

Original Article

A participatory assessment of dietary patterns and food behavior in Pohnpei, Federated States of Micronesia

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Non-communicable diseases are escalating rapidly within the Pacific region, including Pohnpei, Federated States of Micronesia. A shift in dietary patterns from indigenous, high fiber, healthy local food to energy-dense, imported food with low nutritional value, and increased sedentary lifestyles are expediting this process. Essential to counteract this trend is an understanding of how people make food decisions. This participatory assessment utilized a quantitative and qualitative approach to capture diet patterns and knowledge, attitudes, beliefs and practices of food consumption. A structured 7-day food frequency questionnaire (FFQ) was used to quantify the diets of 293 adult Pohnpeian women attending an island-wide education/disability screening program. An ethnographic approach, including in-depth interviews, informal focus groups and observations documented food behavior practices and contributed to the design of the FFQ. Of those responding to the FFQ, 96% reported eating rice frequently (3-7 days/week) whereas 75% reported eating locally grown carbohydrate foods frequently. Factors associated with culture change, including availability, affordability, convenience, and status of food items were found to determine food decisions. Food-based, culturally sensitive and innovative strategies that utilize existing resources are required to promote local food production and consumption. Prevention programs with an information, education and communication (IEC) approach are needed to provide accurate and available health and nutrition knowledge and to increase the demand for local foods. Behavior modification requires the continued collaboration of the national, state, and community organizations that partnered on this research to strategize programs in order to target individual food choices and to transform the environment to support these decisions.

Key Words: Micronesia, dietary patterns, type 2 diabetes, obesity, nutrition transition

INTRODUCTION

Non-communicable diseases (NCDs), including type 2 diabetes, have been recorded in the Federated States of Micronesia (FSM) and other Pacific Island countries at some of the highest global rates.^{1,2} As a major cause of morbidity and mortality in Pohnpei (an island state of FSM) this increasing disease burden requires urgent public health measures. Current research reports that over 80% of Pohnpei's population in the 35-55 year-old age group are overweight or obese and at risk for NCDs.^{3,4} However, early studies indicate that Pohnpei was once considered a model of health with minimal obesity and hypertension, along with a diet of traditional foods and active lifestyles.⁵⁻⁷

Food and the exchange of food, particularly in relation to certain ritualistic events, play a key role in Pohnpeian culture. Exchanging and sharing food identifies and solidifies social networks and the social hierarchy within the community.⁸ Knowledge of the production of food (and the sharing of this knowledge) and evidence of the production of high-status food products, including yams, taro and pigs, was once (and often still is) highly re-

spected and central to social relationships. The offerings of food to the chiefs and the sharing and exchange of abundant quantities of food at ceremonial occasions, such as funerals, have long been important in Pohnpeian culture.^{9,10} Although the goods exchanged at these ceremonies have undergone some changes, for example, gifts of money may replace gifts of food; food consumption continues to be important in Pohnpei. Food not only contributes to physical health, but to social relationships and the maintenance of the society and its culture. Culture change, particularly since World War II, has not changed the centrality of food in this society, but it has had an impact on the kinds of foods involved and the value placed on particular foods. For example, imported foods have

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taken on greater status value, replacing other food products that once marked status in the community.¹¹⁻¹³

The traditional Pohnpeian diet was once reliant on locally-grown vitamin-, mineral- and fiber-rich carbohydrate staples (generally referred to in the Pacific as “local food”), along with fish and seafood. The present-day diet has shifted to the consumption of imported, refined, less nutritious foods, such as white rice and foods high in fat, salt and sugar, including: turkey tail (literally the tail of the turkey), fatty frozen chicken and canned meat products, soft drinks and other processed foods. Furthermore, lifestyle changes have drastically reduced physical activity levels.^{9,13,14}

Thus, Pohnpei is in the midst of a major shift from infectious to lifestyle diseases related to lifestyle changes and eating patterns, referred to as epidemiologic and nutrition transitions. Global studies indicate these transitions are common patterns among countries undergoing significant culture change.^{15,16} Characteristics include a shift from subsistence to a cash economy with increased sedentary work, urbanization, global external influences, integration of women in the workforce and other factors contributing to changing lifestyles.^{12,15}

The people of Pohnpei have had many years of external influence, including successive colonization by Spain, Germany and Japan from 1886-1945.^{12,14} After World War II, this island region came under United States (US) administration until 1986, when it became a state within the newly independent nation of the Federated States of Micronesia, with a continued close relationship with the US through the Compact of Free Association. This 15-year aid agreement (renewed in 2004) provided substantial funding that accelerated culture and lifestyle changes.^{12,17} A US Department of Agriculture School Lunch Program carried out in Pohnpei from the 1960s to the 1990s also greatly affected family consumption patterns and altered dietary tastes and attitudes through its provision of white rice and other highly processed surplus commodities.¹⁸

Without interventions, it is projected that almost half of Pohnpei’s current population will become diabetic in the next quarter century, with increased premature deaths.²⁻⁴ Concurrently, the high cost of off-island referrals for diabetic care and reliance on curative services has escalated Pohnpei’s economic burden.^{19,20} Yet prevention through the promotion of healthy diets and lifestyles has shown to decrease NCDs and risk factors^{21,22} with one study citing a 70% decrease in NCD-related premature deaths.²³

Historically, a “meal” in the Pacific region was comprised of a starchy local food accompanied by cooked or raw seafood.^{9,24} Pohnpei’s natural asset, its fertile soil, produces an abundance and diversity of indigenous foods including 131 breadfruit, 55 banana and 24 giant swamp taro varieties.²⁵ The Wai’anae Diet Program in Hawaii demonstrated that unrestricted consumption of these starch foods (including taro and breadfruit) and restricted consumption of high fat foods could lead to weight loss and reduction of cardiovascular risk factors. Reasons cited for this success include the high nutrient and fiber content of the indigenous carbohydrate food, leading to increased satiety.²⁶

Intervention strategies to promote healthy local food consumption and production are required to counteract the present NCD trend. Food-based interventions that utilize existing resources and are community-driven and cost-effective have resulted in increased adherence to health prevention programs.²⁷

Necessary to the adaptability, sustainability and cultural appropriateness of these interventions are data on current dietary patterns and the complexity of food decision-making behavior, including food availability, costs, tastes, beliefs, and other related economic, political, social and cultural issues. These data can contribute to existing surveillance information and provide baseline research for follow-up studies. If data are collected using a community participatory collaborative approach they are more likely to be reliable and accurate while building community capacity in research and program development.

Thus, the objectives of this study were to use a participatory collaborative research approach: 1) to describe the food patterns and trends that may impact NCD in Pohnpei; and 2) to gain insight into the knowledge, attitudes, beliefs, and practices relating to health and food consumption among Pohnpeian adults.

METHODS

The study design, an island-wide cross-sectional survey, used a “mixed methods” strategy combining quantitative and qualitative approaches. Trained local interviewers (n=6) administered a structured questionnaire to 293 participants in face-to-face interviews conducted over a five day period. A participatory approach was used, involving public health, agriculture, and education officers of the state and national government and individuals of other organizations and communities, in the design and development of the research, including the questions for the survey questionnaire.

A thorough literature review was conducted to enhance a local understanding of the culture and to tailor the research methods appropriately. For example, the “Pacific Way” is a term to describe how functioning within a collective, socially, rather than individually, is preferred and most respected.⁹ This information was essential to the design and delivery of the study and for the training and collaboration with the Pohnpei interviewers.

The study sample targeted 15- to 64-year old women from individual households – bringing their children (from birth to five years of age) to an education/disability screening program (Tehkie Mahs). (The screening program included hearing tests and other health and early development tests to identify any disabilities that would affect a child’s educational capacity). A household was defined as a person or group of people sharing regular meals and usually (but not necessarily) living in the same housing unit. Participants voluntarily came to a centralized survey location (school or health clinic), with transportation provided by program facilitators. Advertisement for this event was delivered through radio broadcasts, community banners and the Tehkie Mahs school program.

The ethnographic approach utilized 30 in-depth key interviews (17 female and 13 male), 2 informal focus group discussions and on-going observations. Participants for the

key informant interviews and focus groups were purposively selected, using guidance from the relevant government and non-government agencies and community leaders. Criteria for selection included members of Pohnpei communities who work in agriculture, education, health, and community organizations, have experienced chronic disease, and/or have insight relating to Pohnpei diets. All interviews were done with adults over the age of 25 years. The ethnographic data were used to develop the structured questionnaire. In addition, this data provided further insight into the Pohnpeian belief system, identified patterns of diet choice and the environment relating to those patterns, verified quantitative information (triangulation), and contributed to a more culturally sensitized study. Purposive and wide sampling were employed to capture a broad range of perspectives and were continued until data repetition (data saturation).

A 7-day food frequency questionnaire (FFQ) of 27 items was developed based on one previously used in FSM¹¹ using data from the key informant interviews, focus groups and observations. Participants were asked for the number of days in the last seven days that they consumed the selected items, listed as either an individual item (i.e., rice) or a specific category (i.e., flour products). The results were presented as: 0 days = never consumed, 1-2 days = sometimes consumed and 3-7 days = frequently consumed.

Individual foods and categories selected for the FFQ

were confirmed by an extensive literature review, past surveys and key informant interviews. To describe the specific categories to participants, a list of food items included in these categories was read during the interview process. Some categories were grouped as local or imported foods similar to the FSM National Nutrition Survey¹³ to allow for specific analysis. Non-food items affecting health (tobacco and betel nut) were also included.

The second half of the structured survey provided questions on knowledge, attitudes, beliefs and practices relating to health and food consumption, including food preparation, availability, taste and food preferences. The questionnaire was pretested by administering it to non-participants to ensure clear, culturally appropriate and relevant questions.

Training of the survey staff (interviewers and monitors) on survey and consent form delivery promoted consistent and accurate data collection. Interviewers were monitored throughout the survey and all forms were checked on-the-spot for completion and errors. Similar to past studies in FSM and as requested by the bilingual interviewers, the survey was written in English and verbally translated into Pohnpeian. Approximately 98% of the participants were fluent in Pohnpeian language and customs (all interviewees spoke some Pohnpeian, but a few originated from other FSM states with different languages and preferred some questions to be presented in English).

Table 1. Demographics: Characteristics of the study population

Characteristics	n (%)
Gender: Female	293 (100)
Age group (yrs)	
15-24	65 (22)
25-49	209 (71)
50-64	19 (7)
Age in years, mean \pm SD [†]	34 \pm 10.3
Number of years of school	
0 (no school)	1 (0.4)
1-8 (primary) [‡]	140 (48)
9-12 (secondary)	113 (39)
12+ (college)	39 (13)
Number of years of school, median/ mean \pm SD	9/9.4 \pm 2.7
Location of Residence on Pohnpei: Municipality [§]	
Nett combined with Kolonia	41 (14)
U	61 (21)
Madolenihmw	73 (25)
Kitti	61 (21)
Sokehs	57 (20)
Ethnicity	
Pohnpeian [¶]	243 (83)
Other/Multiple ^{**}	65 (17)
Family Income	
Salaried position ^{**}	189 (65)
Other income ^{§§}	
Farming only	49 (17)
Money from relatives/friends	30 (10)
Self-employment	25 (9)
Both farming and fishing	22 (8)
Fishing only	18 (6)

[†] Standard Deviation; [‡] Primary school included grades 1-8; secondary school included grades 9-12 and college, included beyond secondary and 12+ years; [§] Pohnpei Island is divided into the five municipalities as listed; [¶] Both parents were born in Pohnpei; ^{**} Includes participants from Mwoakilloa, Pingelap, Kapingamarangi, Nukuoro, Sapwuaifik, Kosrae, Chuuk, Yap and participants with divided ethnicity between Pohnpei and the other islands; ^{§§} This question on family income was worded as follows: Does anyone in the family have a salaried position providing support for the participant? For the purposes of this study, only one answer, salaried job or other was acceptable; ^{§§} Within the 'other income' category, the data presented includes single and multiple responses.

Research approval was obtained from the Emory University Institutional Review Board, FSM Department of Health, Education and Social Affairs, and the Pohnpei State Department of Health Services. The study protocol was initiated in November 2003 and the research in Pohnpei was conducted over a six-week period: January – March, 2004. Interview instruments are available upon request from the first two authors listed.

Data Analysis

The qualitative data were written into field notes and thematically analyzed simultaneously with other data collection. The quantitative analysis included survey coding for confidentiality and descriptive statistical analysis in Epi Info™ 2000.¹

Participatory Approach: How is as important as What

The research design facilitated local input and community participation to create accurate and culturally appropriate questionnaires and research outcomes. As a result, relationships between public health, education, agriculture and other community organizations were more firmly established. Officers from these same organizations also participated in conducting the interviews, thus building further research and program capacities. Other members of the community participated through the key informant interviews and the focus groups.

RESULTS

Table 1 profiles the demographic characteristics of the survey sample population, including age distribution, education level and main source of family income. Most participants were Pohnpeians between the ages of 25-49 and had at least some primary school education. Many participants had at least one person in the family with a salaried position (defined as consistent employment by the government or private sector). Others had revenues from farming, fishing, other self-employment, or relatives. All participants approached for this survey and those who met the requirements for inclusion (i.e., must be female between the ages of 15-64 years old, from individual households, attending the education/disability Tehkie Mahs screening program with a child aged birth to five years old, fluent in Pohnpeian and/or English and gives consent to do the interview) resulted in a 100% response rate.

Food consumption patterns

The 7-day FFQ results demonstrated that certain less nutritious, imported foods are popular and consumed frequently (Table 2). Imported white rice was reported as the most frequently consumed food of all foods/categories (a mean of 6.5 days per week). In contrast, local food (as a group) was reported to be consumed a mean of 4.5 days per week, followed by flour products (in the carbohydrate category), specifically white bread, doughnuts and instant noodles. Bananas and breadfruit were reported as the most frequently consumed of the specified local foods. However, seasonality of some foods affect consumption practices (i.e., this study was carried out during the breadfruit season).

In the protein category, participants consumed local fish/seafood on average twice as frequently (4.8 days per week) compared to imported fish/seafood (2.4 days per week). Distribution-wise, participants (79%) reported frequent consumption of local fish/seafood whereas, only half that amount of participants (41%) reported frequent consumption of imported fish/seafood. In contrast to the fish/seafood category, local meats were consumed on average less frequently (1.3 days per week) than imported meats (1.9 days per week). Selected high fat foods, including turkey tail, were common items in the diet. Most participants (over 50%) had frequently consumed high-fat food (a mean of 3 days per week).

Participants who frequently consumed local vegetables (50%) exceeded those participants who frequently consumed imported vegetables (25%). Local fruits, on average, were consumed much more frequently (3 days per week) than imported fruit (0.5 days per week).

Sugar drinks (which included soft drinks and drinks prepared with refined sugar) were reported as more frequently consumed (58% of participants) than the juice of young drinking coconuts (25% of participants). Local food with sugar was reported to be frequently consumed (at least 3 days per week) by over one-third of the participants.

The local drink *sakau* (*Piper methysticum*), also known as kava in other parts of the Pacific, was reported consumed by almost half (49%) of the participants for at least one day of the past week. The majority of participants (87%) reported no alcohol consumption. Betel nut and tobacco were reportedly used by one-third of the participants.

Factors affecting dietary intake

Data on food purchase, cooking methods, food preparation, taste preferences, local food acquisition, diabetes knowledge and access to health information were also captured in the survey in order to better understand their influence on food decisions. Females within a household were reported to be the primary persons purchasing (64%) and preparing (99%) the food. Most participants (77%) responded that their household food expenditure was half or more than half of their monthly income. Of all participants, fifty-two percent reported consuming local food half or more than half of a month. The most popular imported foods reported were canned meat and fish, frozen chicken, instant noodles, doughnut, turkey tail and fat, including shortening and vegetable oil.

Kerosene stoves and rice cookers were reported as the main cooking tools, replacing the traditional earth oven (*uhmw*). Boiling was reported as the most common cooking method for fish or meat, followed by frying with vegetable oil, shortening or lard.

Rice was reported by ninety-nine percent of participants as more convenient to cook than local food. However, in taste, participants preferred local food (74%) over rice (18%). Most participants (70%) added sugar, salt or both as a common food preparation practice.

As observed and reported, increased migration to urban centers often resulted in people having limited access to land and thus they were dependent on store-bought foods. Inconsistent supply and high prices of local food in the

Table 2. Reported frequency of consumption of selected food and non-food items by female Pohnpeian adults¹ determined from a 7-day food frequency questionnaire (n=293)

Food Category	Never (0 days) n (%) [‡]	Sometimes (1-2 days) n (%)	Frequently (3-7 days) n (%)	mean days(SD) [§]
Carbohydrate				
Local food as a group [¶]	9 (3)	65 (22)	219 (75)	4.5 ± 2.3
Banana	35 (12)	125 (43)	133 (45)	2.9 ± 2.3
Breadfruit	37 (13)	125 (43)	131 (45)	2.8 ± 2.2
Giant swamp taro	211 (72)	69 (23)	13 (4)	0.5 ± 1.0
Yam	210 (72)	69 (23.5)	14 (5)	0.5 ± 1.0
Dryland taro	257 (88)	31 (11)	5 (2)	0.2 ± 0.7
Tapioca, sweet potato	257 (88)	31 (11)	5 (2)	0.2 ± 0.7
Imported rice	0 (0)	12 (4)	281 (96)	6.5 ± 1.4
Imported wheat flour product	44 (15)	88 (30)	161 (55)	3.5 ± 2.6
Protein				
Local fish and seafood	7 (2)	55 (19)	231 (79)	4.8 ± 2.3
Imported fish and seafood	47 (16)	126 (43)	120 (41)	2.4 ± 1.9
Local meat	124 (42)	120 (41)	49 (17)	1.3 ± 1.6
Imported meat	95 (32)	113 (39)	85 (29)	1.9 ± 2.1
Fruit and vegetables				
Local fruit	51 (17)	100 (34)	142 (49)	3.0 ± 2.5
Imported fruit	229 (78)	42 (14)	22 (8)	0.5 ± 1.2
Local vegetable	87 (30)	59 (20)	147 (50)	2.9 ± 2.7
Imported vegetable	179 (61)	40 (14)	74 (25)	1.5 ± 2.4
Selected high-fat food				
Local or imported fat	36 (12)	104 (35.5)	153 (52)	3.0 ± 2.2
Imported turkey tail	179 (61)	94 (32)	20 (7)	0.7 ± 1.1
Beverage				
Local drinking coconut	102 (35)	118 (40)	73 (25)	1.8 ± 2.1
Imported sugar drink	54 (18)	70 (24)	169 (58)	3.8 ± 2.8
Other food and non-food items				
Local food with sugar	87 (30)	98 (33.5)	108 (37)	2.3 ± 2.4
Imported snack food	206 (70)	57 (19)	30 (10)	0.7 ± 1.4
Sakau	150 (51)	57 (19.5)	86 (29)	1.8 ± 2.4
Alcohol	256 (87)	17 (6)	20 (7)	0.5 ± 1.5
Betel nut	185 (63)	13 (4)	95 (32)	2.2 ± 3.2
Tobacco	191 (65)	10 (3)	92 (31)	2.2 ± 3.2

Note: All participants were asked how many days in the previous seven days had they consumed the selected food items;

[†] Participants were between ages of 15-64; [‡] Number and percentage of participants, unless otherwise indicated;

[§] Standard Deviation; [¶] Local food as a group was defined to include banana, breadfruit, giant swamp taro, yam, dryland taro, or tapioca/sweet potato. Consumption of any one of these specific items was asked as a separate question.

Table 3. Factors associated with food choice given by participants

Factors	Participant Response
Attitude	<i>-People do not feel they should buy local foods. Usually 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. -Selling local food is a sign that you are poor because you are selling something that everyone has available.</i>
Body Image	<i>-I visited my relatives on an outer island where local food and physical activity are part of the common lifestyle and lost a lot of weight and felt great. When I returned to the Pohnpei main island, my relatives all thought I was sick and needed to gain weight.</i>
Generation Gap	<i>-I like local food, but my kids all prefer canned meat or imported food. I cannot get them to eat any local food. -My children are not interested in learning how local food is grown ..., this information is being lost.</i>
Social Status	<i>-Rice and canned meat are prestigious foods. You are considered wealthy if you have canned meat. Also, you want to be seen walking out of the store with a grocery bag as it symbolizes high status. -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.</i>
Taste	<i>-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. Pohnpeian people love the taste of turkey tails.</i>
Traditional	<i>-Rice, canned meat and soda are replacing local food at community feasts in large numbers. 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 purchased and distributed.</i>

marketplace were found to be purchasing deterrents. A moderate number of participants (30%) reported selling local food. However, as reported by store clerks, an irregular supply of local food to grocery stores has reduced access to buying these foods.

Cultural, social and environmental constructs comprise the complexity of food behavior, as illustrated in the qualitative data (Table 3). Themes such as convenience, cost, availability, social status, generational gaps, taste and body image are presented to identify motivations or barriers to behavior change. The convenience of imported foods was stressed as perhaps the most important. One male informant explained: "People are moving faster, going to school and working more....they need foods that cook quicker." A female informant reported: "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 firewood to cook, but now I have a rice cooker and it is much easier."

Cost was another factor, as some families in Pohnpei may not have land for growing their foods or may not live within walking distance to their land and are thus reliant on the market for local foods. One informant pointed this out: "In the markets, a 50-pound bag of rice can cost \$14.00 and feed a full family and relatives for weeks. Enough breadfruit to provide the same amount of food for the same time period would be more expensive and take more time to prepare."

Ethnographic data obtained is consistent with past studies showing that meals in Pohnpei are often eaten intermittently throughout the day as "one feels hungry".²¹ Due to frequent family visits, it is respectful to have food always available to "share." To support these cultural traits and meal patterns, large amounts of food are usually prepared in the morning. As reported by participants, food, such as rice, that is available, affordable and quick to cook in bulk is valued over the more nutritious, labor-intensive local food preparation.

Knowledge and access to health education/information

A high percentage of participants (27%) reported not knowing the cause of diabetes. Data revealed that many people attribute superstitious beliefs, jealousy, or ill-intention as the cause of illness or death, rather than a diagnosed biological disorder. Despite recent efforts at community nutrition education¹¹ many participants (41%) reported never receiving information on healthy food and nutrition. However, local food was reported as healthier by participants than rice (98%). Of those reporting having received information on healthy food and nutrition, the main information sources were community workshops (22%), radio (18%), public health clinics (14%), doctor (6.1%), school (6.1%) and various other sources (8%).

DISCUSSION

Pohnpei is a society in transition with a trend towards consumption of less nutritious foods. The food consumption patterns and knowledge, attitudes, beliefs and practices were motivated by many factors associated with culture change. Ease and convenience of food preparation

have become a priority as women, the primary food preparers, are integrating into the workforce. Less nutritious imported foods were found to be affordable, accessible and in high demand. Specifically, global imports of white rice and canned meats are associated with an image of success, demonstrating the importance of social perceptions.

Similar to other countries in a nutrition transition, when refined rice is consumed in equal portions to the more nutrient-dense and fiber-rich local food, overconsumption of energy requirements is likely to result, leading to increased overweight and obesity.¹⁶ Despite this trend, the study found that Pohnpei's local food, including local fish and meat, remain a consistent part of the diet. Subsistence farming and traditional agriculture practices are also still important. However, the trend towards use of imported foods indicates the need for promoting traditional food systems before they are lost.⁷ Therefore, younger generations must be targeted in intervention strategies to maintain the orally transferred traditional cultivation techniques. In addition, programs are required to promote an increased stable supply of local food in the marketplace and to change beliefs related to the purchase of these foods. Thus, Pohnpei is in a critical stage requiring a paradigm shift on all levels of society to address individual consumption behavior, policy and environmental factors to increase the demand and supply of local food.

Healthcare approaches addressing NCDs require a shift from curative services to a preventative and health promotion campaign to alleviate the growing health and economic burdens. First, the demand for healthy foods must be increased through education and social marketing. This campaign requires an information, education and communication (IEC) strategy to provide accurate and available information on healthy foods and the connection between food, disease and health.

Despite most of the sample population reporting that local food was healthier and preferred in taste than white rice, many reported their behavior was to eat more white rice than local food. Therefore, behavior change requires not just knowledge, but a strategy that supports better food choices through cultural integration, social support, media, and community involvement. Specifically, an intersectoral approach is needed to influence the complexity of food habits as food is intricately related to social norms, economic factors, production availability and preferences. Innovative, community-centered prevention strategies that promote local foods by utilizing existing networks, community leaders and local organizations are necessary. Numerous relationships, based on familial ties, church groups or occupational avenues are highly valued within Pohnpei with food as a tool of connection. With this approach of mapping social assets as platforms for interventions, these strategies will have "control" originate from the community leading to sustainable and culturally-integrated interventions.

While the current direction of culture change in Pohnpei carries health, economic and cultural costs, it also brings benefits and is preferred by many as seen in the total data collected (not all presented in this paper.) Therefore, innovative and creative solutions combining the "traditional" and the "contemporary" approaches are

required. Essential to this approach's success is the collaboration on all levels of Pohnpeian society to influence individual food decisions and the economic, political and social environment that can support these decisions.

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AUTHOR DISCLOSURES

Allison Corsi, Lois Englberger, Rafael Flores, Adelino Lorens and Maureen H Fitzgerald, no conflicts of interest.

REFERENCES

1. WHO. Regional Office for the Western Pacific and the Secretariat of the Pacific Community. Meetings of the Ministers of Health for the Pacific Island Countries. Diabetes and Other Noncommunicable Diseases. March 9-13, 2003;1-15. www.who.int.
2. Shmulewitz D, Auerbach SB, Lehner T, Blundell ML, Winick JD, Youngman LD et al. Epidemiology and factor analysis of obesity, Type II diabetes, hypertension, and dyslipidemia (syndrome X) on the island of Kosrae, Federated States of Micronesia. *Hum Hered.* 2001;51:8-19.
3. Centers for Disease Control and Prevention (CDC). Diabetes: A Serious Public Health Problem, At-A-Glance 2000. U.S. Department of Health and Human Services; 2000.
4. Department of Health Services Diabetes Control Program. Diabetes Today. Federated States of Micronesia National Government; December 2000.
5. Patrick RC, Prior IAM, Smith JC, Smith AH. Relationship between blood pressure and modernity among Ponapeans. *Int J Epidemiol.* 1983;12:36-44.
6. Coyne T, Badcock J, Taylor R. The effect of urbanisation and western diet on the health of Pacific island populations. SPC Technical Paper No. 186. South Pacific Commission, Noumea, New Caledonia; 1984.
7. Kincaid PJ. Trust Territory of the Pacific Islands Nutrition survey. Department of Health Services. Trust Territory of the Pacific Islands, Saipan, Northern Mariana Islands; 1973.
8. Keating, E. Moments of hierarchy: Constructing social stratification by means of language, food, space, and the body in Pohnpei, Micronesia. *Am Anthropol.* 2000;102:303-320.
9. Pollock NJ. These Roots Remain: Food Habits in Islands of the Central and Eastern Pacific since Western Contact. Laie, Hawaii: The Institute for Polynesian Studies; 1992.
10. Riesenber, S. The Native Polity of Ponape. Washington DC: Smithsonian Institution Press; 1968.
11. Englberger L. A community and laboratory-based assessment of the natural food sources of vitamin A in the Federated States of Micronesia. PhD Thesis, University of Queensland, Brisbane, Australia; 2003.
12. Hezel, FX. The New Shape of Old Island Cultures: A Half Century of Social Change in Micronesia. Honolulu, Hawaii: University of Hawaii Press; 2001.
13. Elymore J, Elymore A, Badcock J, Bach F, Terrell-Perica S. The 1987/88 National Nutrition Survey of the Federated States of Micronesia. Technical report prepared for the government and Department of Human Resources of the FSM. South Pacific Commission, Noumea, New Caledonia; 1989.
14. Englberger L, Marks GC, Fitzgerald MF. Insights on food and nutrition in the Federated States of Micronesia: a review of the literature. *Publ Health Nutr.* 2003;6:5-17.
15. Martorell R, Stein A. The Emergence of Diet-related Chronic Diseases in Developing Countries. In Bowman, BA and Russel, RM 8ed. Present Knowledge in Nutrition. ILSI Press, Washington, 2001;Chapter 58:665-685.
16. Popkin BM, Horton SH, Soowon K. The Nutrition Transition and Prevention of Diet-related Diseases in Asia and the Pacific. *Food and Nutr Bull.* 2001;22(supplement):1-58.
17. CIA World Fact Book. <http://www.cia.gov/cia/publications/factbook/geos/fm.html>. 2006. Accessed on July 9, 2006.
18. Schoeffel P. Food, health, and development in the Pacific islands: Policy implications for Micronesia. *ISLA: J. Micronesian Studies.* 1992;1:223-50.
19. Zimmet P, Alberti KGMM, Shaw J. Global and social implications of the diabetes epidemic. *Nature.* 2001;6865:782-787.
20. Federated States of Micronesia. A Situation Analysis of Children and Women in the Federated States of Micronesia. Suva, Fiji: UNICEF Pacific; 1996.
21. Knowler W, Barret-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, Nathan DM. Reduction in the Incidence of Type 2 Diabetes with Lifestyle Intervention or Metformin. *New Engl J Med.* 2002;346:393-403.
22. Lindström J, Louheranta A, Mannelin M, Rastas M, Salminen V, Eriksson J, Uusitupa M, Tuomilehto J. The Finnish Diabetes Prevention Study (DPS): Lifestyle intervention and 3-year results on diet and physical activity. *Diabetes Care.* 2003;Dec26:3230-6.
23. Alto WA. Alleviating the burden of chronic illness. *Pacific Health Dialog.* 1994;3:96-9.
24. Englberger L, Aalbersberg W, Ravi P, Bonnin E, Marks GC, Fitzgerald MH, Elymore J. Further analyses on Micronesian banana, taro, breadfruit and other foods for provitamin A carotenoids and minerals. *J Food Comp Anal.* 2003;16:219-236.
25. Raynor B. Agroforestry Systems in Pohnpei- Practices and Strategies for Development. RAS/86/036 Field Document 4. FAO/UNDP South Pacific Forestry Development Programme, Pohnpei, Federated States of Micronesia; 1991.
26. Shintani TT, Hughes CK, Beckham S, O'Connor HK. Obesity and cardiovascular risk intervention through the ad libitum feeding of traditional Hawaiian diet. *Am J Clin Nutr.* 1991;53:1647S-51S.
27. Braun KL, Ichiho HM, Kuhaulua RL, Aitaoto NT, Tsark JU, Spegal R, Lamb BM. Empowerment Through Community Building: Diabetes Today in the Pacific. *J Public Health Manag Pract.* Nov 2003;9Supplement:S19-S25.
28. Centers for Disease Control and Prevention. <http://www.cdc.gov/epiinfo/>. Epi Info 2000.

Original Article

A participatory assessment of dietary patterns and food behavior in Pohnpei, Federated States of Micronesia

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參與性評估密克羅尼西亞聯邦波納佩州的飲食模式與食物行為

在太平洋地區，非傳染性疾病快速地增加，密克羅尼西亞聯邦波納佩州(Pohnpei)也是如此。飲食模式從固有的、高纖維、健康當地食材轉成高熱量密度、低營養價值的進口食物以及增加久坐的生活型態都加速這個進程。對抗這個趨勢必須先了解人們如何決擇食物。參與性評估是利用一個量化及定性的方法去獲知飲食模式及飲食攝取的認知、態度、信念與實行。使用7天的結構性飲食頻率問卷(FFQ)去量化293名參加全島嶼的教育/失能篩檢系統的波納佩州成人女性。以一個人種誌的方法，包含深入的訪問、非正式的焦點團體及觀察來記錄食物行為的實行及貢獻FFQ的設計。回覆FFQ的女性中，有96%報告經常吃米飯(3-7天/週)，反之75%報告經常吃當地生長的碳水化合物食物。與文化改變的相關因子，包含可獲性、支付能力、便利性及食物項目的狀態會決定食物的選擇。必須以食物為基礎，對文化有認知及利用現有資源的創新政策去促進當地食物的產量及攝取。需要包括資訊、教育及交流(IEC)的預防性計劃以提供正確及可得的健康及營養知識，並且去增加對當地食物的需求。行為的修飾需要國家、州及社區組織的繼續合作，以便針對個人的食物選擇及支持這些選擇的環境轉換訂出策略。

關鍵字：密克羅尼西亞、飲食模式、第二型糖尿病、肥胖、營養轉換。