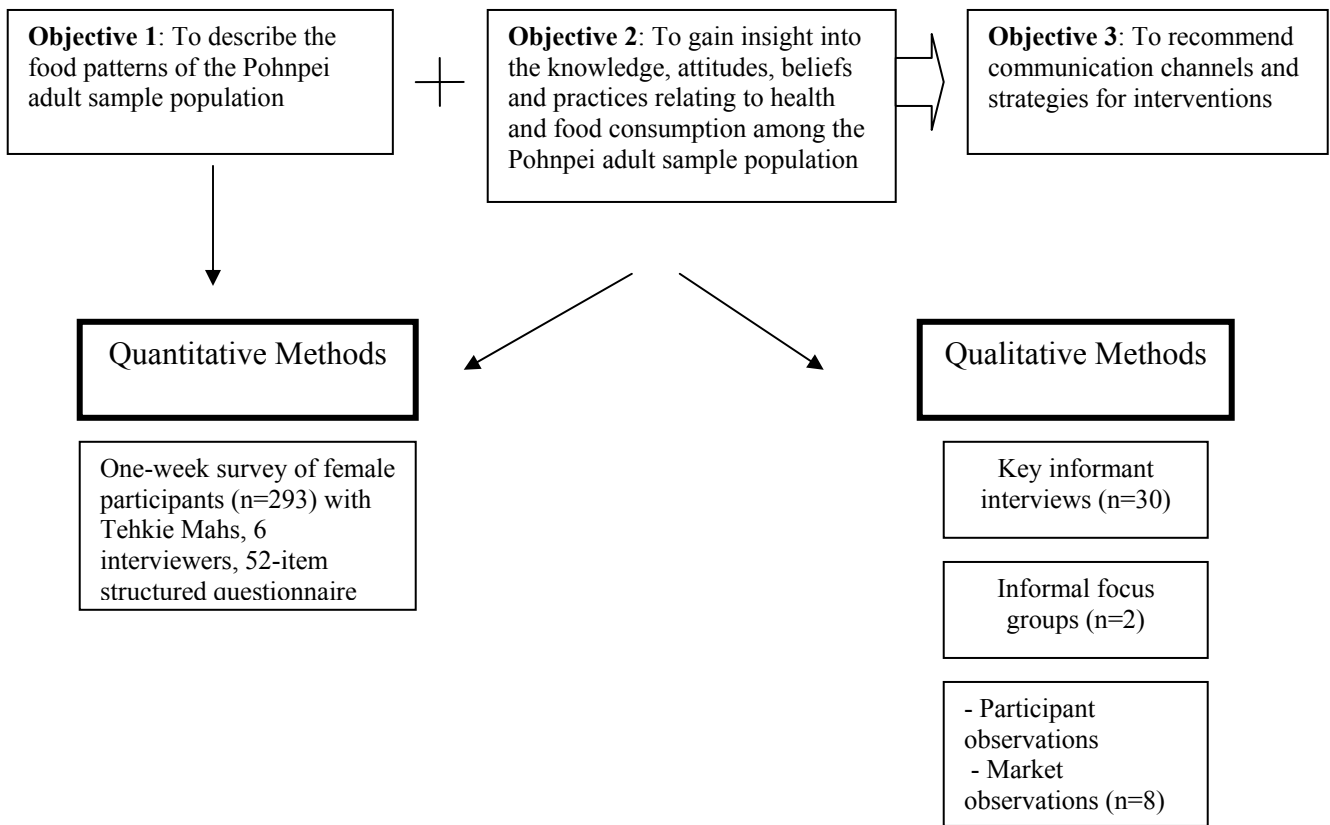
The first objective, to describe the food patterns of the Pohnpei adult sample population, and the second objective, to develop insight into the knowledge, attitudes, beliefs, and practices relating to health and food consumption practices, were addressed through the administration of a 52-item, quantitative survey. This survey consisted of a 7-day Food Frequency Questionnaire (FFQ) combined with a structured questionnaire composed of other selected questions (Appendix A). Administered by six trained interviewers with the assistance of three monitors, the surveys were delivered in a face-to-face format in the Pohnpeian language.

To further address the second objective, an ethnographic approach allowed insight into perceptions and beliefs through a combination of several qualitative methodologies including

participant observations, key informant interviews and informal focus group discussions. Conducted by the lead researcher in English, triangulation of these methods strengthened the internal validity of the information collected. This approach allowed the researcher to explore the Pohnpeian belief system relating to decision-making and traditional behaviors surrounding food, health and nutrition.

Figure 2: Research Design

Research Design



Due to the wide variety of variables used in determining food behavior such as availability, knowledge, affordability and practice, both methods were essential to gain understanding into the motivations and barriers to behavior change with the aim to provide valuable information to construct culturally appropriate and effective interventions.

Partnerships

Diverse partnerships were essential in the design and delivery of this project as food behavior is complex. Island-wide food and nutrition research has only included the National Nutrition Survey in 1989, therefore, local Pohnpeian organizations invested their time, the interviewers and additional resources to support this study. A collaborative approach was used to define objectives in order to ensure useful and relevant results to community, state and national organizations including the Island Food Community of Pohnpei (IFCP)- a new non-governmental organization established in Pohnpei for researching and promoting locally grown Pohnpei food, the Pohnpei Department of Economic Affairs/Agriculture Office, College of Micronesia-FSM Land Grant program, the Pohnpei Department of Health including Pohnpei Public Health Office, the Headstart Early Childhood Education Program, Tehkie Mahs Child-Disability Screening Program, and the FSM Department of Health, Education, and Social Affairs. Collaboration was also established with schools, church groups, the traditional sector in the community and other governmental and non-governmental organizations.

Fieldwork schedule

Preparations for the study began in November 2003 and included background familiarization, advocacy for the project among key department heads, securing approvals, and survey instrument development. Dr. Lois Englberger, working with the project partners, initiated

pre-testing of the survey previous to the lead researcher's arrival in Pohnpei. The fieldwork was conducted during a seven-week period, January 25th – March 15th, 2004. The first week included meeting with all the partners, updating the qualitative interview guide, performing key informant interviews, and pretesting the quantitative survey instrument, as well as confirming participation of interviewers and planning logistics. Qualitative methods were employed initially to ensure the quantitative survey instrument contained the significant questions and words appropriate to the culture. The second week was devoted to recording interviews and informal focus group 'themes' and to writing the quantitative interviewer-training guide. Interviewer training was conducted during the third week and the following week the survey was delivered to the sample population. The remaining time was spent on key informant interviews, double checking consistency of all survey data, coding surveys and finishing all remaining field research.

Quantitative Methodology

Approval for the Research

Activities important to the success of this project included securing partnerships and getting the involvement of Pohnpeian organizations. Official approval letters from FSM Department of Health, Education, and Social Affairs, the Pohnpei Department of Health, and Pohnpei Agriculture were secured for this project in advance. Meetings with the Island Food Community of Pohnpei, and College of Micronesia- FSM Land Grant Program were conducted to affirm their investment and support in this research as well.

Sample Description

Females from individual households, ages 15-64, participating in the "Tehkie Mahs special education screening program for children ages 0-5" served as the sample population. The

Tehkie Mahs program was carried out by the Pohnpei Department of Education in intersectoral effort including the Head Start and Department of Health. In accordance with the FSM National Nutrition Survey, females were chosen for this study based on their designation as the most sensitive indicators of the overall sample population's nutritional status and therefore, representative of what average households eat. A household was defined as a person or group of people sharing regular meals together and usually (but not necessarily) living in the same housing unit.

The sample size was based on the inclusion criteria of women (ages 15-64) who brought children to the Tehkie Mahs program located at five sites. Variables affecting these criteria include: those choosing to participate in this event and those who had access, although free transportation to the site was provided. The total sample size was 293 participants with a range of 40-70 participants from each of the five sites and a range of 17-70 participants from each of Pohnpei's six municipalities. Two municipalities (Kolonia and Nett) were combined into one site based on projected decreased attendance and close proximity of the two locations.

Sample Selection and Study Site

Cultural appropriateness of the survey design was essential to its delivery and effectiveness within Pohnpei. Characteristic of the Pacific culture, the values of collaboration and group work dominated the methods used for this survey. A key component in determining the sample selection and study area was to identify existing delivery mechanisms to the community with which this survey could partner. Because of limited resources and also for means of sustainability, decisions were made collaboratively on sample population selection and within this process, key relationships with community organizations were established to identify potential intervention program mechanisms and follow-up surveys.

Combined with the one-week “Birth to Five Tehkie Mahs” island-wide screening program, this survey took place in five sites on the main island of Pohnpei. The program was set up in a different site each day taking place between February 16-20, 2004 from 9am-3pm. Tehkie Mahs has been successfully conducting this screening for the past five years. Each year, they advertise with signs and radio broadcasts to encourage families to bring their children to the program sites, providing bus transportation as a means to increase access to each location. These sites were chosen based on the highest population (census data) within the six municipalities of Pohnpei. Schools or other public facilities were used for the sites. The only variation between locations was the combination of two municipalities, Kolonia and Nett, into one site due to their close proximity and expected smaller attendance. The remaining four sites were individual municipalities.

Interviewers

Interviewers were chosen on the basis of their organization affiliation, influence, availability and connection with nutrition programs as well as familiarity with local foods, culture and the Pohnpeian language. Interviewers consisted of the Pohnpei Public Health nutritionist, who is the lead nutrition counselor for diabetic patients and institutional nutrition programs, and three Public Health Assistants. All four were interviewers for the STEPwise NCD surveillance survey. The COM Land Grant provided their statewide nutrition educator who currently conducts education teachings with women’s community groups. The Pohnpei Department of Agriculture of the Department of Economic Affairs provided another interviewer who was essential not only for her expertise about foods, but culturally, she was also the spokesperson for our group at the Tehkie Mahs thank you ceremony because of her familial relations with a traditional leader. Each interviewer with her experience and expertise was

essential to the success of this interview process, both in its design and delivery. The interviewers may also lead some of the nutrition intervention programs that may be developed based on the survey data and thus the training and experience obtained from this survey will be instrumental to the intervention stage. Due to limited resources, these organizations will be working together in the future to deliver nutrition programs. Therefore, this survey process is an opportunity to build stronger relationships amongst the interviewers for these programs.

Due to funerals, which are a common occurrence on this island, two interviewers were absent for two days of the interviews. However, this circumstance did not seem to hinder the interview process nor create inconsistencies in the number of surveys collected.

As part of the internal validity check, three monitors were present during the interviews including the lead researcher, Dr. Lois Englberger and Amy Levendusky. Because the interviewers were situated in one location (usually a classroom), the monitors were able to check every survey as it was completed. Unanswered questions and inconsistency errors were promptly identified and taken back to the interviewer to correct before continuing with the next participant. In addition, each interviewer initialed the top right corner of the completed survey in case of questions. This ‘check’ process increased the efficiency and validity of the interviewers’ work.

Training interviewers / Survey translation

Because of differing schedules, individual preliminary interview training took place over a week, with only one one-day group formal training session. Similar to the Kosrae nutrition study (Englberger, 2003), the survey was written in English and translated orally by each interviewer into Pohnpeian. Due to the limited vocabulary of the local Pohnpeian language this survey was more precisely written in English. In addition, the interviewers found it easier and

more accurate to translate into Pohnpei orally from the English words. As a requirement, all interviewers were fluent in both languages (as English is the official language, but spoken less often in rural areas). However, the written consent form was translated into Pohnpeian and each interviewer was trained on how to deliver this section to ensure confidentiality and rights. As part of the training, Pohnpeian translations were practiced and agreed upon to ensure that the interviewers clearly understood the question and had consistent translations.

Motivation of interviewers is essential to the validity and amount of surveys conducted. Because of the interviewers' experience in health and agriculture, their partnership and investment were important to fulfill the study's objectives. Therefore, the decision to integrate this survey into an already established community program such as Tehkie Mahs and to work as a team in a group setting as culturally preferred allowed a design that promoted motivation. In the Pacific culture, it is not acceptable to 'stand out' but rather it is more respected to work on a team rather than as an individual (Englberger 2003; Pollock, 1992). Interviewers were also paid a small stipend after the study, which was important as an incentive and token of appreciation for their participation.

Lead Researcher's Role

The lead researcher's role was to act as decision-maker, traffic coordinator and validity monitor. Because the survey was designated as a 'station' and integrated as part of the screening program, it was important to assure the flow of participants within the classroom, assess when each interviewer was done, and to either check the survey or pass it on to another monitor. This process was important to secure the maximum amount of participants and ensure correct monitoring processes. Each morning, the lead researcher would brief the group on any changes or points to be emphasized from the day before. Because Tehkie Mahs is a collaborative process

with Public Health and Headstart participating, the lead researcher would briefly interview some of these workers as time permitted. In addition, it was important to establish a good relationship with the head of Tehkie Mahs for future collaboration, and consequently he is receptive to having a nutrition survey again next year.

Data Collection: Instruments

All survey instruments were submitted and approved by Emory University's Institutional Review Board and Pohnpei's Research Committee of the Pohnpei State Department of Health Services, Director of Health Services and Secretary of the FSM Department of Health, Education and Social Affairs (Appendix A). All interviewers were trained to deliver the written consent forms. Names and telephone numbers were taken as a means to contact the participants if there were questions, but this information was coded on the analysis for confidentiality. Surveys were safely locked in a secure place to ensure protection.

The 52-item quantitative survey instrument, comprised of a 7-day Food Frequency Questionnaire (FFQ) and a second section consisting of structured questions, took approximately thirty-five minutes to deliver to each participant. Developed to assess the sample population's food intake, the 7-day FFQ was used to gain insight into participants' weekly eating habits. The 7-day FFQ was based on the recall instrument used in a nutrition study done in Kosrae (a neighboring single-island state) with similar objectives (Englberger, 2003). Accuracy of the foods chosen as well as the categories were confirmed by a literature review and key informants from Pohnpei Department of Agriculture, Pohnpei Public Health and other food experts in Pohnpei through ethnographic methods. Key foods listed individually (e.g. rice, turkey tails) and certain food groups were categorized (e.g. flour products, local meats and imported meats) based on their local versus imported status. For each food type or category participants were asked,

“How many days, in the past seven days have you eaten.....”. In addition, individual foods researched as important for this project were listed under each category and circled if the participant had eaten it in the past seven days. The addition of sakau (a local traditional drink), alcohol and betel nut, were added as they are becoming public health problems in Pohnpei and potential risk factors for NCDs. Food recall is always difficult to measure and recall bias is present in most studies, therefore comprehensive interviewer training and questionnaire accuracy were employed to minimize these limitations. In analyzing the food pattern data, foods are measured in one-day increments as a frequency of consumption. Therefore, if someone ate half a banana one day, they were reported as consuming local food for one day. Important to future evaluations is the amount of food consumed within that day, however, these data do not quantify the amounts consumed; therefore that information cannot be deduced from these data. In addition, seasonality of local food was not accounted for in the survey.

The second section of this survey was designed through expert opinion and based on the Kosrae Nutrition survey and other surveys (Englberger, 2003; Snowden, 2001). This section consisted of demographic, knowledge, attitude, belief and practice questions as they relate to food preparation, consumption, preference, diabetes knowledge and other questions that address more specific future interventions such as knowledge and cultivation of certain bananas. The quantitative survey included questions about which participants had grown certain types of bananas that are rich in provitamin A and total carotenoids (beta-carotene and total carotenoids may help to reduce the risk to non-communicable diseases) on their land to understand their specific availability (Ford *et al.*, 2001). Because this survey addressed ways that people make food choices, and with many different stakeholders, it was important to cover a broad range of questions while maintaining the validity of each answer. Therefore, many questions were

reworded and pretested before deciding on their appropriate form. To establish the measured outcomes for nutrition and agriculture intervention programs, the stakeholders assessed each of these questions carefully.

The survey was pretested on various Pohnpeian people (15 people) and stakeholders in Kolonia, and reviewed by experts including the Director of Public Health, the Director of Pohnpei Agriculture, the FSM National Health Director, the FSM National Nutritionist, and the former Pohnpei Diabetes Today program director. The lead researcher also attended the FSM National Non-communicable Disease conference and the FSM National Biodiversity Strategy Action Program workshop, which had a particular focus on agro-biodiversity and local foods to meet key nutrition personnel and learn how this survey could be best tailored to their existing work.

Qualitative Methodology

Key Informant interviews

“Key informants are individuals with special knowledge, status, or communication skills who are willing to share what they know with the researcher (FHI, 2002).” Key informant interviews were essential to identify patterns of diet choice, the environment relating to these patterns, and to verify or expand upon the quantitative information gathered. Purposive sampling at government, organization and community levels ensured many perspectives on food and nutrition and continued until saturation. Wide sampling based on age, gender and ethnicity captured a range of people and views. Probing questions and in-depth interviewing style were used to extract the most information. This method was essential to construct the most accurate and culturally sensitive quantitative survey, which continued for the duration of the research.

Informal focus groups

“A focus group is the use of group interaction to produce data and insights that would be less accessible without the interaction found in a group (FHI, 2002).” Informal focus groups are a natural setting in the Pacific culture where an ‘open and social’ environment exists (Englberger, 2003). Based on social networks, focus groups were informally established consisting of 6-8 people within two different municipalities. Conducted in English with the lead researcher as the moderator, these interviews consisted of open-ended questions with a semi-structured interview guide to gather main themes and topics; many of which were gathered from the key informant interviews.

Participant Observation

“Participant observation brings the researcher into direct interaction with people and their activities (FHI, 2002).” Observing the ebb and flow of activity around a study site is essential to building context of the data collected. Participant observation was conducted in many settings within the different municipalities such as community meetings, the Headstart schools, college cooking demonstrations and conference settings. A holistic, inductive, observational method allowed the researcher insight into the Pohnpei life and food decisions. Unable to attend all gatherings due to time restriction, construction of certain events such as feasts was done through key informant interviews and background literature. In addition, due to cultural inhibitions and the limited time frame, the lead researcher did not include home setting observations in this study.

Food markets were essential to understanding the consumer buying behavior, available foods and comparable costs. Observations were conducted of all types of markets (n=8) including grocery stores, where mostly imported foods are sold, and local markets, where locally

grown foods are mostly sold. This type of observation also provided triangulation with the data received from the other methods.

Data Analysis

Qualitative data from the observations, interviews and informal focus groups were analyzed simultaneous with data collection and after using thematic analysis (Rice & Ezzy, 1999) to determine local descriptions of food, the importance of consumption patterns, and the perspectives and beliefs motivating consumption behavior. Written field notes were typed into Microsoft Word each night after the interviews. For the quantitative analysis, each survey was reviewed for any missed information and the appropriate participant was contacted if needed. Each survey was then coded for confidentiality. EpiInfo 2002 was used for the descriptive statistical analysis including frequencies and means.

In summary, this integrated approach allowed the researcher to establish food consumption patterns and the knowledge, attitudes, beliefs and practices constructing these food behaviors. This multiple methodology and collaborative approach serves as a model for follow-up surveys and continual study. The next chapter will present the findings and results of this combined approach.

CHAPTER THREE: RESEARCH FINDINGS

This chapter is divided into two sections. The first section describes the sample population characteristics for the quantitative survey to ensure careful interpretation of the data collected and to provide background information. The quantitative descriptive analysis is included which focuses on the results of the 7-day Food Frequency (FFQ). The second section combines the qualitative findings and the second half of the quantitative survey findings and presents themes identified to aid in understanding food choices including knowledge, attitudes, beliefs and practices.

Food Patterns

This analysis describes the findings from the 52-item structured questionnaire delivered to the sample of 293 female adults between the ages of 15 to 64 who brought their under-five year old children to the TehkieMahs screening programs in the five major sites on Pohnpei Island.

Sample Group Characteristics

All participants approached for this survey and those who met the requirements for inclusion in the study (on page 22) agreed to be interviewed, resulting in a 100% response rate. The integration of the survey with the Tehkie Mahs screening program is likely to have contributed to this high response rate.

The majority of the participants were between the ages of 25-49. Most participants had at least some formal schooling with the largest group schooled up to eight years (equivalent to primary education in Pohnpei). The municipalities were evenly represented, except for Kolonia and Nett, which have a smaller population (Table 1). Most of the participants were Pohnpeian. The majority of the remaining participants had parents from Pohnpei primarily from outer atolls

of Pohnpei. Because of migration to Pohnpei Island from the outer islands there tends to be a range of ethnicities, particularly in the more ‘urban’ areas such as Kolonia and Nett (Table 1). Many of the participants had at least one person in the family with a salaried job. ‘Salaried job’ was defined as a consistent income and includes government or private sector jobs. For those who did not have a salaried job, there were a range of income avenues including farming, money from relatives, self-employment, and fishing (Table 1).

Table 1: Characteristics of the sample population

Characteristics	Survey Sample n (%)
Gender: Female	293 (100%)
Age group:	
15-24	65 (22%)
25-49	209 (71%)
50-64	19 (7%)
average age	34±10.3
Number of years in school:	
0 (no schooling)	1 (0.4%)
1-8 (primary) ²	140 (48%)
9-12 (secondary)	113 (39%)
12+ (college)	39 (13%)
median / mean	9 / 9.4±2.7
Location of Residence: Municipality	
Nett combined with Kolonia	41 (14%)
U	61 (21%)
Madolenihmw	73 (25%)
Kitti	61 (21%)
Sokehs	57 (20%)
Ethnicity:	
Pohnpeian	243 (83%)
Others/Multiple ²	65 (17%)
Family Income:	
Salaried paid position ³ :	189 (65%)
Other income ⁴ :	
Farming only:	49 (17%)
Money from relatives/friends:	30 (10%)
Self-employment:	25 (9%)
Both farming and fishing	22 (8%)
Fishing only:	18 (6%)

- 1- Primary school is generally 8 years of schooling in Pohnpei. Secondary school is from 9-12 grades and college is considered 12+ years.
- 2- This includes participants from Mokil, Pingelap, Kapingamarangi, Nukuoro, Sapwuafik, Kosrae, Chuuk, Yap and participants with parents from both Pohnpei and other islands.
- 3- The question is asked if anyone in the family has a salaried supporting the participant. Participants may have a 'salaried' job but also farm or fish for income. For the purposes of this study, only one answer salaried job or other is acceptable.
- 4- Within the 'other' category, the participant can have multiple answers such as farming and fishing, etc. If neither participant nor her family has a monthly paid position, then she is asked what other income type does the participant or her family receive for support.

Results of the 7-day Food Frequency Questionnaire (FFQ)

The 7-day FFQ (Appendix A), comprised the first 30 questions of the survey and quantified participants' present-day diet based on their recall of food intake over the previous seven days. Specific food categories, such as *flour products* and *local foods* (defined as the traditional carbohydrate foods) and key individual food items, such as *rice* and *turkey tails*, were included to identify their consumption over the previous week. Non-food items including *tobacco* were also listed. Some categories were divided between local and imported foods similar to the National Nutrition survey to allow for specific analysis.

The findings were divided into three groups based on the number of days (0 days, 1-2 days and 3-7 days), of consumption. This analysis describes the data frequency by 'never eaten', 'sometimes eaten' and 'frequently eaten' (Table 2). This design, in accordance with the standard food availability indicator of Vitamin A-rich foods (WHO, 1996; Englberger, 2003) was also based on the Micronesian One Diet Fits All Today (MODFAT) diet recommendations. The FFQ results include the frequency and the mean number of days that each item was consumed over the previous 7 days.

Within some categories, individual foods were included on the survey as a second question (Appendix A). For example, the category *imported vegetables* included a list of types: head cabbage, carrots, etc. These specific foods were included as part of the overall category described by the interviewer so that respondents could state how many days in the past 7 days they had consumed any food in this category. The interviewer then asked the participant to specify which of these foods was consumed during the last 7 days. Each individual food was analyzed as a yes/no question so that multiple foods could be included in each category.

The process of selecting certain foods for each category was based on qualitative investigation. Key informants, including the partners of this project with their expertise in Pohnpei food identification and consumption, were interviewed to determine the most common foods consumed in each category. In addition, initial market research provided valuable data into the top selling and thus, most consumed foods.

Categories are self-explanatory with a few unique classifications. *Flour products* was defined as the most common foods comprised of flour. Doughnut was classified as both a *flour product* and a *food with sugar* because it is both a highly refined starchy food with high sugar content. *Local food* included locally grown carbohydrate foods. *Dryland taro* (otherwise known as common taro or *Colocasia esculenta*) and *giant swamp taro* (*Cyrtosperma chamissonis*) are two distinctly different root crops and were therefore classified separately. Preliminary research and pre-testing of the survey determined that banana should be included as a carbohydrate rather than a fruit because it is frequently cooked and eaten as a starch in the main meals. *Local vegetables* and *fruits* refer to those grown locally. Some crops have been introduced into Pohnpei more recently (i.e., cucumber), but are now grown locally and are therefore included in these categories. *Imported vegetables* and *fruits* are those shipped in from other countries and sold in grocery stores and markets. The protein heading consists of *meats* and *fish/seafood* further broken down into local and imported categories. The *fats* category includes cooking oils and foods high in saturated fat.

**Table 2: Reported consumption of selected items by female Pohnpeian adults¹
0 days, 1-2 days, or 3-7 days in the 7-day FFQ (n=293)**

Food Category	Never 0 days n (%)	Sometimes 1-2 days n (%)	Frequently 3-7 days n (%)	mean days (s.d.) ²
Carbohydrate				
Rice	0 (0.0%)	12 (4.1%)	281 (95.9%)	6.5±1.4
Flour products	44 (15.0%)	88 (30.1%)	161 (54.9%)	3.5±2.6
Local foods, as a group ³	9 (3.1%)	65 (22.2%)	219 (74.7%)	4.5±2.3
Banana	35 (11.9%)	125 (42.7%)	133 (45.4%)	2.9±2.3
Breadfruit	37 (12.6%)	125 (42.7%)	131 (44.7%)	2.8±2.2
Giant swamp taro	211 (72.0%)	69 (23.5%)	13 (4.5%)	0.5±1.0
Yam	210 (71.7%)	69 (23.5%)	14 (4.8%)	0.5±1.0
<i>Taiwang</i> banana	248 (84.6%)	31 (10.5%)	14 (4.8%)	0.4±1.4
Tapioca, sweet potato	257 (87.7%)	31 (10.5%)	5 (1.7%)	0.2±0.8
Dryland taro	257 (87.7%)	31 (10.5%)	5 (1.7%)	0.2±0.68
Vegetables and Fruits				
Imported vegetables	179 (61.1%)	40 (13.7%)	74 (25.2%)	1.5±2.4
Local vegetables	87 (29.7%)	59 (20.1%)	147 (50.2%)	2.9±2.7
Imported fruit	229 (78.2%)	42 (14.4%)	22 (7.5%)	0.5±1.2
Local fruit	51 (17.4%)	100 (34.1%)	142 (48.5%)	3.0±2.5
Protein				
Imported fish and seafood	47 (16.0%)	126 (43.0%)	120 (41.0%)	2.4±1.9
Local fish and seafood	7 (2.4%)	55 (18.8%)	231 (78.8%)	4.8±2.3
Imported meat	95 (32.4%)	113 (38.6%)	85 (29.0%)	1.9±2.1
Local meat	124 (42.3%)	120 (41.0%)	49 (16.7%)	1.3±1.6
Selected high-fat foods				
Fats	36 (12.3%)	104 (35.5%)	153 (52.2%)	3.0±2.2
Turkey tails	179 (61.1%)	94 (32.0%)	20 (6.8%)	0.7±1.1
Beverages				
Drinking coconut	102 (34.8%)	118 (40.3%)	73 (24.9%)	1.8±2.1
Drinks with sugar	54 (18.4%)	70 (23.9%)	169 (57.7%)	3.8±2.8
Other foods and non-food items				
Foods with sugar	87 (29.7%)	98 (33.5%)	108 (36.9%)	2.3±2.4
Snack foods	206 (70.3%)	57 (19.4%)	30 (10.2%)	0.7±1.4
Sakau	150 (51.2%)	57 (19.5%)	86 (29.4%)	1.8±2.4
Alcohol	256 (87.4%)	17 (5.8%)	20 (6.8%)	0.5±1.5
Betel nut	185 (63.1%)	13 (4.4%)	95 (32.4%)	2.2±3.2
Tobacco	191 (65.2%)	10 (3.4%)	92 (31.3%)	2.2±3.2

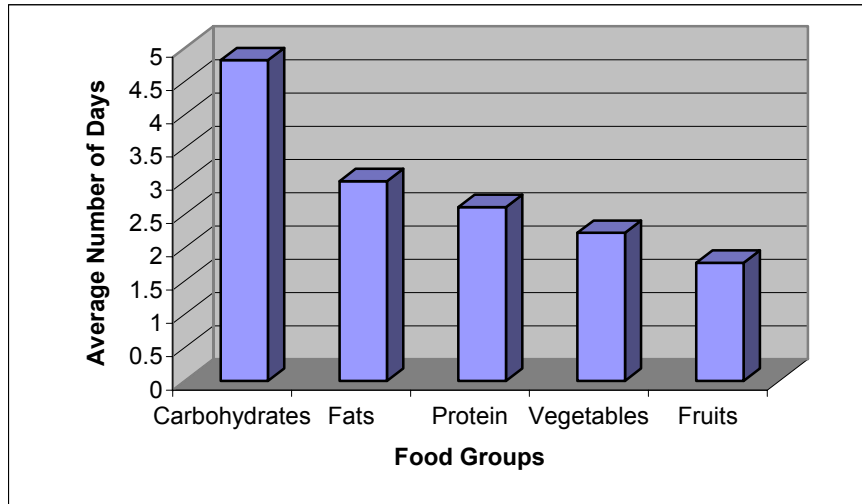
1- Adult is defined as ages 15-64

2- Standard Deviation

3- Local food includes breadfruit, banana, giant swamp taro, dryland taro, yam, tapioca, sweet potato and was asked as a separate question in the category of local food on the survey.

Food Groups

Figure 3: Average number of days that female Pohnpeian adults reported consumption on selected food groups in the 7-day FFQ (n=293)



Carbohydrates

The carbohydrates food group consisting of imported starches including rice and flour products and local starchy foods such as breadfruit and taro was the most frequently consumed of all the food groups (Figure 3). The average frequency of rice consumption exceeded the frequency of local food consumption. However, the local food consumption was greater than the consumption of flour products (Table 2).

Imported carbohydrates

Rice, the leader in the analysis of imported starches and the most frequently eaten food among all the categories in the survey, had an average consumption of 6.5 days. Therefore, 95.5% of the female participants ate rice frequently (3-7 days) with 85% reporting the consumption of rice every day during the previous week. Over 50% of the female participants consumed flour products frequently with an average consumption at 3.5 days (Table 2). The most frequently consumed flour products included bread, doughnuts and instant noodles (Table 3).

Table 3: Reported consumption of selected imported starch foods on at least one day by female Pohnpeian adults in the 7-day FFQ (n=293)

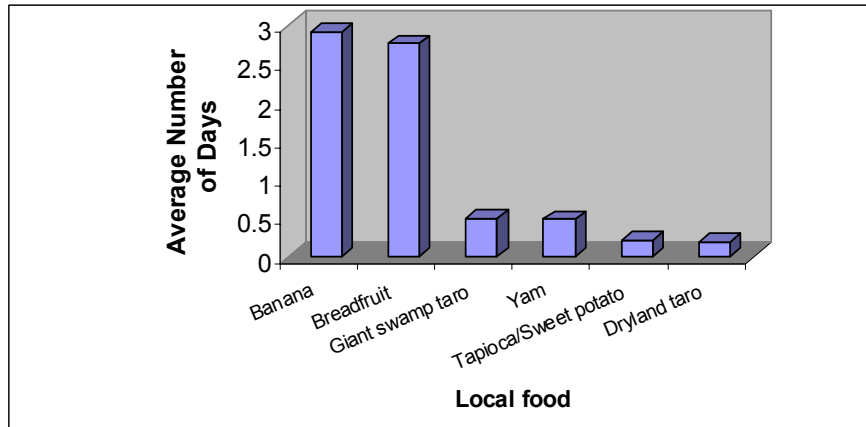
Imported starches	n (%)		n (%)
Bread	143 (48.8%)	Ship biscuit	12 (4.1%)
Doughnut	137 (46.8%)	Spaghetti	3 (1.0%)
Ramen (instant noodles)	123 (42.0%)	Cracker	1 (0.3%)
Pancake	35 (11.9%)		

Local carbohydrates

Local food, consisting of the locally grown starch foods, was analyzed both as a group and individually. Participants were asked how often local food as a category was consumed over the past week, and were then asked how often each individual food in the local food category was consumed. Participants consumed local foods, as a category, an average of 4.5 days out of 7 days with the majority of participants having eaten local foods during the past 3-7 days (Table 2). Within that group, 38.2% reported local food consumption 7 of the past 7 days.

Forty percent of the participants reported frequently consuming breadfruit and banana, (average days, 2.8 and 2.9 days respectively). *Taiwang* banana, giant swamp taro, dryland taro, yam and tapioca/sweet potato, were consumed less frequently (Figure 4). Seasonality of some local food may effect consumption practice; however not all foods are seasonal such as banana and taro. Accessibility factors such as land ownership also may influence food consumption.

Figure 4: Average number of days that female Pohnpeian adults reported consumption of the common local foods in the 7-day FFQ (n=293)



Vegetables and Fruits

Vegetables and fruit, both local and imported, are reported as consumed often, however historically, they were not part of the staple diet. Past intervention programs focused on vegetable consumption were met with limited success. Local vegetables were consumed twice as frequently as imported vegetables during the past 3-7 days (Figure 5), however, imported vegetables such as head cabbage and carrots were the leading vegetables consumed within the vegetable category (Table 4). Specific local vegetables had a wider distribution of consumption with a range of 5% to 25%. The leading local vegetables included Chinese cabbage (22.2%) and cucumber (25.3%) (Table 4).

Figure 5: Average number of days that female Pohnpeian adults reported consumption of local versus imported vegetables and fruits in the 7-day FFQ(n=293)

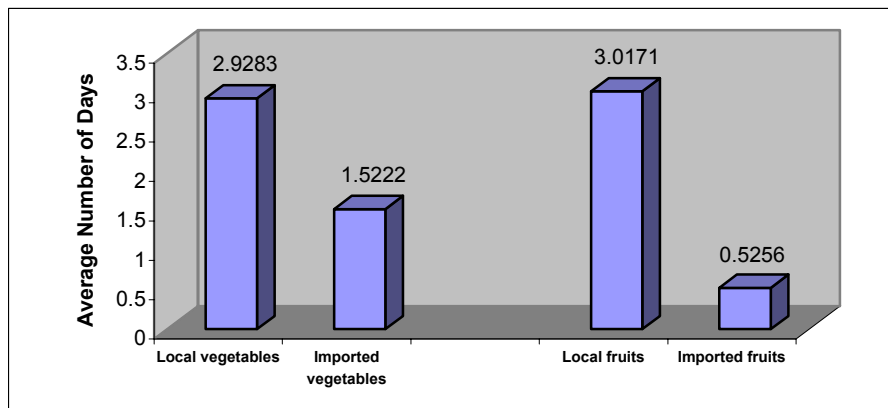


Table 4: Reported consumption of imported versus locally grown vegetables on at least one day by female Pohnpeian adults in the 7-day FFQ (n=293)

Imported vegetables	n (%)	Local vegetables	n (%)
Head cabbage	79 (27.0%)	Cucumber	74 (25.3%)
Carrot	67 (22.9%)	Chinese cabbage	62 (22.2%)
Catsup	13 (4.4%)	Green pepper	46 (15.7%)
Tomato	6 (2.0%)	Kang kong	45 (15.4%)
Others	6 (2.0%)	Chaya	31 (10.6%)
Lettuce	3 (1.0%)	Spinach	27 (9.2%)
Legume beans	1 (0.3%)	Chili Leaves	23 (7.8%)
		Bele	19 (7.4%)
		Eggplant	16 (5.5%)
		Others	8 (2.7%)
		Pumpkin tips	5 (1.7%)
		Taro leaves	1 (0.3%)

Protein

Fish and seafood

Fish and seafood was consumed an average of 2.4 days (Table 2). Participants consumed local fish and seafood on average twice as frequently (4.8 days) as imported fish and seafood (2.4 days) (Figure 6). Canned fish, including mackerel and tuna had over fifty percent consumption levels. However, reef fish scored the highest over all consumed fish (75.4%). Interestingly, fresh local tuna and canned tuna had practically the same consumption amount at 50.2% of the participants (Table 5).

Figure 6: Average number of days that female Pohnpeian adults consumed local and imported fish and meat in 7-day FFQ (n=293)

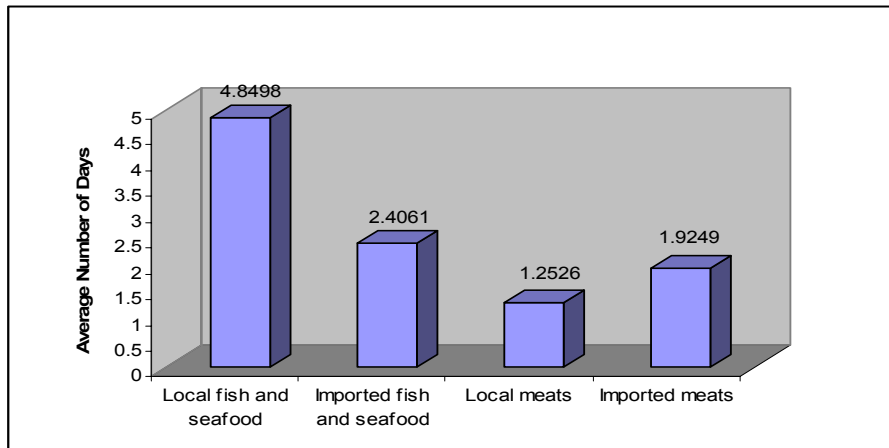


Table 5: Reported consumption of selected imported and local fish and other seafoods for at least one day by female Pohnpeian adults in the 7day FFQ (n=293)

Imported fish and seafood	n (%)	Local fish and seafood	n (%)
Canned mackerel	199 (67.9%)	Reef fish	221 (75.4%)
Canned tuna	148 (50.5%)	Tuna	147 (50.2%)
		Mangrove crab	16 (5.5%)
		Other fish	9 (3.1%)
		Other	5 (1.5%)

Meats

Meats as a category, in general, averaged fewer days of consumption (1.6 days) than fish and seafood intake (3.6 days) (Figure 6). Imported meats had a higher consumption frequency than local meats in the 3-7 day category with similar scores in the 1-2 day range (Table 2). Local pig had the highest intake (41.3%) (Table 6). Imported chicken, usually sold in quarters, was also consumed frequently (39.6%). Although canned corned beef was only consumed by a quarter of the sample population (24.6%), the qualitative data suggests that it is a preferred, prestigious food (Table 6).

Table 6: Reported consumption of selected imported and local meats on at least one day by female Pohnpeian adults in the 7day FFQ (n=293)

Imported meats	n (%)	Local meats	n (%)
Chicken	116 (39.6%)	Local Pig	121 (41.3%)
Canned corned beef	72 (24.6%)	Local Chicken	56 (19.1%)
Spam (canned)	56 (19.1%)	Dog	14 (4.8%)
Hotdogs	24 (8.2%)	Deer	8 (2.7%)
Sausage	11 (3.8%)		
Beef	1 (0.3%)		

Selected high-fat foods

Fatty foods, ranking number two for consumption in the total food groups, were frequently consumed by more than half the participants. (Table 2). Over thirty-five percent

reported occasional consumption of fatty foods. Therefore, most participants, over 87%, have eaten at least one high-fat food within the last 7 days (Table 2). Turkey tails, classified as a fat due to its high percentage of fat to meat composition based on the National Nutrition Survey guidelines, (Elymore *et al.*, 1989) was consumed by 38.8% of respondents during the past 7 days. Participants reported using vegetable oil (38.6%) and shortening (Crisco) (34.1%) most frequently in this category (Table 7). Coconut cream, a local food high in fat and considered more of a healthy fat, had a lower reported consumption (14.3%). Pig fat, highly utilized for frying foods, was not consumed as much as other fats (13.7%) but is an important item listed somewhat frequently on this survey (Table 7).

Table 7: Reported consumption of selected fat-containing foods on at least one day by female Pohnpeian adults in the 7-day FFQ (n=293).

Fats	n (%)
Vegetable oil	113 (38.6%)
Shortening (Crisco)	100 (34.1%)
Coconut cream	42 (14.3%)
Pig fat	40 (13.7%)
Butter/margarine	8 (2.7%)
Turkey tail fat	2 (0.7%)

Beverages

Drinks with sugar, the third highest average intake category (3.8 days), were frequently consumed by over half the participants (57.7%) (Table 2). Only a small number of participants (18.4%) reported no consumption. Coffee was the leading drink with sugar (36.5%) followed by soft drinks (31.7%) (Table 8). Koolaid is considered a beverage in the United States and is classified as such here; however, it is consumed both as a beverage and dry, as a sugary snack food, in Pohnpei.

Table 8: Reported consumption of drinks with sugar on at least one day by female Pohnpeian adults in the 7-day FFQ.

Drinks with sugar	n (%)
Coffee	107 (36.5%)
Soft drinks	93 (31.7%)
Tea	42 (14.3%)
Koolaid	40 (13.7%)
Milk	35 (11.9%)
Water	3 (1.0%)

‘Drinking coconut’, the name for coconut harvested early by Pohnpeians to drink the coconut water, has been a traditional and common practice for many years. Utilized also for medicinal purposes, drinking coconut is a healthy alternative to sugary drinks. However, its common practice is being replaced by some of these more ‘modernized’ artificial, chemically fortified beverages as seen in its low average daily consumption (1.8 days in the past week) (Table 2). One fourth of participants frequently consumed drinking coconut, while over fifty percent frequently consumed drinks with sugar. Despite the lower consumption of drinking coconut, this practice still exists in over sixty percent of the participants who drank drinking coconut in the past week. These statistics are based on the availability of coconuts and their seasonal variability. However, most of Pohnpei’s land grows coconuts in abundance. Those who do not have land can buy coconuts for a small price of \$.50-\$., as compared to canned soft drinks (\$1.25-\$3.50).

Other foods and non-food items

Foods with sugar

Foods with sugar were consumed by a high number of participants (70%) during the past week and with a high frequency (37%) (Table 2). Doughnut was consumed most frequently in this category (46.8%) (Table 9). In addition, the relatively new practice of adding sugar to the staple food breadfruit, was documented here (23.5%) (Table 9).

Table 9: Reported consumption of selected foods containing sugar or salt on at least one day by female Pohnpeian adults in the 7day FFQ (n=293).

Food with sugar	n (%)	Snack food	n (%)
Doughnut	137 (46.8%)	Potato chips	46 (15.7%)
Breadfruit	69 (23.5%)	Cheese crisps	16 (5.5%)
Pilohlo ⁴	28 (9.6%)	Popcorn	15 (5.1%)
Cookies	22 (7.5%)	Peanuts	3 (0.1%)
Ice cream	23 (7.8%)		
Banana	12 (4.1%)		
Candy/chocolate	10 (3.4%)		
Other*	10 (3.4%)		

*Bread, tapioca, taro, fried flour, rice

Snack foods

Snack foods were not consumed frequently as reported in this survey. Of the participants, over half (70.3%) did not eat any snack foods over the past 7 days and only a few (10.3%) of the participants ate snack foods frequently (Table 2).

Sakau en pohnpei / Sakau en alcohol

Sakau en pohnpei, *Piper methysticum*, a traditional narcotic drink made from pounding the kava root into a liquid drink, historically has been used only in ceremonies such as funerals, and predominantly consumed by the most prestigious leaders. The active ingredients in *sakau* (the kavalactones) comprise a psychoactive drug that produces a sedative effect. Today, this drink is consumed more frequently as the results indicate, on average of 2 days out of 7, as a common practice but is still consumed infrequently by this sample population. Observations at *sakau* bars, which are numerous in Pohnpei, demonstrate its popularity. There has been some speculation on societal and social negative responses leading to a public health problem as well. In addition, alcohol consumption as a ‘chaser’ after drinking *sakau* has become a common practice. Alcohol has been proven to increase the risk for NCDs. Of those who have drunk

⁴ Pilohlo is a traditional dish of pounded local starch foods, mainly banana.

sakau, 29.4% had a higher frequency of consumption in the past 3-7 days (Table 2). Only a small number of participants (12.5%) reported drinking any alcohol in the last 7 days (Table 2).

Betel nut / tobacco

Chewing betel nut, which grows abundantly in Pohnpei, with tobacco is a common Pohnpeian practice and contributes to the risk for NCDs. One-third of the participants reported chewing betel nut (36.8%) and using tobacco (34.7%) in the past week (Table 2). These numbers are less than half of the sample population, but remain a cause for concern as these are highly addictive substances.

Factors Affecting Dietary Intake

Both qualitative and quantitative methods were employed to capture the knowledge, attitudes, beliefs and practices objective. The following is the second part of the quantitative structured survey addressing factors such as cooking methods, food preparation, taste preferences, local food acquisition, the interrelationship of health and food, diabetes knowledge and access to health information. The qualitative analysis from the participant observations, key informant interviews and informal focus groups further explore these factors affecting dietary intake.

Cultural, social, and environmental constructs comprise the complexity of behavior. Key factors related to how and why people make food decisions are presented in this data analysis. Themes such as convenience, availability, affordability, social status, taste, body image and knowledge are presented to identify motivations or barriers to behavior change.

Sample Group Characteristics

For the quantitative analysis of this section, the sample group remains the same as the 7-day FFQ analysis discussed previously (Table 1). The sample used in the qualitative methods section is different. Key informant interviews (n=30) were conducted with both male and female participants living mostly in Kolonia. The two informal focus groups comprised of six people each included adult Pohnpeian females located in Kolonia. Participant observations and market research (n=8) was mostly done in Kolonia but included brief visits to all municipalities while delivering the quantitative survey.

Practices

Consumption Patterns

Consumption patterns, identified by the qualitative methods, are important to understand how people make food decisions. Meals in Pohnpei are often eaten intermittently throughout the day as ‘one feels hungry’. Large amounts of food are usually prepared in the morning to support this behavior. In addition, due to frequent family visits, it is respectful to have food always available to ‘share’.

Rice is reported as the most common food consumed, replacing local food as interviews and observations confirmed. Rice is fast becoming the new ‘local food’ as stated by many participants, and as one female describes, “*A meal is not considered a meal without rice.*”

The majority of participants ate local food half of or more than half of a total month. Most participants reported acquiring local food from their own land (Table 10).

Table 10: Reported levels of consumption and places of acquisition of local food by female Pohnpeian adults (n=293)

Every month, how much of the food you eat is local food?		Where do you get most of your local food?	
	n (%)		n (%)
Less than half	129 (44.0%)	Own Land	272 (92.8%)
Half	74 (25.3%)	Multiple answers	8 (2.7%)
More than half	78 (26.6%)	Local markets	6 (2.0%)
Don't know	12 (4.1%)	Relatives/friends	6 (0.2%)
		Community Land	1 (0.3%)

Other popular imported foods include canned meats and fish, frozen chicken, ramen (instant noodles), doughnuts (flour), turkey tails and fats including shortening and vegetable oil. Sugar foods are abundant and soda is available as a replacement for water. Kool-Aid is often eaten as a snack without water. Sugar is also added to beverages such as coffee, tea, milk or

water. *Sakau* and alcohol are reported in this analysis as more widely consumed when compared to the results of the 7-day FFQ. There are many *sakau* bars throughout Pohnpei. One participant explained the relationship between the *sakau* and alcoholic beverages “*More people are using alcohol as a chaser for sakau in order to get a ‘lift’ from the relaxed effects.*” The non-food item, betel nut, is regularly chewed by many Pohnpeians as evidenced by the red stained teeth seen throughout the municipalities.

Other factors of consumption patterns

Consumption patterns are also influenced by who prepares and buys the food. Females, reported as the primary food buyer, were clearly the food preparer within a household (Table 11). In respect to the proportion of funds spent on food, most participants responded that their household spends either half or over half of their income monthly for food (Table 11).

Table 11: Reported household member (male versus female) who purchases and prepares food by female Pohnpeian adults (n=293)

Who buys most of the food in your household?		Who prepares most of the meals in your household?	
	n (%)		n (%)
Female	188 (64%)	Female	290 (99.0%)
Male	105 (36%)	Male	3 (0.1%)

Cooking methods and food preparation are important factors to understand current health practices. Boiling was reported as the most commonly practiced cooking method for fish or meat followed by frying (Table 12). One explanation for this finding as described by a female participant, “*Boiling is probably the most common method of cooking because it is less expensive and you can put a lot of food into one pot and feed a large number of people.*”

Fried foods are a common preference. Fried reef fish is often on the menu of most restaurants and is considered a popular food. Vegetable oil, shortening and lard are economical

and sold in stores. Olive oil is by comparison much more expensive. One female informant stated, *“We sometimes save the oil from one dish and put it in the cupboard and use it again for the next dish.”* Local food is also served fried, such as fried breadfruit chips.

As noted in interviews and observations, cooking methods rely heavily on the common kerosene stove and rice cookers, replacing the traditional earth oven (called *um*). In terms of cooking preparation and time efficiency as a motivation for behavior, rice was unanimously found to be easier to cook than local food. As described by a male participant, *“With the rice cooker, foods are available all the time. Before, you had to forage and physically harvest foods, but now, it is much easier with the rice cooker.”*

Table 12: Reported cooking behavior by female Pohnpeian adults (n=293)

What is the most common way you or your family cooks fish or meat?		What foods do you think are easier to cook, rice or local food?	
	n (%)		n (%)
Boil	229 (78.2%)	Rice	291 (99.3%)
Fry	44 (15.0%)	Local food	2 (0.7%)
Multiple ways	8 (2.7%)		
Grill	5 (1.7%)		
Other	4 (1.4%)		
Bake	0 (0.0%)		

Taste preference, an important factor, contributes to a change in how people prepare their foods. One male participant explained, *“People determine what they eat by the taste. I know people that will grow local foods and sell them to get money to buy imported turkey tails. The Pohnpeian people love the taste of turkey tails.”* Local food (74.4%) was found to be preferred in taste than rice (18.4%) (Appendix B).

Changes in cooking preparation of local food include the addition of salt and sugar as stated by a female participant, *“I usually add sugar to breadfruit or bananas. Otherwise, I definitely add salt to improve the taste.”* A combined 73.7% of the participants consistently added sugar (20.5%) or sometimes added sugar (53.2%). Salt added to foods, a more common

practice, had similar total results, but had a marked increase when combined with those who consistently added sugar (74.4%) (Appendix B). As an observation, in attending different local food lunches, sugar was a common additive to boiled breadfruit.

Availability (Market Observations)

Pohnpei's grocery stores are within the more 'urban' regions where most imported foods are available. Public markets with local foods such as breadfruit, bananas, fresh fish and mangrove crabs are found in these areas and throughout Pohnpei. Small neighborhood food stands that sell mostly canned meats and fish, snack foods, doughnuts, betel nut, alcohol and some locally grown foods are scattered throughout the island providing some of the popular imported brands. Ox & Palm canned corned beef was cited as the most popular canned meat in many of the stores. Frozen chicken quarters that are sold in a box of 10 or 20 were one of the top products purchased. Rice remained the number one selling item in the stores.

Limited availability of local food in the marketplace reduces access to buy these foods. Grocery stores, as reported by store clerks, had a more difficult time selling local food because of inconsistent supply. With increased migration to urban centers, urban dwellers lack access to land and are more dependent on store-bought foods. Cultural barriers prevent some people from selling and buying local foods as a male participant observed, *"People do not feel they should buy local foods. Usually the people migrating to Pohnpei are the ones buying local foods because they do not have land. Otherwise, locals believe they have the foods growing already so they do not need to buy."* Another male participant explained, *"Selling local food is a sign that you are poor because you are selling something that everyone has available."* Despite these

data, a moderate amount (30%) of participants reported selling these foods, suggesting how strong the subsistence agriculture and small farmers are in Pohnpei (Appendix B).

Affordability

Affordability was a common theme when determining food consumption behavior. Numerous participants stated that rice is more affordable than local foods and can feed more people. Local food is often sold at a high price as confirmed by the market research. Reasons for this high price include a lack of supply in the formal cash markets and an elevated price established when the US tried to promote local foods (without success). In the markets, a 50-pound bag of rice can cost \$14.00 and feed a full family and relatives for weeks. Whereas, enough breadfruit to provide the same amount of sustenance for the same time period would be more expensive and more labor intensive (and take more time) to prepare.

Attitudes and Beliefs

The primary reasons cited for choosing less nutritious imported foods such as rice and canned meats over local food include factors related to time management, affordability and status. In addition, accessibility and ease of preparation have become important issues as society shifts to a cash economy with employment growth. As explained by one male informant, *“People are moving faster, going to school and working more. They are basing (food choice) decisions on the time efficiency of foods. Therefore they need foods that cook quicker.”*

Another female participant described the convenience of cooking and eating rice. *“It is much easier for me to cook rice in the rice cooker and have food available all day for children and relatives who visit, especially when I am working. I used to have to get up at 5am to cook*

food that would last the day. Also I used to have to gather fire wood to cook, but now I have a rice cooker and it is much easier.” Since females were found to prepare most of the meals, their changing role in society affects their food behavior.

Historically, in the Pacific Islands, having an abundance of food was a sign of good health, wealth and status and this concept continues today. With the ‘Pacific way’ of collectivity, people often base decisions on social perceptions. Social status was a theme expressed often as explained by one female informant, *“Rice and canned meats are prestigious foods. You were considered wealthy if you had canned meats. Also, those walking out of the store with a grocery bag were highly regarded. You wanted to be seen with one of these bags.”* Another male participant stated, *“You always must have a bag of rice at your house in case your relatives come by. You would be looked down upon if you did not.”*

Feasts and funerals, part of this collective social culture, were once an informal distribution channel for local foods. But these largely attended events are now becoming a channel to distribute less nutritious foods. *“Rice, canned meats and soda are replacing the local foods at these events in large number,”* cited a male participant. He continued, *“Food donated to feasts includes 50 pound bags of rice and huge amounts of imported frozen chicken. When you have 50 or more funerals a year, this means there is a lot of imported food purchasing and distribution.”*

Traditionally, the preferred body image is a larger sized body. This image still continues to influence views of physical health. As explained by a female informant, *“I went to visit my husband’s family on an outer island where imported foods are not easily available and people depend on harvesting local foods using traditional cooking methods. I lost 20 pounds and felt great. When I returned to Pohnpei, my family thought I was sick because I was thinner and told*

me that I needed to gain some weight.” Based on the informal focus group, perceptions do seem to be changing as westernized advertising increases and as education about weight reduction as a health measure continues to be a message.

Generational gaps are being created based on food preference as well as local food cultivation knowledge. Many children have grown up on these less healthy foods, and in fact, prefer them to local food. Many participants reported the following similar story: *“I like local foods, but my kids all prefer canned meats or imported foods. I cannot get them to eat any local food.”* In addition, rice, because of its soft texture, is highly valued for serving to children. *“Rice is used often for young children because it is considered easier substance for children to eat. Many of the local foods are much more difficult for children to eat except for the karat banana (a soft, pudding-like textured banana).”* Many participants stated that their children are not interested in learning cultivation knowledge and thus, this information is being lost.

Knowledge

Knowledge of the connection between food and health and disease is an important factor in identifying barriers to behavior change. In terms of healthier foods, almost all participants (98%) reported some knowledge that local foods are healthier than rice (Appendix B). In addition, only slightly over half of the participants reported receiving information on healthy foods (Table 13).

The most common avenues for information on healthy foods were through community workshops, radio and public health clinics (Table 13). Therefore, community outreach interventions seem to have the most infiltration at reaching community members. Doctors and schools tended to have a similar and lower profile.

Table 13: Reported receipt of healthy food information and avenue of receipt by female Pohnpeian adults (n=293)

Have you ever received information on healthy foods?		If answered 'yes', have received information, Where?	
	n (%)		n (%)
Yes	173 (59%)	Community workshop	65 (22.2%)
No	120 (41%)	Radio	54 (18.4%)
		Public health clinic	40 (13.7%)
		Doctor	18 (6.1%)
		School	18 (6.1%)
		Other**	12 (4.1%)
		Relative/friend	10 (3.4%)
		**Headstart seminar, posters, tv-chan.6	

Knowledge of diabetes and diabetes diagnoses was important to measure as a potential behavior change mechanism, as well as for public health to identify future screening programs. Few participants reported having diabetes. However, of those who reported not having diabetes, the majority (70.9%) had not been tested (Appendix B).

Still over half of the participants reported they had someone in their family with diabetes. When asked why people become sick with diabetes, over half reported diet as the cause. Over a quarter of the participants reported 'Don't Know' indicating a lack of knowledge in this area (Table14).

Table 14: Reported knowledge on cause of diabetes by female Pohnpeian adults (n=293)

Why do you think people become sick with diabetes?	
	n (%)
Diet	179 (61.1%)
Don't know	78 (26.6%)
Lack of Exercise	49 (16.7%)
Other*	26 (8.9%)
Curse/magic	0 (0.0%)
*Eat too much sugar, imported foods, stress, laziness, genetic	

The qualitative analysis provided meaning and texture to these quantified answers. When informal focus group participants were asked if they associated food with diseases such as Type 2 diabetes, only some were aware of this connection. Observations based on a local event where a famous citizen had died demonstrated that many still attribute sickness and death to magic or a curse. When asked if this was the case for Type 2 diabetes, the response was that *“People may think that magic is the cause of sudden death like heart attacks, but because diabetes is a longer term illness, it is not as much believed to be associated with magic.”*

In some of the interviews, knowledge was observed to minimally affect food choices. Many participants reported some knowledge of the association between preventing Type 2 diabetes and eating healthier foods but did not feel compelled to change eating habits. Those with diabetes stated that they had been trying to change these habits. One male explained, *“People are not used to foods being connected to illness nor thinking of what they are eating and how it affects their bodies. People do not know that diabetes is related to nutrition.”*

Mixed messages exist in the community as barriers to local food consumption. One female participant stated, *“We heard that local foods are starches and that starches are bad for you. Therefore, we should not eat them.”*

As a conclusion to this section, when one male participant was asked about change and how he viewed the nutrition transition, his response was, *“These changes have happened quickly, and we have not had time to keep some of our traditional beliefs nor integrate them.”*

The quantitative data presented described the food patterns of the Pohnpeian sample. These qualitative data summarizes some of the major themes that characterize a society undergoing many changes of modernization and presents ethnographic evidence to lend reasoning behind these food decisions. Certain new values, such as time management, are

presented and important to consider when designing health promotion interventions. Therefore, interventions need to take into consideration the individual psychosocial elements to decision-making as well as the socio-economic environmental factors that enforce these decisions as these data presented. This data is not generalizable to the whole population nor the Pacific region based on its non-random sampling, however, it clearly serves as a warning sign of the increasing diet-related NCD prevalence in the Pacific Islands.

CHAPTER FOUR: DISCUSSION

Globalization is an increasingly prevalent phenomenon where rapid communication and technology have created a web of connections impacting all levels of society - individual, community and national. Societies that once experienced 'traditional ways' are now 'modernizing' and experiencing new advantages and challenges due to this international interdependence. Increased disparities have crippled some populations, while increased alliances and growth have benefited others. Despite the negative or positive perception, globalization is a reality with escalating momentum. Characteristics of countries undergoing globalization have one common theme, change. Understanding and managing this process is the key to embracing its favorable aspects and reducing negative consequences.

Numerous global studies indicate that modernization, a catalyst for many transitions, includes a pattern of epidemiologic shifts. Developed countries such as the United States serve as the blueprint of influence for developing countries especially in health. Once suffering from infectious diseases, these modernized cultures now battle increased non-communicable, lifestyle diseases such as Type 2 diabetes, cardiovascular illness and cancers. Non-communicable diseases bring their own challenges as they are related to individual behaviors and lifestyle choices as well as environmental components including economic, social and cultural factors that shape behavior.

With increased modernization, imported foods more highly saturated in fat are available, affordable, accessible and in high demand in the Pohnpei culture. Similar to other countries in the nutrition transition, Popkin *et al.* (2001) confirms this food trend of refined grains (white rice or wheat) replacing the local starchy staple foods. For example, white rice, less nutritious and more energy-dense than local food is the preferred choice of the two.

Fortunately, existing food resources such as local food are still consumed frequently and remain important in the Pohnpei diet. This fact confirms Pohnpei's mid-transitional status, where "traditional agriculture, food systems and food habits still flourish" as described by Popkins *et al.* (2001) as a characteristic of the Pacific Small Island Developing States. To create interventions based on this research, education messages need to promote the combination of local food such as breadfruit, banana and taro with the increasingly preferred less nutritious foods. This integrated approach adds nutrients as opposed to sending a more difficult message to abstain from less nutritious foods.

While studies on the younger generations are needed, the qualitative data from this adult sample suggests that there is a generation gap in food preferences. Pohnpei's transitional period is critical indicating a possible "tipping point" where many small changes, such as those produced by modernization and within generations, converge in time to produce a large shift towards the preference for less nutritious foods (Gladwell, 2002). Therefore, it is important to address these issues before further consequences arise.

The quantitative methods led to the identification of this mid-transitional status in food patterns and the qualitative methods provided further information to construct a psychosocial model of food decision-making. Information derived from this research and supported by the literature, indicates that food consumption decisions based on knowledge, attitudes, beliefs and practices are motivated by many factors including time management. Accelerating the nutrition transition are new lifestyle components such as ease of preparation and technological advances, such as the freezer, refrigerator and rice cooker, that demand less effort and time compared to traditional food preservation, cooking practices, and food preparation methods. Women are the primary food purchasers and preparers, as indicated in the findings therefore, their increased

participation in the work force also has an effect on food behavior and must be considered in the design of intervention strategies.

The importance of status was found to be a key indicator, and demonstrates that marketing and social perceptions are significant factors when creating interventions. Foreign powers hold an immense amount of influence not just economically but also socially. Foreign imported foods such as white rice and canned meats are found to be associated with higher status and image of success. Similar to other Pacific cultures, the 'Pacific Way' describes Pohnpei's collective environment of promoting social interaction and group dynamics (Pollock, 1992). These social food beliefs are contagious and perceptions are supported and reinforced within these groups and disseminated throughout the culture. Building the status of local foods and associating them with a new and changed culture is essential to the creation of effective interventions.

Continued accurate and available information on healthy foods and the connection between food, disease and health is necessary. Most of the sample population indicated local food was healthier than white rice, which is a positive indication. However, many did not understand the connection between diet and diabetes. There were also many who reported not receiving nutrition information. Community programs were cited as the number one way that people learned about healthy foods. Doctors' offices and other areas need improvement in this area.

Availability of local food and the traditional food system is decreasing as discussed in the qualitative findings. Barriers to market availability and success include lack of an organized supply structure, high costs, and negative cultural beliefs on selling of local food. Decreased demand, particularly in the younger generations has decreased production (Englberger, 2003).

Most participants reported that their children prefer the imported less nutritious foods or white rice over local food. This data indicates that valuable knowledge of cultivation techniques will be lost with the next generation as this information is generally passed orally from generation to generation. Therefore, targeting strategies must include both children and adults to affect behavior.

Prevention in the form of healthy lifestyle promotion can decrease NCDs such as Type 2 diabetes (WHO, 2003). In spite of increasing demand for curative services and expensive off-island referrals for diabetes and other NCDs, limited funds are allocated to prevention programs. Therefore, a paradigm shift is needed from curative services often used to address infectious diseases to a preventive and health promotion campaign to address NCDs in order to alleviate this growing health and economic burden.

Where vertical programs were prescribed for communicable diseases, horizontal strategies are needed to target non-communicable diseases. Influencing food habits is a complex task within any society. Because food is intricately related to social norms, economic factors, production availability and preferences, intervention programs need a population-based, community-wide implementation. An intersectoral approach is necessary to address individual decisions and the environmental factors that influence these decisions. With this societal approach change is slow, but the goal is to simply deliver the same culturally sensitive message through many different channels while simultaneously building environmental factors to enable and support the community to make healthier food decisions more easily. A state-wide Information, Communication and Education (ICE) strategy is needed to create this message and delivery system targeting both adults and children. In addition, national policies effecting the demand and supply (agriculture) channels need to be examined to determine appropriate actions.

Partnership, as stated by the CDC (2004), is essential to delivering community-wide programs and influencing behavior. Low resource settings require innovative and collaborative approaches. Many partners that were integral to the design and delivery of this survey form the core group that will strategize the intervention plans. With limited resources where diabetes affects all areas of society, collaboration is essential to community interventions that promote the production and consumption of local food. Partners in Agriculture, Public Health, Education as well as the National Health Department, and the local producers, markets, and food processing groups all have influence needed to affect policy, production and consumption of foods. Therefore, this survey has been specifically designed to capture significant baseline information, and within this survey process, to establish and solidify intersectoral relationships building community capacity for nutrition interventions and delivery mechanisms.

Identifying how groups interact and the mechanisms to distribute information is key to strategizing the intervention plan. Mapping assets, a term coined by McKnight and Kretzmann (1997) describes a community development awareness shift from deficiency to abundance. Empowerment and ‘control’ originates from the community itself rather than an external influence by identifying existing avenues and resources operating within a community. Pohnpei has many viable assets both in human networks and in natural resources. As presented previously, local food is a nutritious natural resource available. Encouraged by the isolated island geography, close inspection reveals a myriad and mix of interconnected relationships and interdependencies. Numerous relationships, based on familial ties, church groups or occupational avenues, create social capital and are highly valued within Pohnpei. This web can serve not only as a communication channel, but also a mechanism to deliver valuable health promotion programs.

‘Points of influence’ is a term used to denote the areas in society where a person has contact or influence. Many individuals in Pohnpei serve as assets based on their connection or points of influence on all levels of society. For example, the Director of Agriculture (a Pohnpeian man) has influence over policy, farmers and food production. Also, deacon of a church, he holds a highly regarded position in Pohnpei society. His community influence then extends beyond church to feasts/funerals where large amounts of food are donated and informally distributed. He is also part of a local NGO to promote local food production and consumption. He is part of a family, both nuclear and extended with influence in these areas. His wife may belong to a church group where she has influence and etc. This individual is a valuable asset influencing both supply and demand of local food.

Organizations also serve as assets. The Pohnpei Island Food Community, a new NGO, is comprised of influential people at all levels of society and includes expertise in conservation, public health, agriculture, and education. This NGO serves as an important asset in itself. The vision of the Island Food Community of Pohnpei is “to live on a productive, environmentally sound island where a diversity of locally grown Island Food is produced and consumed, providing food security, sustainable development, economic benefits, self-reliance, improved health, cultural preservation, and human dignity.” This think tank has the expertise and experience to create a message to promote the consumption and production of local foods. Simultaneously, these key individuals have many points of influence within their communities and at policy levels serving as the mechanism through which to infiltrate these messages along the most channels.

Rapid change has depleted existing resources and they must not be overlooked nor discarded. As Popkin *et al* (2001) describe, there is a need to swing the pendulum of change back

towards the traditional cultural ways. Therefore, despite these ensuing health and economic costs, particular assets exist to manage this change and empower local communities to participate in their own future. For example, this research identifies valuable information to inform future interventions on the reintegration of traditional food systems.

In addition, due to decreased US Compact funding, Pohnpei is required to build its own infrastructure and resource base. Identifying and utilizing community assets and building social capital is integral to achieving self-sustainability (Kretzmann & McKnight, 1997; Mathie, 2002). Therefore, the inclusion of existing resources such as key individuals and organizations to support this study allows for a collaboration that can serve as a future framework to target many areas within the communities as well as policy level initiatives to effect environment changes to support this behavior.

Partnership, in the broadest sense, is recognized in the synergy created through the combination of the traditional and modernized processes. Modernization in Pohnpei, as it relates to the burdens produced in health, healthcare costs and cultural costs has been addressed in this paper. However, modernization changes are also very beneficial and preferred by many as seen in the data. Therefore, innovative and creative solutions that combine these qualities are required to build this relationship and influence food behavior to have a public health impact.

Recommendations:

1. Enforce the collaboration of partners on a community, state and national level to create the IEC future plan and its delivery strategy.
2. Use the quantitative and qualitative data from this research to create child and adult targeted interventions to address the individual and environmental issues identified to promote both supply and demand of local food.
3. Initiate interventions and follow-up studies to identify impact measures.

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APPENDIX A

Pohnpei Food and Nutrition Survey

- We would like to ask you to take part in a research project of Emory University, Georgia, USA, supported by the Health and Nutrition for Agriculture project and the Pohnpei Department of Health in conjunction with the FSM Department of Health, Education, and Social Affairs and College of Micronesia-FSM.
- The purpose of this study is to learn about food choices of Pohnpei adults. Food choice and nutrition have been related to diseases such as diabetes, high blood pressure and heart disease. The study results will be used to develop programs to help against these problems. The expected duration of your participation is one hour.
- If you take part in this study, you will be asked to respond to questions about your diet and food choice. You have the right to refuse to be in the study and to stop at any time or to skip any question.
- I will keep all information that you give me confidential. Your name and other facts that identify you will not appear when we present this study or publish the results.

If you have any questions about this study, feel free to call the principal investigator, Allison Corsi at 320-8639 or Adelino Lorens at 320-2400. We will later provide the results of this study, if you are interested.

Signature: _____ Date: _____

POHNPEI 7-day food frequency questionnaire for WOMEN 15-64 YEARS AGE

VILLAGE: _____ Municipality: _____ Telephone: _____

Name: _____ Birth date: ____/____/____ Age _____

For each food below, ask the following question- circle items eaten and give the number 0 to 7 in the box:
HOW MANY DAYS, IN THE PAST SEVEN DAYS, DID YOU EAT.....?

FOOD ITEM	# days/wk
1. Rice	
2. Flour products/Imported starch (bread, ramen, doughnut, pancake, spaghetti, ship biscuit, cracker, other)	
3. Local food of any kind (breadfruit, banana, yam, tapioca, sweet potato, taro)	
4. Breadfruit (<i>mahi</i>)	
5. Banana (<i>uht</i>) of any kind (ripe or cooked)	
6. Taiwang banana	
7. Giant Swamp Taro (<i>mwahng</i>)	
8. Dryland taro (<i>sawa</i>)	

Pohnpei Food and Nutrition Survey

9. Yam (<i>keh</i>)	
10. Tapioca (cassava), Sweet potato (<i>pateta</i>)	
11. Vegetables of any kind (<i>Iasai</i>), <u>fresh, frozen or canned</u>	
<i>12. Local vegetables, <u>only fresh</u> (Chinese cabbage, chili leaves, cucumber, egg plant, green pepper, kang kong, chaya, spinach, pumpkin tips, taro leaves, tapioca leaves and others)</i>	
<i>13. Imported vegetables, <u>fresh, frozen or canned</u> (carrot, head cabbage, catsup, lettuce, leek, tomato, legume beans, radish and others)</i>	
<i>14. Fruits of any kind, <u>fresh, frozen or canned</u></i>	
<i>15. Local fruits, <u>only fresh</u> (mango, papaya, Pohnpei apple, Pohnpei orange, lime, soursop, pandanus, Pohnpei watermelon, tangerine, pineapple, guava, pandanus, kalamansi and others)</i>	
<i>16. Imported fruits, <u>fresh, frozen or canned</u> (apple, orange, tangerine, watermelon and others)</i>	
<i>17. Local fish and seafood, <u>only fresh</u> (reef fish, tuna, other fish, freshwater eel, sea eel, shrimp, mangrove crab, octopus, lobster, shellfish, turtle and others)</i>	
18. Imported fish and seafood, <u>canned or frozen</u> (canned tuna, canned mackerel and others)	
19. Local meats, <u>only fresh</u> (local chicken, local pig, deer, ducks, dog and others)	
20. Imported meats, <u>canned or frozen</u> (canned corned beef, spam, sausage, chicken, beef, hotdogs, (not turkey tails), and others)	
21a. Fats: Vegetable oil, olive oil, shortening (Crisco), butter/margarine, cheese, coconut cream	
21b. Turkey Tails	
<i>22. Drinking coconut</i>	
23. Drinks with sugar (soft drinks, koolaid, sugar added to coffee, tea, milk)	
24. Food with sugar (pilohol, breadfruit, doughnut, pancakes, ice cream, cookies, candy/chocolate, and others)	
25. Snack food, <u>store bought</u> (potato chips, cheese crisps, popcorn, peanuts, other)	
26. Sakau en pohnpei (kava)	
<i>27. Sakau en wai-Alcohol (beer, wine, whiskey)</i>	
28. Betel nut	
29. Tobacco use (chew or smoking)	

APPENDIX A

Pohnpei Food and Nutrition Survey

43. What food do you think is healthier, rice or local foods (breadfruit, bananas, taro, yam-staples)?

1. Rice 2. Local foods 3. Don't know

44. What food do you think is easier to cook, rice or local foods (breadfruit, bananas, taro, yam-staples)??

1. Rice 2. Local foods 3. Don't know

45. What is the most common way you or your family cooks fish or meat?

1. Fry 3. Bake 5. Raw, do not cook
2. Boil (soup) 4. Grill 6. Other

46. Do you have diabetes? 1.Yes 2.No

47. **If no**, were you ever tested on diabetes? 1.Yes 2.No

48. Is there someone in your family with diabetes? 1.Yes 2. No

49. Why do you think people become sick with diabetes? **(Circle or write in answer)**

1. Diet 4. Other _____
2. Lack of exercise 5. Don't know
3. Curse/magic

50. Have you ever received information on healthy foods? 1. Yes 2. No

If yes, where? (Circle all that apply)

1. Public health clinics 3. Relative/friend 5. School
2. Doctor 4. Community training 6. Radio 7. Other

51. Which of these bananas do you grow on your land? **(Circle all that apply)**

1. Taiwang 4. Utin Kerenis 7. Karat
2. Utin Iap 5. Mangat 8. Akadahn
3. Ihpali 6. Akadahn Weitahta 9. Other
10. Don't have land

52. What do you think about *Taiwang* banana? **(Circle all that apply)**

1. We like it and eat it.
2. We like it just for making some cooked dishes, like pihlolo.
3. We don't eat it, it is mainly for the pigs
4. We don't eat it, it causes worms, has germs.
5. We don't eat it, because our elders told us not to eat it.
6. Don't know it/not available
7. Other

THANK YOU!!!! KALAHNGAN!!

APPENDIX B

Factors affecting Food Behavior Survey Results¹

<p>Who buys most of the food in your household?</p> <table> <thead> <tr> <th></th> <th>n (%)</th> </tr> </thead> <tbody> <tr> <td>Female</td> <td>188 (64%)</td> </tr> <tr> <td>Male</td> <td>105 (36%)</td> </tr> </tbody> </table>		n (%)	Female	188 (64%)	Male	105 (36%)	<p>Who prepares most of the meals in your household?</p> <table> <thead> <tr> <th></th> <th>n (%)</th> </tr> </thead> <tbody> <tr> <td>Female</td> <td>290 (99.0%)</td> </tr> <tr> <td>Male</td> <td>3 (0.1%)</td> </tr> </tbody> </table>		n (%)	Female	290 (99.0%)	Male	3 (0.1%)								
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<p>Every month, how much of your family's money pays for food?</p> <table> <thead> <tr> <th></th> <th>n (%)</th> </tr> </thead> <tbody> <tr> <td>Less than half</td> <td>53 (18.0%)</td> </tr> <tr> <td>Half</td> <td>100 (34.0%)</td> </tr> <tr> <td>More than half</td> <td>126 (43.0%)</td> </tr> <tr> <td>Don't know</td> <td>14 (0.5%)</td> </tr> </tbody> </table>		n (%)	Less than half	53 (18.0%)	Half	100 (34.0%)	More than half	126 (43.0%)	Don't know	14 (0.5%)	<p>Every month, how much of the food you eat is local food?</p> <table> <thead> <tr> <th></th> <th>n (%)</th> </tr> </thead> <tbody> <tr> <td>Less than half</td> <td>129 (44.0%)</td> </tr> <tr> <td>Half</td> <td>74 (25.3%)</td> </tr> <tr> <td>More than half</td> <td>78 (26.6%)</td> </tr> <tr> <td>Don't know</td> <td>12 (4.1%)</td> </tr> </tbody> </table>		n (%)	Less than half	129 (44.0%)	Half	74 (25.3%)	More than half	78 (26.6%)	Don't know	12 (4.1%)
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<p>Where do you get most of your local food?</p> <table> <thead> <tr> <th></th> <th>n (%)</th> </tr> </thead> <tbody> <tr> <td>Own Land</td> <td>272 (92.8%)</td> </tr> <tr> <td>Multiple answers</td> <td>8 (2.7%)</td> </tr> <tr> <td>Local markets</td> <td>6 (2.0%)</td> </tr> <tr> <td>Relatives/friends</td> <td>6 (0.2%)</td> </tr> <tr> <td>Community Land</td> <td>1 (0.3%)</td> </tr> </tbody> </table>		n (%)	Own Land	272 (92.8%)	Multiple answers	8 (2.7%)	Local markets	6 (2.0%)	Relatives/friends	6 (0.2%)	Community Land	1 (0.3%)	<p>Do you sell any local food?</p> <table> <thead> <tr> <th></th> <th>n (%)</th> </tr> </thead> <tbody> <tr> <td>Yes</td> <td>88 (30%)</td> </tr> <tr> <td>No</td> <td>205 (70%)</td> </tr> </tbody> </table>		n (%)	Yes	88 (30%)	No	205 (70%)		
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¹ As reported by female Pohnpeian adults (ages 15-64) (n=293)
 Analysis of 2nd part of Appendix A: Pohnpei Food and Nutrition survey (questions #34-52)

APPENDIX B

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Interview Guide for Key Informants/Focus Groups

Local foods

What are the main local foods you eat? Do you buy any local food?

Where do you buy them? Do you grow any local food? What foods do you grow?

What is your favorite local food?

Imported foods

What are your favorite main store foods that you buy?

What is the most common food eaten? How do store bought foods compare to local food in taste, cost and preparation? What would make you buy or eat more local food?

- What is your overall favorite food (local or imported)? What do you eat most often now? Why (cost, taste, availability)?

Status

What foods are considered high in status or associated with being rich? Why? Is local food high in status? What store bought foods are high in status?

What foods are associated with the poor or low in status?

Preparation

How do you prepare food? Do you add sugar or salt?

What do you use to cook foods? Rice cooker, um? Do you use oil to cook your foods?

What factors (time, number of people) contribute to how you prepare food?

Older generation

What did you eat when you were young?

What are the diet changes since you were a child?

Are people concerned about diet changes?

Do you think more local food should be eaten?

Did you eat local food, bananas, breadfruit, etc. when you were young?

Did you eat from the school lunch program? Did you like it?

What foods do you feed your children? What is their favorite food? What do they think about local food?

- Cultivation knowledge

Do you grow any local food? Do you pass this cultivation knowledge down to your children? Are they interested in it?

Feasts/Funerals

What foods are distributed at feasts? Do certain members based on status get different foods? What foods were distributed at feasts when you were a child? Has the food distribution changed now as an adult? Is there less local food or more of other foods? Specifically what foods or drink are there?

Knowledge of diabetes

Have you heard of diabetes? Do you know anyone who has it? What do you think causes it? Are there certain foods that aid in preventing this disease?

Health and diet

Do you think food is related to health or to diabetes?

Do you know of anyone with diabetes? What do you think people need to do to prevent diabetes?

APPENDIX C

What is healthy food? Are there foods less healthy that cause disease? What are those foods? Why do you think they are eaten? How do you think people will change their food behavior?

Buying behavior

What foods do you buy the most of? What foods cost the least, local or store-bought? What foods are easiest to prepare, rice or local food? Why? What factors effect your decisions on what foods to choose? (Taste, availability, affordability, ease of preparation?)

Markets/Stores

What are your top selling foods?

Do you sell any local food? How much?

Where do you get your local food from? (If applicable, Why do you not sell more local food?)

What is the cost of local food?

What is your top selling canned item? How much is the cost?

What is the future trend of the diet on the island-from their perspective?

(Observations- What are people buying? In their carts? What foods are more prominently displayed?)

Past interventions

What are past interventions promoting healthy food? What has worked? What may need be changed? How do you think behavior can be changed? What do you think is a way to promote local food consumption?