

# Urbanization, Obesity, and the Protective Effect of Traditional Food Behaviors in Fiji

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## Table of Contents

Introduction .....	3
Background and Context .....	4
• Table 1: The Urban Population in Fiji.....	4
• Table 2: Prevalence of Obesity in Fiji.....	4
Historical Background and Food Ecology in Fiji.....	5
Nutrition Transition .....	7
Urbanization .....	9
Social Networks and Behavior Change .....	11
Hypotheses and Predications.....	12
Methods.....	12
Results .....	13
• Figure 1: Bar chart of mothers BMI in Urban and Rural Households. (Chi-square value is 0.17, p value is 0.45).....	14
• Figure 2a: Fresh food consumption in urban and rural households. ....	15
• Figure 2b: Ready to eat food consumption in urban and rural households. ....	15
• Table 3: Corned beef consumption between urban and rural households (Chi-square value is 10.47, p value is 0.06).....	21
• Table 4: Tinned fish consumption between urban and rural households (Chi-square value is 1.15, p value is 0.89).....	21
• Figure 3a: Corned beef consumption between urban and rural households.....	21
• Figure 3b: Tinned fish consumption between urban and rural households.....	21
• Table 5: Corned Beef Consumption in Rural and Urban Households .....	22
Discussion.....	23
Conclusion .....	26
References: .....	28
Appendix I: Proposal.....	30
Appendix II: Urban Household Interview Sample.....	33

## **Introduction**

Obesity has become an overwhelming issue around the world today and is a potential leading cause of more severe public health problems. The world is a diverse place in terms of environments and cultures and, as a species we influence each other more than is recognized. Environment has played a major role throughout history to answer the questions of how, when, where, why, as the human race, have we come to be as we are today, and ultimately why we are so different. Social environments prove to be a point of diffusion among people and can be used to explain people's behaviors and values in a community. Food is an intersection between culture and ecology because it has been influenced by how people live their lives in a certain environment. This can be a good or a bad thing, either promoting a healthy diet among peers or instigating "bad" habits, and when countries are developing it seems people trend towards a less healthy diet. We have seen issues with dietary behavior in the United States, such as obesity, and now these same problems have spread to other areas of the globe. Humans have come a long way from the hunter-gather lifestyle and advanced in many areas to varying degrees, but our drive for more innovation and an easier lifestyle has manifested into a destructive lifestyle for our health.

I have found a true interest in learning about other cultures and environments and using my knowledge to get involved in other communities. My research project grew from my interests in people and health and through my participant observation experience in Fiji has evolved into this research project. I was given the opportunity to apply for a grant through the National Science Foundation and put my knowledge and effort toward learning about and getting involved in other communities. Therefore, I accompanied one of my professors, Dr. Dawn Neill, to Fiji to conduct a small independent research project looking at a shift in diet in urban populations and how that has affected health.

## Background and Context

Fiji is one of the more developed areas in the Pacific Islands (Bertram 2004). “The culturally diverse society of Fiji is in a constant state of flux as development and westernization allow traditional ways of life to be partially replaced by modern living” (Jansen et al., 1990:1).

Urbanization has been happening rapidly in Fiji, and Nutrition Transition (NT) related changes have been observed among all segments of society. The most current estimate for the population census of Fiji stands at 837,271 residents; of this 475,739 are of Fijian descent. The total urban population is 424,846 which has increased from the last census (1996) when it was 338,337 (Table 1) (FIBS, 2004). Among adults, between 1993 and 2004, the prevalence of overweight increased from 22.9% to 32.3%. In the same period obesity rates increased from 9.8% to 23.9%, an increase of over 23% (Table 2). Rates of overweight and obesity increase with age, are higher among Fijians than Indo-Fijians, and are higher among females and urban dwellers (NNS, 1993).

**Table 1: The Urban Population in Fiji**

	<b>Total Urban</b>	<b>Indigenous Fijians (% urban)</b>
<b>1986 Census</b>	39%	33%
<b>1996 Census</b>	46%	41%
<b>2007 Census</b>	51%	44%

**Table 2: Prevalence of Obesity in Fiji**

	<b>Rates of Overweight</b>	<b>Rates of Obesity</b>
<b>1993</b>	22.9%	9.8%
<b>2004</b>	32.3%	23.9%

In 2005, the Australian Child and Adolescent Obesity Research Network identified key areas for research associated with preventing childhood obesity and future chronic disease. More research is needed to identify variable environmental risks and protective factors. Investigations of dietary transition have implicated urban ecology as dominant in driving NT. However, research on the dynamics of how rural-urban migrants adopt elements of an urban diet is limited. Research suggests that migrants undergo a kind of diet substitution process during transition

wherein they begin adding elements of the new urban diet while eliminating elements of their traditional diet (Popkin, 1998). Urban diets are characterized by the consumption of more highly processed grains and higher levels of sugar, fat, animal products, and processed foods. However, the foods that change most are supplementary foods such as snacks and sweets, while those that remain unchanged for the longest period of time are staple foods (Gilbert and Khokhar, 2008:2003). The objective of my research project is to understand the association between maintenance of traditional dietary elements among urban migrants and the potential effect on obesity prevention.

### **Historical Background and Food Ecology in Fiji**

Fiji has been subject to a number of outside influences, including those of missionaries and the colonial British government in the 1800's, which had a great impact on the Fijian population. "Many of the colonial administration's regulations impacted on food production, gathering, preparation and consumption, thus influencing both eating and activity pattern" (Mavoa, 2008:376). Europeans instigated a huge migration of Indians between 1897 and 1916 to work on the sugar plantations, and many of them remained in Fiji which has led to indifference between Fijians and Indians. When speaking to the Fijian locals, their disdain of the Indians is apparent for coming in and "taking their land." Even though this migration was due to the colonization process, many Fijians see the Indians as the ones at fault. This migration and introduction of a new population impacts all aspects of life, including diet and urbanization. Many of the urban foods that people eat are of Indian origin. Prior to the introduction of Indian spices and foods, Fijians ate mostly root crops and fish flavored with little other than coconut milk (lolo). Today, most Fijians curry their meat to add more flavor to it and eat foods with roti, which is Indian flat bread. This trend is popular in the urban areas where the Indians reside and has dispersed to Fijian populations that have migrated there as their eating habits evolve to a more modern diet.

There is still no clear research indicating that these changes have impacted patterns of eating and physical activity in relation to obesity, but there are some implications that this multi-cultural fusion of Indians and Fijians in Suva has made some difference to populations.

One aspect of food in Fiji is clear; eating is a part of an important cultural lifestyle. Food fills a social and psychological need and is a central part of a belief and value system based on ceremonies, families, and communities. “A gathering of people, either for religious, social, political or economic activities, is not considered whole or complete without the presentation of food and drink to the participants” (Ravuvu, 1991:622). Food is viewed as such a wonderful thing in Fiji and the consumption of food is seen as a celebration. During my time in Fiji, I spent a lot of time eating meals with our local research assistants and with the people in the village and I was always encouraged to eat more. This was strange to me because in America, with our rising obesity issue and associated health problems, I have learned to use portion control, but there are no such dietary behaviors in Fiji. In the village everyone was so hospitable, we had big welcoming and going away ceremonies that consisted of enormous amounts of food, as well as dinner each night cooked by one of the village families. “When someone intends to call a meeting or other gathering, he or she has to first think about how to cater for them in terms of shelter, food and drink. They are three of the basic elements of a good life among Fijians...The greater the hospitality, the more successful and impressive the occasion will be” (Ravuvu, 1991:629). All of the households were so welcoming and always offering us food or drink; it became clear how eating was viewed by Fijians. During my participant observation I saw firsthand that food is not just about eating to subsist but is a true example of generosity. Each time I ate, I was told “Kana levu” which means to “eat big” in Fijian, and there was so much work they did each time they offered us a meal. I couldn’t believe their kindness and the

encouragement to eat more. This mentality has a lot to do with the way Fijians consume food, it is never seen as negative to eat a lot, especially when someone else has cooked for you. This may be reflected in the trend towards how a heavy consumption of new urban foods, which, in addition to the traditional eating style of Fijians, could be one explanation for their obesity issue.

### **Nutrition Transition**

NT describes population shifts associated with urbanization, receding famine, economic growth and increased frequency of degenerative diseases. NT research shows that “dietary and activity changes are paralleled by major changes in health status, as well as by major demographic and socioeconomic changes” (Popkin and Du, 2003:3899). As our species began with a hunter-gatherer lifestyle about ten thousand years ago, people’s diets consisted of foods low in fat and high in fiber with complex carbohydrates. As the Industrial Revolution happened so did a second agricultural revolution which resulted in a shift to a diet higher in fat and sugar which is what is seen in modern societies today. Like in many areas undergoing NT, Fiji has experienced a shift toward a more westernized diet and a simultaneous shift away from consumption of traditional foods. In developing countries, the growing availability of cheap fats and oils could turn out to have a profound effect on diet, “Between 1991 and 1996/7 global production of vegetable fats and oils rose from 60 million to 71 million metric tons” (Drewnowski, 1997:34). Observations show that among Fijians, in many areas the interference of outside influences as well as commercial pressures is shifting eating habits quite significantly (Jansen et al., 1990). Dietary changes associated with NT have been shown to differ qualitatively with the inclusion of novel ‘urban’ foods (e.g. red meat, bread, butter) and quantitatively as the amount of a certain foods consumed increases (e.g. sugar, fat). A key suggestion for explaining NT is the inclusion of these new ‘urban’ foods in the diet. “Wealthy industrialized nations in North America and the

European Union spend significant sums of money to convince their citizens to replace dietary fats with a simpler diet based on grains, vegetables, and fruit. Paradoxically, developing nations use their growing incomes to replace their traditional diets, rich in fibers and grains, with diets that include a greater proportion of fats and caloric sweeteners” (Drewnowski, 1997:31). In Fiji, this could also be impacted by maintenance of cultural norms of high consumption combined with eating new, higher density urban foods.

Although NT is associated with socioeconomic development, the exact cause remains unclear. Given an evolutionarily selected predisposition to feast or famine cycles (Neel, 1962), lifestyle choices in urbanizing environments could be key to understand NT-related diet change. “Associated socioeconomic changes especially important in the nutrition transition phenomenon are (a) changes in the role of women (especially with respect to patterns of time allocation); (b) changes in income patterns; (c) changes in household food-preparation technology; (d) changes in food production and processing technology; and (e) changes in family and household composition” (Popkin, 1998). There has been a big change in nutritional patterns for women, who usually spend a lot of time on the preparation and cooking of food, now allocate less of their time doing so because technology has made it easier for them. With the arrival of urbanization, food habits have changed to where “a Fijian woman consuming a recommended 2200 calories per day would receive 20 percent of her energy in the form of sugar. With the change in nutritional patterns and lifestyle, health and disease patterns have changed in the Pacific, with the emergence of non-communicable diseases such as diabetes mellitus, hypertension, heart disease, obesity and anemia” (Robertson, 1991:670). Lifestyle related explanations suggest a decline in physical activity as people move from subsistence agriculture to a more urban sedentary lifestyle and alter their dietary intake towards higher consumption of sugar and fat-dense foods



(Drewnoski, 2004). In addition, “One of the most inexorable shifts with modernization and industrialization is the reduced use of human energy to produce more capital-intensive manufacturing and goods and services” (Popkin, 1998:10). This movement towards a more modern diet and a less active lifestyle can be linked to increases in BMI and obesity. Therefore, it has been suggested that maintenance of traditional food norms may be protective against obesity (Shroder et al., 2004).

### **Urbanization**

In addition to nutrition transition, high urbanization rates have negatively affected lower income countries and created an uneven transition of diets. These populations now have the availability to acquire a more modern diet which includes more fats and sugars and less of the traditional diet of fiber and protein. These types of foods are becoming more accessible to developing countries, especially to urban migrants who look for cheap and quick-to-cook products to accommodate their more fast-paced and expensive lifestyle in city areas. “Global availability of cheap vegetable oils and fats has resulted in greatly increased fat consumption among low-income nations. Consequently, the nutrition transition now occurs at lower levels of the gross national product than previously, and is accelerated further by high urbanization rates” (Drewnowski, 1997:31). This trend can be seen in the United States and other countries today, the economy is finding easier ways for the population to eat that do not cost as much, but this has consequences. There has been an epidemiological transition as non-communicable diseases (NCD’s) now include heart disease, diabetes, and obesity compared to infectious and nutrient related disease before “Rapid urbanization is accompanied by unhealthy dietary practices, sedentary lifestyle and obesity, all of which are major risk factors of NCD’s. All these risk factors are lifestyle related and are influenced by change from rural to urban lifestyle” (Yadav and Krishnan,

2008:400). In addition, less physical activity is associated with urban diet because there is less work to get or cook these foods. In developing countries there has been an effort to create healthier eating habits in areas that have the means to do so, but in lower income countries the pace of urbanization has surpassed economic growth. “For example, whereas urbanization in more industrialized countries was associated with economic growth, in many developing countries it results in urban poverty” (Vorster, et al., 1999:342).

Urban areas are shifting towards a higher poverty level because rural populations are migrating to areas near big city centers but still living in poor conditions. “Urban agglomeration has been linked to the shift of poverty toward the urban areas, particularly toward squatter and slum areas. The rates of population growth are far greater in urban than in rural areas because of the continuation of long-term patterns of migration” (Drewnowski, 1997:35). One of my field sites for this project was in a squatter settlement and I was able to see firsthand that these areas are very crowded and more unstable than other areas I surveyed. Many of the houses were built out of tin or wood and located in the hills of mud and grass, whereas other migrants lived in apartment complexes. There is this rush of rural population to urban centers for jobs and to be part of the growing city, but poverty still exists and is becoming a bigger part of urbanization in these countries. In addition, urbanization in these areas is developing at such a rapid pace that the migrants of traditional indigenous populations are at a stronger vulnerability and a higher risk of NCD’s. These rural to urban migrations are interwoven with the NT from traditional foods to more modern foods, high in fat and sugar that result in an overall unhealthy diet and the addition of a more sedentary lifestyle. Further, circular migrants carry novel urban food ways back to rural areas, elaborating the spread of NT.

## **Social Networks and Behavior Change**

Social networks have been suggested to have an effect on diet through their effect on cultural norms and attitude. Within a social organization, individual members maintain relationships of varying degrees of closeness with other members. The connectedness of relationships between members in a society can be defined as that person's social network (Bott, 1955). People in more rural areas are more strongly connected with other members of society in small, tight knit communities. Though the size of the rural and urban social networks is similar, the connectedness is much looser in urban environments. The close connectedness of rural social networks provides a buffer against social change. "Together, group structures, and a group's dominant world views, values, ideas and expectations about food, eating, physical activity and preferred body size create a social and cultural environment that has the potential to promote or protect against obesity" (Mavoa, 2008:379). The closer contact between rural and urban environments through kin can potentially reflect a similarity in diet whereas a less connected relationship may promote change in one's diet. With urbanization, connectedness typically decreases and behavioral change is predicted to result. The effect of social networks on behavior change outcomes has been shown in studies on fertility decline and contraception use (Watkins, 1995; Kohler 2001), educational attainment (Mare, 1991), social support (Kanaiaupuni et al., 2005), and migration (Massey, 1987, 1988). Social network analysis has been also applied to health-related studies including adoption of risky health behaviors such as smoking (Alexander et al., 2001), infectious disease transmission (Morris 1997) and drug use (Pearson and Michell, 2000). Although there is evidence of relation between social network characteristics and health behaviors, the research for nutrition and obesity in terms of social networks is still lacking.

After thoroughly researching public health issues around the world and the associated trend of rapid urbanization, I have chosen to test the following hypotheses in order to further understand populations in Fiji and their dietary behaviors.

### **Hypotheses and Predications**

H1: Maintenance of traditional foods in the diet is protective against obesity among urban Fijians.

Prediction: The smaller the proportion of diet coming from traditional foods, the higher an individual's BMI.

H2: Rural social networks are protective against obesity, as they favor maintenance of traditional food behaviors.

Prediction: Greater contact with friends and family in residence in the village will be positively associated with maintaining traditional foods in the diet.

### **Methods**

In my proposal to the National Science Foundation in 2010, I proposed a budget of \$4,000 to fund my travel and living expenses for six weeks of fieldwork in Fiji. I lived in two field sites, both the urban capital, Suva, and a rural village, Vuisiga, located in the Naitasiri highlands. In the field, I recruited 22 urban migrant households and 25 rural households which have been identified through Dr. Neill's larger survey for participation in this study. These households were asked to participate in a short follow-up study component regarding diet and BMI, and standard anthropometric measures were also taken (Gibson, 1990). All data were collected with approval from the Cal Poly Human Subjects Internal Review Board. A detailed food frequency questionnaire containing an exhaustive list of both traditional and urban foods was administered to the mother of the household. Anthropometric data were collected and BMI and BMI-for-age were computed for each adult using the EPI-INFO software program. According to the Department of Health and Services, a number of 30 or greater is considered obese, and anything less than 30 is non-obese weight, therefore mothers were organized into two categories: "Obese" and "Non-Obese". These two categories are to be compared to other variables in terms of what

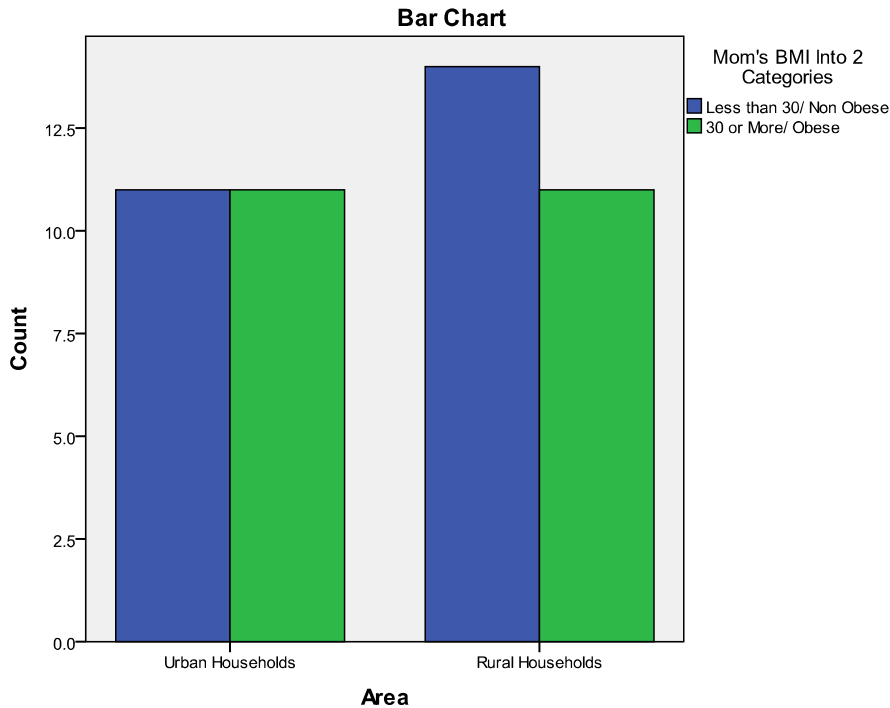
foods they consume, “Ready to eat” and “Fresh foods.” “Ready to eat” foods indicate a more urbanized diet of convenient foods such as noodles and bread, and “fresh foods” referring to fresh fish, grown vegetables, or root crops which are typical of a more rural diet. These variables were organized in terms of frequencies of consumption ranging from “Never” to “More Than Once a Day,” which are displayed in my results. This quantitative data was coded and entered into SPSS for testing and Chi square tests were calculated to assess the hypotheses. I will rely on these data and methods above to either support or reject the hypotheses.

Also, a short interview on diet, time in urban area, frequency of contact with friends and family living in rural village, and motivations for foods consumed was conducted. The interview data were recorded electronically in Fijian, and then translated to English by a bilingual research assistant to then be thoroughly analyzed for any projected themes.

## **Results**

My first hypothesis states, “maintenance of traditional foods in the diet is protective against obesity among urban Fijians,” predicting a larger number of residents will be obese in urban settings due to consuming less traditional foods. Prior to assessing food consumption, general comparison of BMI between urban and rural areas was done with the expectation that urban households would show a higher number of obese women than rural households. However, when looking at BMI, my results showed that there was not a significant difference between the BMI of mothers living in an urban area and mothers living in the village (Figure 1). Urban households seem to be split evenly between non obese and obese women with an average BMI of 31.6, and there are only a slightly higher number of non obese women than obese women in the village with an average BMI of 30. These differences were non-significant (Chi-square= 0.17,  $p= 0.45$ , non-significant). These results suggest little to no variation in obesity, indicating that

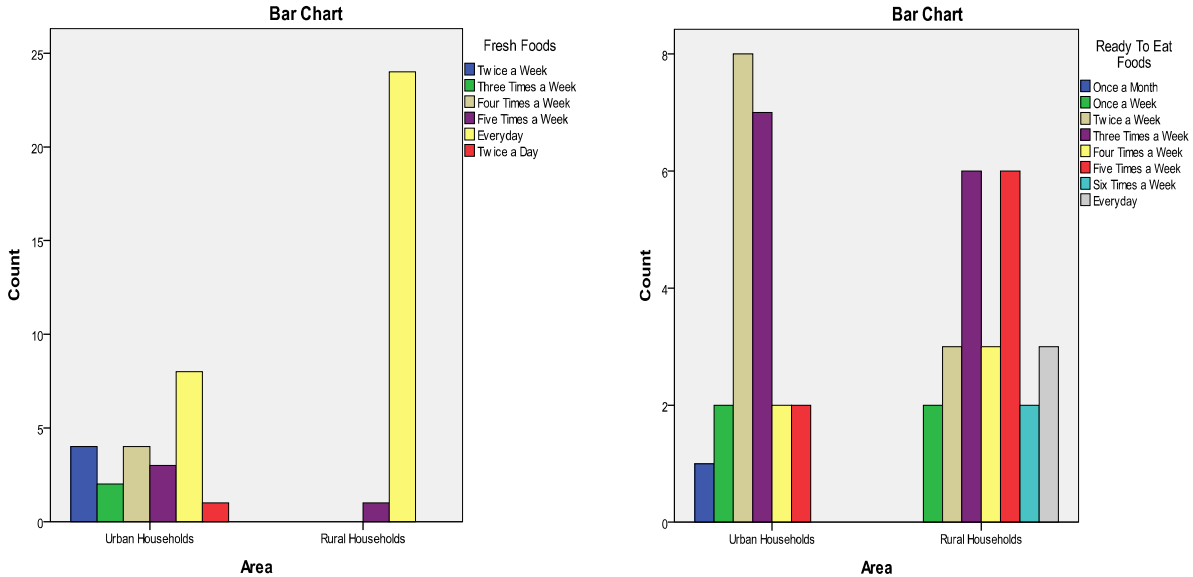
further quantitative exploration of hypothesis one would be fruitless without additional data collection, further implications for this will be forthcoming in my discussion.



**Figure 1: Bar chart of mothers BMI in Urban and Rural Households. (Chi-square value is 0.17, p value is 0.45)**

To explore the relationship between ecology and diet, I wanted to look at food consumption between urban and rural areas in terms of characteristic traditional (fresh foods) and urban (ready to eat) foods. Although these data cannot demonstrate significant difference, descriptive statistics show that food consumption does appear to vary. As expected, a greater number of rural households are eating fresh foods more frequently, indicating a more traditional diet than urban households (Figure 2a). In contrast to urban households that do not show a strong relationship to a certain frequency in consumption of these foods. Figure 2b shows that there is a large number of urban households consuming ready to eat foods two to three times a week, and rural households are eating the same foods about three to five times a week. There is

a greater similarity between urban and rural household consumption for ready to eat foods, and this dietary behavior demonstrates a shift towards a more modern diet in a developing area.



**Figure 2a: Fresh food consumption in urban and rural households.**

**Figure 2b: Ready to eat food consumption in urban and rural households.**

Next I analyzed my qualitative data from household interviews to further explore my first hypothesis and see if I could obtain more explanation in my research objective. Three major themes emerged that could shed light on the relationship between maintenance of traditional foods and obesity. The questions asked for both urban and rural households assessed:

- Frequently consumed foods
- Processing of left over root crops
- Favorite and least favorite foods and why

The three themes include dietary choices made for each household in urban and rural areas, diffusion of frying seen in left over crops, and favorite/ least favorite foods and why. The first theme from the interviews includes what each family consumed on a weekly basis. There

was a considerable number of urban households that consumed bread, such as buns and/ roti. Bread to Fijians can be anything, including biscuits (crackers), lolo bun (a roll of bread soaked in coconut milk and eaten at breakfast), or roti (Indian flat bread and can be eaten during any meal). There is a new introduction of bread products that is not characteristic of indigenous populations; traditional carbohydrates include dalo (taro root) and cassava compared to modern enriched carbohydrates such as bread and rice. Bread is not typically made in the village; rather it is bought in city centers and brought home to be eaten. Urban mothers typically discussed the incorporation of such food as follows, for example:

Interviewer: “Please tell me what your family consumed this week?”

Mother: “Monday biscuit, rice with curry tinned tuna. Tuesday Topoi [flour mix with sugar and hot water], tuna sandwich, and cassava with rourou lolo[leafy greens in coconut cream] and fish. Wednesday biscuit, tuna sandwich, and rice curry. Thursday we had bele [leafy vegetable] with fish and cassava. Friday we had rice with stew sausage. Saturday we had fish with lolo and rourou and dalo, Sunday rice with ika [fish] and lolo fried.”

This is typical of urban households- urban foods include tinned tuna, sausage, and bread while some traditional foods are maintained. We would be less likely to see a high number of breads and rice in the rural diet because they rely on more traditional foods that families grow themselves, such as vegetables or root crops. Also, there is more tinned fish recorded in the urban diet which is a characteristic of their city location where they can easily purchase canned foods that are simpler to cook and store. In the village, their most popular foods were dalo, cassava, rourou, and bele. Dalo is a purplish gray root crop that is very dense and usually boiled, whereas cassava is another root crop that is starchy but usually much softer. Rourou is a very



common leafy vegetable that is common to spinach and bele is another green leaf vegetable, distantly related to okra. Most data show the foods eaten by the people from the village came from what they choose to grow on their own land. Indicating they are more self sufficient and do not purchase much at the supermarket because they grow their main staples. This theme exemplifies availability and consumption patterns, urban households are eating more products that are accessible in city locations, such as tinned fish and bread products, and rural environments are consuming more of what they grow for themselves, including dalo and rourou.

The second theme examines a multi-cultural diffusion of oils between urban and rural environment that has led to frying of certain foods. In Suva, all the participants in the study said they fried their leftovers to eat the following day.

Interviewer: “What do you do with leftover root crop?”

Mother: “Fry it for the kid’s lunch and also ours.”

This shows an urban trait of what people do with food when they have the accessibility of vegetable oils to produce a new way of eating the traditional foods. An interesting fact to note here is that many Indians that live in Suva fry their foods as well, and this behavior could indicate a blend of cultures in the urban area that contributes to a modern trend of frying food. It also demonstrates that people strive for a variety in their diet and find a selection of foods that require less effort and time the following day to eat (Drewnowski & Popkin, 1997). This can be a model for the shift from a limited diet to a more diverse eating habit. In addition, almost everyone in the village had a similar response, frying their leftover when they can which emphasizes the diffusion and availability of oil.

The third theme reflects what the participant’s favorite and least favorite food(s) are and why. This theme provides more insight into personal dietary choices and the effect of urban

ecology on diet and obesity. In Suva, many of the urban residents interviewed chose vegetables as their favorite food and most preferred them to be boiled because it was healthy and they “grew up eating it,” most likely prior to migrating from the village. The household residents that were interviewed in Suva are all migrants from the village, who are now living in squatter settlements or typical housing complexes. This interview is from an urban household but shows a nostalgic connection to that person’s village and traditional food.

Interviewer: “What’s your favorite food?”

Mother: “Fijian food like vegetables, like rourou.”

Interviewer: “Why?”

Mother: “I like it because I started eating it when growing up in the village until now.”

Many other households responded with the same favorite foods for similar reasons and/ or because they knew those foods are healthy, which exemplifies that households are aware of what foods are healthy and many associate that with traditional foods. Additionally, a great number of mothers answered that their favorite food was “Fijian food;” this reference towards Fijian foods possibly indicates an affiliation with their culture. In Fiji, the meaning of what it is to be Fijian is “kaiviti” and exemplifies their sense of belonging to their land, kin and culture. In an urban area with a large Indian population, Fijians could have responded this way to distinguish their Fijian culture from the Indian or multi-cultural urban population. Respondents’ least favorite foods include many types of meats because many believe that chicken or other meats can cause sickness. From the same interview, the mother was asked,

Interviewer: “What’s your least favorite food and why don’t you like it?”

Mother: “Meats, because I’ve heard stories about it causing a lot of sickness and disease.”

As for the village members, they said their favorite foods were THE traditional foods, fish and rourou, because both foods are healthy and filling. Their least favorites were again meat, because it is taboo and thought to cause sickness, and also dhal, which is a lentil, because it causes bloating and has a plain taste. Also, dhal is regarded as an Indian food which can promote a more negative attitude towards the food. From two different village households mothers commented on their least favorite foods,

Mother 1: “Beef and pork because after I ate it I’ll feel heavy and lazy to do the work.”

Mother 2: “Food that has been stored in the refrigerator because it’s not healthy.”

Mother 1’s response relates to the stereotype of an urban lifestyle where people eat foods that are easier to consume but lead to less physical activity. Her response lends to the American saying “you are what you eat” and she associates these more urban foods with a reason for less energy. In addition, Mother 2’s response discusses refrigerated foods which highlight the non-traditional aspect of these urban foods that can be stored for longer periods of time. This stands in contrast to going to the garden to get more fresh food. It is interesting to note that for both areas, health is a major factor in what they like or dislike eating, with the urban members relating some foods back to their childhood, illuminating the overlap in dietary preferences between these environments. Taking a deeper look at the certain food behaviors highlights the connection between rural and urban areas and how preferences can play a role in consumption patterns.

My second hypothesis states, “Rural social networks are protective against obesity, as they favor maintenance of traditional food behaviors.” This hypothesis predicts that greater contact between urban and rural residents will result in higher maintenance of traditional foods for urban households. Alternatively this suggests that greater contact could also erode traditional food habits of rural households, if there is more contact between urban and rural households.

The processes in either area can be affected in terms of traditional food consumption. In addition to those noted above, typically urban foods include tinned meat, such as corned beef, because it is not fresh, contains virtually no nutritional value, and is processed and canned for the fast pace urban lifestyle. Therefore, we will look at corned beef as a proxy for an urban diet characteristic and test it in comparison to contact that these households have with each environment.

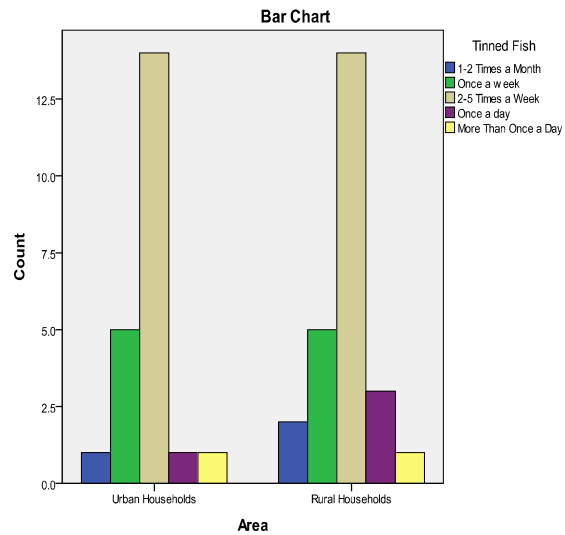
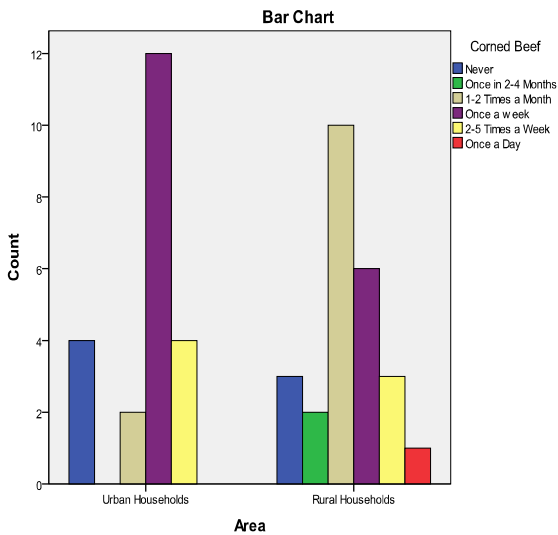
When looking at the frequency of consumption for corned beef, urban households eat this more often than rural, however there are still large numbers of village members who also consume corned beef (Table 3). A Chi Square test showed a marginally significant difference between observed and expected consumption of corned beef by area (Chi-square value is 10.47 and a p value of 0.06), indicating that corned beef is a more urban food. Though urban households are eating more corned beef, rural households are not far behind in the amount they are consuming (Figure 3). This outcome was not expected but captures the effect of diffusion of these typically urban foods back to rural villages. Predictably, there is no significant difference between observed and expected values for tinned fish, (with a p value of .89) (Table 5). This is not surprising because fish is the most traditional Fijian food, though tinned fish is a more urban form of this food, it is still more traditional than corned beef. Therefore, similarities in consumption between urban and rural households are expected. Both urban and rural households are eating quite frequent and similar amounts of tinned fish but vastly different amounts of corned beef; this can be more visually represented in the figures below.

**Table 3: Corned beef consumption between urban and rural households (Chi-square value is 10.47, p value is 0.06)**

		cornbeef						Total
		1	2	3	4	5	6	
Area	Urban Households	4	0	2	12	4	0	22
	Rural Households	3	2	10	6	3	1	25
	Total	7	2	12	18	7	1	47

**Table 4: Tinned fish consumption between urban and rural households (Chi-square value is 1.15, p value is 0.89)**

		fish_tin					Total
		3	4	5	6	7	
Area	Urban Households	1	5	14	1	1	22
	Rural Households	2	5	14	3	1	25
	Total	3	10	28	4	2	47



**Figure 3a: Corned beef consumption between urban and rural households**

**Figure 3b: Tinned fish consumption between urban and rural households**

Importantly, respondents were also asked in the personal interviews about their consumption of tinned fish and corned beef. When reading through my interviews and recording the frequency of consumption between urban and rural households and these foods, the results

seemed incongruent. In oral interviews, only four urban households claimed to eat corned beef comprising only 17% of the total urban surveys (Table 6). In comparison, 8 rural households making up 33% of the village members interviewed said they ate corned beef. In addition, I recorded below the amount of contact both rural and urban households had with each other to possibly see if social diffusion would be supportive of corned beef consumption in rural areas. However, the qualitative data did not show to have an effect on the consumption of corned beef. This was puzzling and indicated more urban food consumption in rural households, prompting further investigation.

**Table 5: Corned Beef Consumption in Rural and Urban Households**

	Rural		Urban	
	Eat	Don't Eat	Eat	Don't Eat
	8	16	4	18
<b>Frequent Contact</b>	13	7	0	3
<b>Less Frequent Contact</b>	11	9	4	15

When compared with quantitative food frequency data taken from the larger survey of households, a possible reporting bias can be seen in the qualitative data. Respondents stated corned beef consumption as expected when surveyed about food consumption. However, when the respondents were asked in a more personal interview about their eating habits and likes and dislikes, their answers seemed to change. There are programs in Fiji to increase education and awareness among residents about dietary behaviors, especially geared towards urban obesity. It is possible respondents altered or withheld information of the consumption of specifically unhealthy food during the data collection process to appear more compliant with what the media says people “should” eat. In addition, I was present for observation during the interview process and could have been the reason for the mothers to respond differently when asked a second time about the foods they ate. This will be further discussed in the next section, along with what Fiji,

as a country, is doing to improve their health and how this could explain the disconnect between the quantitative and qualitative data.

### **Discussion**

After examining the quantitative and qualitative data, it is apparent that urbanization is happening more rapidly than anticipated, especially for areas similar to Vuisuga village in close proximity to bigger urban centers, such as Suva. The village where I worked is largely influenced by the globalization happening in the city, in large part due to its short distance to Suva. Though Suva is not the closest city, it is the easiest to reach in that it only requires a three hour commute by bus to take people directly. Therefore, the contact between the urban and rural areas I surveyed is great and could be a factor in the results I obtained. It is possible that more remote rural populations could still show significant differences in obesity rates that relate to the consumption of traditional foods being protective against obesity, but for the purpose of my analysis this effect is inconclusive. Therefore, it is important to also look at the qualitative data that display some important themes in availability and consumption patterns, as well as dietary preferences.

My first hypothesis predicted that with a smaller proportion of diet coming from traditional foods we would see a higher BMI; however we did not see a significant difference in BMI between rural and urban households. Though this hypothesis could not be further examined due to low variation in BMI, the bar charts for consumption of fresh foods and ready to eat foods provides some important information. As shown in Figure 2, there is a definite difference in consumption of fresh foods. Urban households vary the amount they eat, but overall consume a lot less than rural households. In contrast, rural households show an overwhelming amount of fresh food consumption, indicating a more traditional diet which was expected. However,

looking at Figure 3 there is more similarity in intake of ready to eat foods, which might explain the similarity in BMI. More rural households are eating ready to eat foods that are characteristic of an urban diet and this is likely related to the village's proximity to Suva. Vusiga is only about three hours away from the capital of Fiji, which means the village residents have greater access to transport into the city, which provides greater availability of ready to eat foods. Compared to other more rural areas, the village I surveyed should be defined as more peri-urban exemplifying certain urban indicators being more common in their diet. Research describing urbanization describes the spread of urban behavior in rapid growth areas. If the urban core is accessible from outlying areas, then there is more opportunity for interaction between groups and spread of urban behavior. This diffusion is a likely explanation for seeing a more urbanized diet in the village households.

Even though there was no ecological variation in BMI, my interviews revealed a lot what was expected for my first hypothesis. The first theme about personal dietary choices showed that many urban households consumed items such as bread and rice, and that more vegetables and root crops are present in the village diet, which villagers grow for themselves. The second theme about the diffusion of vegetable oils in the processing of leftover root crops displays a more urban approach, given the availability of oils in the village of processing leftovers. This behavior when possible is also seen when villagers fry leftovers as frequently as urban households. The third theme, about favorite and least favorite foods, showed some interesting facts, for both urban and rural households. Both said that healthier food, such as vegetables, were their favorites, and meats that were fattening were their least favorite. Also, many of the urban households said that their favorite foods were so liked because they reminded them of what they ate in the village. This theme provides tangential support for my prediction because



urban respondents said that the foods they ate in the village, such as vegetables, were their favorite because they were healthy. In addition, both urban and rural households described meat as being a fatty food that caused sickness, resulting in it being their least favorite food. Therefore, there is some kind of knowledge about what foods are healthy and which aren't that must be projected to them via the media and diffusion of knowledge.

It is also important to remember the discrepancy between Indians and Fijians living in the same area. The Indian population has had a big influence on the urban diet, with the Indians running many of the food shops and businesses in Suva; their food culture has dispersed with their entrepreneurship. With many Fijians still feeling like their country has been invaded by Indian outsiders, their response towards dietary behaviors may very well reflect an emphasis on Fijian pride and belonging.

For my second hypothesis, my quantitative data showed that there was no significant difference in consumption of fish between urban and rural households, and tinned meat (corned beef) consumption was only moderately significantly greater among urban households. These findings were contradictory to my qualitative data, which showed that a larger number of rural households reported eating corned beef than did urban households. This is likely because of a reporting bias in the urban respondents. It is possible that when they were asked to give a quantitative response on how frequently they ate corned beef they responded accurately, but when they were asked to describe their diet behavior in an interview they reported less frequent consumption of unhealthy food. During the detailed food frequency questionnaire in the quantitative survey, mothers are asked an exhaustive list of foods and are to report their frequency of consumption of each, which could make it easier for them to report the truth in a more straight forward response. In comparison to the interview when we ask them more

personally about the specific foods they eat, they may be more hesitant to reply that they eat corned beef which is seen as an urban fatty food. As an outsider, I can see how my presence during the interview could have urged them to respond differently towards a question, especially during a time of urbanization when these foods are more available but also publically unhealthy. There are programs set up in Fiji to educate people on health and diet, and knowing what foods are “good” and “bad” for you can make it harder to answer truthfully during a personal interview and increase the likelihood of participant saying what they think they “should” say. It is likely that they withheld information about their diet when it came to an unhealthy food such as corned beef because they knew that it is considered unhealthy. There could have been a strategic modification of diet when they responded during the interview that affected the results yielding an incongruity between quantitative and qualitative results.

### **Conclusion**

The environment is a very important factor impacting dietary availability, especially given influences from areas such as urban centers “The major dilemma facing ‘developing countries’ is how to best promote economic growth, reduce infectious diseases, and at the same time delay or prevent the onset of NCD” (Vorster, et al., 1999:341). It is apparent that there is an issue facing less developed countries affecting urban development and diet, and there needs to be a next step in determining new policies and planning for nutrition in these areas. “It is not too soon for developing nations to develop policies for education and intervention that would avert some of the adverse health effects of the nutrition transition” (Drewnowski, 1997). Strategies can be implemented to promote a better quality diet, including providing information and education, effective advertising, and possible price interventions (Yadav and Krishan, 2008). With appropriate nutrition policies and programs, people will have better access to proper knowledge

about how to apply a healthier diet to their lifestyle. More research on nutrition and health issues will help to better find a way to make an improvement in communities. “That these changes appear to be occurring across so many countries lends weight to the need to understand the underlying environmental causes related both to shifts in diet and activity rather than focusing attention solely on genetic causes of obesity” (Popkin, 1998). There is a lot more to learn about diet and health issues but it is to be recognized that there is an issue that has been emerging in developing countries and it is not too late to develop resources to help avert some of these problems.

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## Appendix I: Proposal

### **REU: Urbanization, Obesity, and the Protective Effect of Traditional Food Behaviors in Fiji**

**Intellectual Merit:** This research takes an in-depth look into the protective effects of maintaining traditional dietary norms after undergoing urban migration. The study approaches nutrition transition and the effect of urbanization from the perspective of social network theory. By doing so, this study will contribute to understanding some effects of dietary shifts associated with urbanization and nutrition transition.

**Broader Impacts:** This study identifies the effect of maintenance of traditional foods on obesity among rural to urban migrants in Fiji. Fijians suffer from extremely high rates of obesity and chronic disease and rates continue to climb as Fiji undergoes economic development. By quantifying the effect of certain dietary components on obesity, this research will contribute to targeted urban public health campaigns in Fiji. In addition, this opportunity will provide valuable field experience that will contribute to my skills and knowledge in medical anthropology, as well as prepare me for further scholarly growth during graduate training.

**Introduction:** Nutrition transition (NT) describes population shifts associated with urbanization, receding famine, economic growth and increased frequency of degenerative diseases. NT research shows that “dietary and activity changes are paralleled by major changes in health status, as well as by major demographic and socioeconomic changes” (Popkin and Du, 2003: 3899). Like in many areas undergoing NT, Fiji has experienced a shift toward a more westernized diet and a simultaneous shift away from consumption of traditional foods. Observations show that among Fijians, in many areas the interference of outside influences as well as commercial pressures is shifting eating habits quite significantly (Jansen et al., 1990).

Although NT is associated with socioeconomic development, the exact cause remains unclear. Given an evolutionarily selected predisposition to feast or famine cycles (Neel, 1962), lifestyle choices in urbanizing environments could be key to understand NT-related diet change. Lifestyle related explanations suggest a decline in physical activity as people move from subsistence agriculture to a more urban sedentary lifestyle and alter their dietary intake towards higher consumption of sugar and fat-dense foods (Drewnoski, 2004). Dietary changes associated with NT have been shown to differ qualitatively with the inclusion of novel ‘urban’ foods (e.g. red meat, bread, butter) and quantitatively as the amount of a certain foods consumed increases (e.g. sugar, fat). A key suggestion for explaining NT is the inclusion of these new ‘urban’ foods in the diet. Conversely, it has been suggested that maintenance of traditional food norms may be protective against obesity (Shroder et al., 2004). Thus, I propose to examine the effect of diet on body mass index (BMI) from the perspective of traditional food maintenance in urban migrants.

**Background and Context:** Fiji is one of the more developed areas in the Pacific Islands (Bertram 2004). “The culturally diverse society of Fiji is in a constant state of flux as development and westernization allow traditional ways of life to be partially replaced by modern living” (Jansen et al., 1990:1). Urbanization has been happening rapidly in Fiji, and NT-related changes have been observed among all segments of society. The most current estimate for the population census of Fiji stands at 837,271 residents; of this 475,739 are of Fijian descent. The

total urban population is 424,846 which has increased from the last census (1996) when it was 338,337 (FIBS, 2004). Among adults, between 1993 and 2004, the prevalence of overweight increased from 22.9% to 32.3%. In the same period obesity rates increased from 9.8% to 23.9%, an increase of over 23% (Table 2). Rates of overweight and obesity increase with age, are higher among Fijians than Indo-Fijians, and are higher among females and urban dwellers (NNS, 1993).

**Table 2: The Urban Population in Fiji**

	<b>Total Urban</b>	<b>Indigenous Fijians (% urban)</b>
<b>1986 Census</b>	39%	33%
<b>1996 Census</b>	46%	41%
<b>2007 Census</b>	51%	44%

**Table 2: Prevalence of Obesity in Fiji**

	<b>Rates of Overweight</b>	<b>Rates of Obesity</b>
<b>1993</b>	22.9%	9.8%
<b>2004</b>	32.3%	23.9%

In 2005, the Australian Child and Adolescent Obesity Research Network identified key areas for research associated with preventing childhood obesity and future chronic disease. They suggest more research is needed to identify variable environmental risks and protective factors (Byrne et al., 2008). Investigations of dietary transition have implicated urban ecology as dominant in driving NT. However, research on the dynamics of how rural-urban migrants adopt elements of an urban diet is limited. Research suggests that migrants undergo a kind of diet substitution process during transition wherein they begin adding elements of the new urban diet while eliminating elements of their traditional diet. Urban diets are characterized by the consumption of more highly processed grains and higher levels of sugar, fat, animal products, and processed foods. However, the foods that change most are supplementary foods such as snacks and sweets, while those that remain unchanged for the longest period of time are staple foods (Gilbert and Khokhar, 2008:2003). Here we seek to understand the association between maintenance of traditional dietary elements among urban migrants and the potential effect on obesity prevention.

**Social Networks and Behavior Change:** Social networks have been suggested to have an effect on diet through their effect on cultural norms and attitude. Within a social organization, individual members maintain relationships of varying degrees of closeness with other members. The connectedness of relationships between members in a society can be defined as that person's social network (Bott, 1955). People in more rural areas are more strongly connected with other members of society in small, tight knit communities. Though the size of the rural and urban social networks are similar, the connectedness is much looser in urban environments. The close connectedness of rural social networks provides a buffer against social change. With urbanization, connectedness decreases and behavioral change is predicted to result. The effect of social networks on behavior change outcomes has been shown in studies on fertility decline and contraception use (Watkins, 1995; Kohler 2001), educational attainment (Mare, 1991), social support (Kanaiaupuni et al., 2005), and migration (Massey, 1987, 1988). Social network analysis has been also applied to health-related studies including adoption of risky health behaviors such as smoking (Alexander et al., 2001), infectious disease transmission (Morris

1997) and drug use (Pearson and Michell, 2000). Although there is evidence of relation between social network characteristics and health behaviors, the research for nutrition and obesity in terms of social networks is still lacking.

**Hypotheses and Predications:**

H1: Maintenance of traditional foods in the diet is protective against obesity among urban Fijians.

Prediction: The smaller the proportion of diet coming from traditional foods, the higher an individual’s BMI.

H2: Rural social networks are protective against obesity, as they favor maintenance of traditional food behaviors.

Prediction: Longer residence in urban areas will be associated with less reliance on traditional foods.

Prediction: Shorter residence in urban areas will be associated with greater reliance on traditional foods.

Prediction: Greater contact with friends and family in residence in the village will be positively associated with maintaining traditional foods in the diet.

**Methods:** In Fiji I will recruit 50 urban migrant households which have been identified through Dr. Neill’s larger urban survey for participation in this study. Households will be indentified during Dr. Neill’s initial data collection and asked to participate in a short follow-up component regarding diet and BMI. During the follow-up interview, standard anthropometric measures will be taken (Gibson, 1990). A detailed food frequency questionnaire containing an exhaustive list of both traditional and urban foods will be administered to the mother of the household. Also, a short interview on diet, time in urban area, frequency of contact with friends and family living in rural village, and motivations for foods consumed will be conducted. Dietary data will be entered into Food Works, a dietary analysis software program focused on South Pacific foods, and analyzed for caloric intake. As is recommended for anthropometric data from less industrialized countries, BMI and BMI-for-age will be computed for each adult and child, respectively, using the EPI-INFO software program. Interview data will be transcribed into Atlas ti and coded. Correlation coefficients (Pearson’s) will be calculated to assess hypotheses. I will rely on these data and methods above to either support or reject the hypotheses. Following data collection and analysis, I will extend this proposal into my senior research project at Cal Poly.

<b>Timeline:</b>	<b>Action</b>	<b>Dates/Cost</b>	<b>Notes</b>
	Arrive	June 15	
	Set Up	June 16- June 20	Sample determination
	Data Collection	June 2- July 21	Data entry
	Wrap Up	July 22-24	
	Depart	July 25	
<b>Budget:</b>	Airfare	\$2,000	Round trip
	Per diem	\$1,400	\$35/days x 40 days
	Transportation	\$200	Bus, taxi (Suva, to/from airport)
	Miscellaneous	\$200	Duplication, books, films, batteries, etc.
	Insurance	\$200	Purchased by Cal Poly



## **Appendix II: Urban Household Interview Sample**

RR. Please tell me about the foods you consumed this week:

LV. Mon-rourou with lolo and shredded sliced tuna, Tues- dhal and rice, wed- dhal and rice, thurs-rourou with lolo, fri- we had a dinner in town, sat- we had lolo bagan, sun-we had octopus with lolo, and cabbage with fish

RR. What did you purchased at the supermarket?

LV. I bought 10 kg flour, 4 kg sugar, toilet paper, soap, and my husband bought fish, dhal, sun bell

RR. What did you eat the most?

LV. we usually have a lot of tuna slice

RR. what did you buy at the market?

LV. bagan, coconut, rourou

RR. What did you eat the most?

LV. rourou

RR. What do you do with leftover root crop?

LV. fry in oil

RR. Did you have fresh fish and how did you prepare it?

LV. just sliced tuna which was mixed with lolo and rourou and cabbage

RR. Did you have some tinned fish/ tuna this week?

LV. yes, it was mixed with dhal

RR. Did you have fresh meat and how was it prepared?

LV. yes, beef it was souped with cabbage and potatoes

RR. Did you have some corned beef or tinned meat?

LV. yes, we had it as soup with noodles

RR. Do you grow a farm? What do you grow? How was it prepared?

LV. cassava, dalo, bele, rourou

RR. How long have we lived in suva?

LV. root crops are boiled and the vegetables are either boiled or lolo

RR. How often do you visit the village?

LV. sometimes on Easter or mother's day but we always go on Christmas and come back after new year

RR. How often do villagers visit you in suva?

LV. after every 2 or 3 weeks

RR. What kinds of food do you prepare when villagers visit you?

LV. just the food we are having that day like rourou or dhal

RR. How often do you have contact with village members living in the village?

LV. my husband can call nearly every afternoon

RR. How often do you have contact with village members living in suva?

LV. the second week of the month we always have our church service and sometimes we meet when there's a soli, funeral or wedding etc, when they will bring the news here

RR. What's your favorite food? Why?

LV. rourou when its boiled or with lolo

RR. What's your least favorite food and why you don't like it?

LV. dhal, because it's not tasty to me

DawnN. Maybe she could tell us a bit about, since her husband is the chief in the village, in the village does he or their family eat the same way as everyone else in the village or is it important that when he comes to visit that she makes certain foods for him because it sounds like that most of the foods she eats are pretty traditional

LV. everybody food is similar but they tend to eat a lot more fish there in the village because its free while here in town its more expensive but our family brings fish, root crops when they come to visit us in suva

DawnN. Is it easier finding food, preparing food, eating food in the village then in Suva?

LV. yes

DN. Why?

LV. in Suva we have to buy, too expensive

DN. What about the quality of food in Suva, do you think that the food is good food or is the food in the village much better?

LV. In the village

DN. Why?

LV. Some food have been in the fridge, it has lost its freshness

DN. Do you think that the food in the market in Suva is fresh or not since it has to come from a distance to get there?

LV. the foods are fresh from the farm so I think that they are fresh still

DN. How do you make soup from tinned beef?

LV. opened the tinned beef and put it in to the pot and then add water to boil and when its boiling add noodles and vegetables like cabbages or bele and potatoes and then when the potatoes is cooked the food is cooked.

DN. Same with chicken soup?

LV. Yes

