ABSTRACT Despite its relative isolation from the world stage and lack of resources, the Marshall Islands serve as an example of the interaction between global political power, macroeconomic forces and local cultural factors. At the national level, patterns of food importation and government programs encourage the consumption of high fat foods. These factors have fostered dependency on Western foods and a loss of traditional food practices. Beliefs come into play as microlevel factors that influence food choice and aspects of lifestyle. Nearly three quarters of women are overweight or obese in this setting. Obesity in women is associated with greater age, higher education and more imported food consumption. Over a third of children ages 1–5 y are stunted, with stunting associated with worse economic status, less active feeding, increased consumption of imported foods and urban residence. What can be done at the microlevel is constrained by macrolevel factors of disempowerment. In this way, issues of power and belief are played out in the bodies of individuals. J. Nutr. 133: 310S–313S, 2003.

KEY WORDS: • power • culture • diet • nutritional status • Micronesia

This report presents a case example that illustrates the interaction of power-related and belief-related factors in diet and nutrition in the Republic of the Marshall Islands (RMI). The Marshall Islands constitute a group of 30 low lying coral atolls ~2500 miles southwest of Hawaii in the Pacific Ocean. The entire country, in which land and topsoil are very limited, totals only 75 square miles of land, covering 600,000 square miles of ocean. Of the total population of 54,000 persons, close to three quarters live in one of two urban centers. Despite its relative isolation from the world stage and lack of resources, the Marshall Islands serve as an example of the interaction between global political power, macroeconomic forces and local cultural factors.

The conceptual framework that provided guidance for our research group is shown in Figure 1. It depicts the flow of imported food through mechanisms that affect availability at local levels, to the acquisition and use of food at the household level, to the production of nutritional status at the individual level. In this setting, the impact of power begins at the macrolevel with the history of foreign contact and extends down to differences in access to power at the microsocial level in the form of access to kin networks to acquire food. Cultural factors can be identified at many levels, although it can be argued that they make their strongest impact at the regional and household levels.

METHODS

Study sample. We worked with households in six different locales in the Marshall Islands, ranging from urban and periurban conditions to remote atolls. In this study household is defined as that group of people who live together and share a cooking pot. The sample totaled 1502 persons living in 205 households.

Data collection. Anthropometric measurements were made by trained anthropometrists who used standard methods. Bioelectrical impedance analysis was used to estimate percentage body fat through use of the Tanita Body Fat Analyzer. Socioeconomic status (SES) was determined by a series of questions on ownership of items and house quality directed toward the male head of household. A knowledge, attitudes and beliefs (KAB) survey was used on the male and female heads of each study household. Questions included how children were fed, adult eating habits, cooking methods used, sources of food and so on. A household food frequency was conducted with the main food preparer in the household, who was asked to recall the frequency of

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consumption of over 60 key foods during the month before the survey.

**Scale development and analysis.** SES was estimated by creating an additive scale of possession of material items (alpha = 0.66). An additive scale was created for island foods by adding monthly frequency of consumption of a subset of locally produced foods (alpha = 0.729). A similar scale was created for a subset of imported foods (alpha = 0.841). Two behavioral scales were developed from the KAB survey data, one that reflected women's eating habits (alpha = 0.50) and one that reflected active-passive feeding of children (alpha = 0.53). Multiple-regression models were developed, and standardized beta coefficients generated for each of the models. Statistical analysis was performed by use of the SAS statistical package (SAS/STST version 6.11, SAS Institute, Cary, NC).

**Moving from macro to micro**

The Marshall Islands were originally settled at least 2000 y ago (1). Western contact came in the form of Spanish explorers, British whalers and German merchants, starting in the 1600s. The country came under the control of the Japanese after World War I and became a trust territory of the United States after World War II.

Because of its strategic location, the United States has conducted military operations in the Marshall Islands since the end of World War II. The most notorious of these activities was a series of atomic bomb tests on Bikini and Enewetak atolls. The original inhabitants were relocated to atolls that were unfit for long-term sustenance. People living on atolls downwind of the tests were exposed to radioactive fallout and have suffered miscarriages and higher rates of certain cancers (2–3). Compensation for victims of the U.S. testing program factors heavily into the power relations in the country and has had an impact on diet and health in numerous ways.

The United States maintains a missile testing site on Kwajalein atoll. In 1986 the United States and the Marshall Islands signed a Compact of Free Association, giving the United States exclusive military rights. Through the Compact agreement, the Marshallese may freely travel to and live in the United States, and are eligible for many food-related programs, such as WIC and Head Start. Marshallese who were directly exposed to radiation and those who were relocated are eligible to receive USDA commodity foods, among other benefits. In our sample, we found that 12% of households claimed to officially receive commodity foods, and almost twice that number unofficially received these foods, despite rules prohibiting sharing and redistribution. We saw no effect of SES on receipt of commodity foods. Of households that received commodity foods, rice (71%), canned meat (66%), juice (64%), vegetables (61%), evaporated milk (55%), flour (52%) and powdered eggs (50%) are among the most commonly reported.

**Epidemiology of the RMI.** The Marshall Islands represents a country in mid-epidemiologic transition, with its share of infectious diseases such as TB, leprosy and gastroenteritis, as well as epidemic levels of chronic, lifestyle-related diseases, such as diabetes, hypertension and heart disease (4,5). Undernutrition in children accounted for 17% of reported deaths of children (<5 y) (4).

**Food importing and fat dumping.** The majority of food consumed by the Marshallese populace is imported from outside the country, brought in on container ships, primarily from Australia, the United States, Fiji, Taiwan, Korea and Japan. A visit to the grocery stores in the urban centers will usually turn up prominent displays of foods such as turkey tails, turkey necks and corned beef. This phenomenon has been termed “fat dumping,” which refers to the marketing of unwanted high fat animal by-products to lower SES populations.

**RMI government policies.** Lacking the maritime resources to harvest its own waters, the RMI government leases harvesting rights to foreign businesses. By regulation, 5% of the commercial value of each ship’s catch is paid to the government. The government also taxes foods brought into the country. Taxation and shipping costs create a narrow profit margin for business owners, which limits the items they can carry as well as their willingness to try untested foods.

**Social structure and cultural beliefs.** All land in the Marshall Islands is owned by a class of hereditary chiefs, who allocate the land to the community. Those using the land paid 1/3 of the harvest to the chief. This system is not functional in crowded urban settings or where communities are fragmented.

Traditionally, a larger body shape in the Marshall Islands was viewed as both healthy and attractive. Standards of attractiveness are changing, with current preferences for somewhat leaner body shapes, although healthiness is still seen as linked to a larger body shape (6). Women who are thin are viewed as potentially infertile or possibly sick. With respect to cultural preferences, Marshallese people are similar to many other peoples of the world in their preference for the taste of...
fat (6,7). Even local foods that are not intrinsically high in fat are commonly consumed in a high fat manner, such as dipping breadfruit in liquid Crisco and sashimi mixed with mayonnaise.

**Meal patterns.** As observed throughout the Pacific (8), a meal in the Marshall Islands consists of a starchy staple and a food complement. This can range from fairly low fat to rather high fat combinations (e.g., breadfruit and fish, rice and corned beef). Importantly, this basic meal format does not commonly include a third item, such as vegetables.

Household members typically eat meals on their own or in small subgroups, taking food from the common pot. Family members may eat at different houses at different times of the day. Shared plate eating is common, particularly among children, which makes it hard for a food server to monitor who gets what. People eat whichever and however much of the prepared foods they wish to eat.

Child care in the Marshall Islands is a collective responsibility. As soon as they can walk, small children wander freely between households of their extended family. They are commonly given small portions of food at their request, though rarely a full meal. No single caregiver monitors what a child is eating throughout a day in this setting.

**Food availability and consumption.** There is considerable variation in food availability in the Marshall Islands, because of differences in locale, and to shortages based on transportation, spoilage and weather. Food can be purchased from stores, received directly or indirectly from government programs or locally gathered and produced. Households in more remote atolls have somewhat higher frequency of consumption of sea foods, although fish is available in the urban center (Table 1). Local plant foods (breadfruit, pandanus, pumpkins, etc.) are much more frequently consumed in outer islands, where they are a significant part of the diet.

Food is imported by eight wholesalers, who retail their merchandise and sell to smaller stores. In addition, on Majuro atoll there are 136 small and medium size stores. Small stores are in business because of convenience, willingness to give credit and purchases from their own family network. Most small stores stock predominantly snack foods, soft drinks, candy and canned meat.

All outer islands have a few stores each, which tend to be very limited in stock because of cargo boat cost and time to get food to outer islands. Generally very few perishable items go to the outer islands because of travel time and the cost of expedited travel.

Rice is the primary staple food in the diet. High fat foods, such as doughnuts, ramen noodles and pancakes, are also commonly consumed. Consumption of purchased fruits and vegetables is very rare in this setting. These foods do not fit in well to the traditional meal structure and few people have developed a taste for them. Vegetables on average cost the same as meat, which is considered more tasty and filling.

There is an inverse relationship between frequency of consumption of local vs. imported/store-bought foods; as households consume more imported foods, they tend to consume local foods less frequently.

**Nutritional status.** On the basis of body mass index (BMI), 50% of Marshallese men over 18 y in our sample were overweight (29%) or obese (21%). We found similar rates of overweight in women (29%), and even higher rates of obesity (31%). No significant variation in obesity rates were observed by atoll.

We modeled adult obesity in women for both BMI and percentage body fat (Table 2). Age is a strong predictor in both equations, with older women more likely to be obese. Higher education was also associated with more obesity in both models, perhaps relating to the sedentariness of employed women. High consumption of store-bought foods was a predictor of higher BMI in women, but not of percentage body fat. Importantly, SES and frequency of consumption of island foods was not a predictor of obesity.

In this setting, we found high levels of stunting in children, with 35.5% of children 1–5 y stunted and 36.3% of children 5–10 y stunted. We found no significant differences by sex or locale in terms of stunting (in young children). Modeling stunting in Marshallse children < 12 y of age revealed that less stunting was associated with better economic status, more active feeding, decreased consumption of store-bought foods and remote locale (Table 3).

In this setting, there are substantial levels of undernutrition in children and overnutrition in adults, much of it within the same households. Almost a third of households in our sample had at least one obese adult and at least one undernourished child, the most common pattern of discordancy we found. Availability of and access to food resources are highly variable and constrained by factors at many levels. These multiple levels of influence offer the potential for many types of interventions.

<table>
<thead>
<tr>
<th>Variable</th>
<th>BMI (Betas)</th>
<th>% Body fat (Betas)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.3696***</td>
<td>0.2655***</td>
</tr>
<tr>
<td>Education</td>
<td>0.1853**</td>
<td>0.1449*</td>
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<tr>
<td>Household SES</td>
<td>−0.0391</td>
<td>−0.0160</td>
</tr>
<tr>
<td>Woman eating habits scale</td>
<td>0.0134</td>
<td>0.0134</td>
</tr>
<tr>
<td>Store food scale</td>
<td>0.1916**</td>
<td>0.1260</td>
</tr>
<tr>
<td>Island food scale</td>
<td>0.0291</td>
<td>0.0022</td>
</tr>
<tr>
<td>Locale</td>
<td>−0.0100</td>
<td>−0.1761*</td>
</tr>
</tbody>
</table>

* P < 0.10; ** P < 0.05; *** P < 0.005.
Concluding remarks

A conceptual framework integrating macro- and microlevel factors is essential for understanding malnutrition in this setting. The current situation in the Marshall Islands relates at the macrolevel to lack of power, brought on by years of colonization, use of their lands for nuclear testing and their isolation from the rest of the world. At the national level, patterns of food importation and government programs encourage the consumption of high fat foods. These factors have fostered dependency on Western foods and a loss of traditional food practices. Beliefs come into play as microlevel factors that influence food choice and aspects of lifestyle. However, what can be done at the microlevel is constrained by macrolevel factors of disempowerment. In this way, issues of power and belief are played out in the bodies of individuals.

The information collected in these studies is currently being used by the Marshallese government as part of their efforts to negotiate a new Compact of Free Association. Finally, interventions working at both the household and environmental levels show some success in encouraging the trial of healthy foods at the household level, and may be sustainable if they can be adopted by stores. Considerable work remains to carry on this effort at higher levels.

LITERATURE CITED


### TABLE 3

Determinants of growth (z-score for height-for-age) in Marshallese children (n = 259, ages 1–12 y)

<table>
<thead>
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<th>P-value</th>
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<td>NS</td>
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<tr>
<td>Sex</td>
<td>0.0831</td>
<td>NS</td>
</tr>
<tr>
<td>Household SES</td>
<td>0.1338</td>
<td>0.0292**</td>
</tr>
<tr>
<td>Active feeding scale</td>
<td>0.1206</td>
<td>0.0461**</td>
</tr>
<tr>
<td>Store food scale</td>
<td>−0.1381</td>
<td>0.0552*</td>
</tr>
<tr>
<td>Island food scale</td>
<td>0.0213</td>
<td>NS</td>
</tr>
<tr>
<td>Locale</td>
<td>−0.1708</td>
<td>0.0652*</td>
</tr>
</tbody>
</table>

*P < 0.10; **P < 0.05; NS, not significant.