

INFANT WEANING PRACTICES IN KIRIBATI

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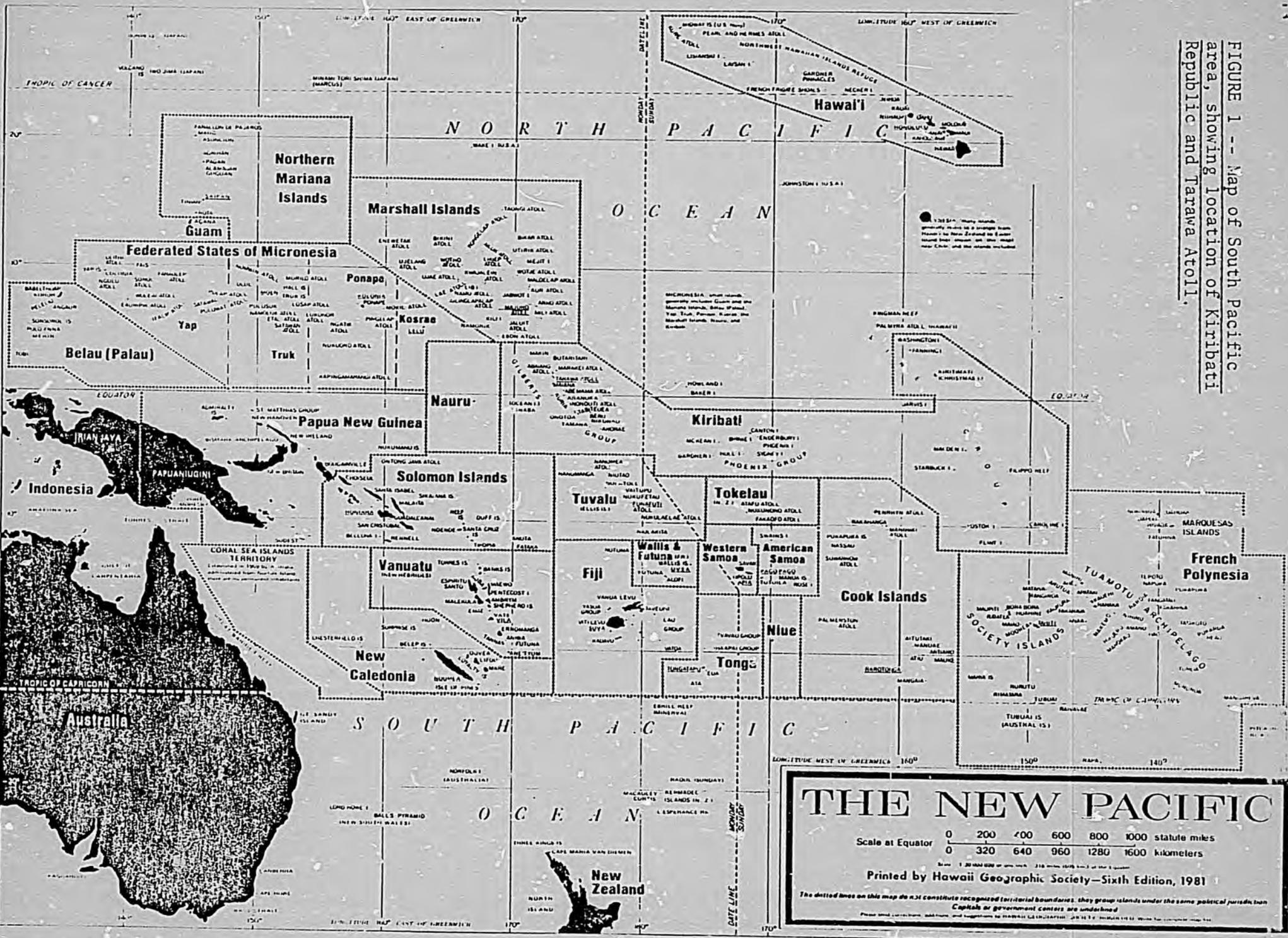
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FIGURE 1 -- Map of South Pacific area, showing location of Kiribati Republic and Tarawa Atoll.



THE NEW PACIFIC

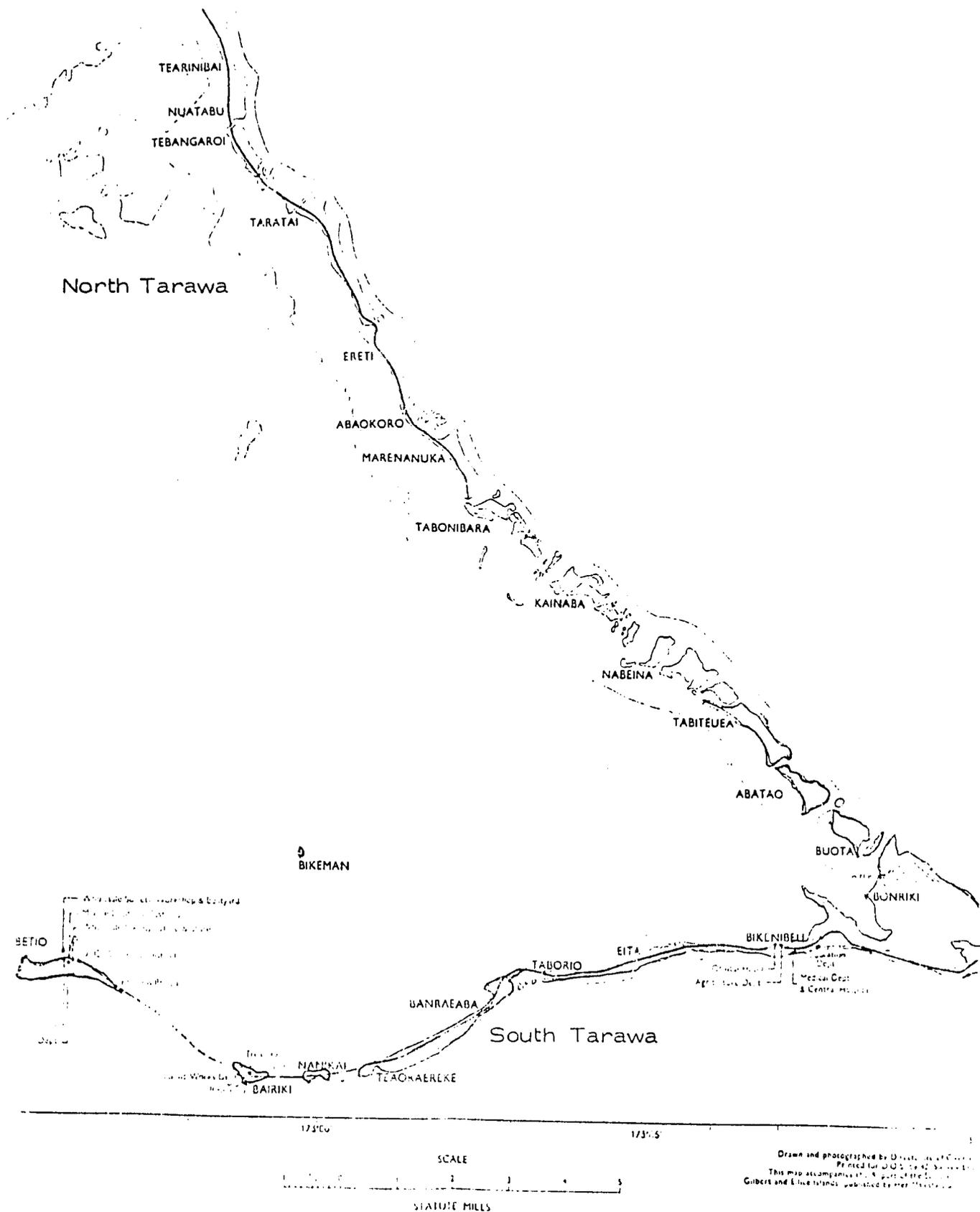
Scale at Equator

0	200	400	600	800	1000
0	320	640	960	1280	1600
statute miles					
kilometers					

Printed by Hawaii Geographic Society—Sixth Edition, 1981

The dotted lines on this map do not constitute recognized territorial boundaries. They group islands under the same political jurisdiction. Capitals or government centers are underlined.

FIGURE 2 -- Map of Tarawa Atoll in Kiribati Republic



EXECUTIVE SUMMARYI. OBJECTIVES

At the request of the Foundation for the Peoples of the South Pacific, relayed through the USAID Mission in Suva, a consulting team consisting of a nutritionist and a psychologist, Drs. Helen A. Guthrie and George M. Guthrie visited the Republic of Kiribati from January 3 to January 18, 1983. Kiribati was formerly the Gilbert Island portion of Micronesia. The original scope of work was:

1. To identify a potential weaning diet or diets made up from locally available foods which would be nutritionally adequate, culturally acceptable, and suitable for preparation in Kiribati homes.
2. To assess the AMAK mothers group as potential nutrition educators and the requirements for a training curriculum which would prepare the AMAK group to promote the new weaning diets in Kiribati.
3. To prepare a report to the Foundation and to HOVIPREP describing the results of the trip and make recommendations for a "Phase Two" or other follow-up activity if such seems warranted.

Additional objectives were included in the written report:

4. An assessment of infant malnutrition in Kiribati.
5. An assessment of infant feeding practices in Kiribati.
6. Suggested uses of available resources to alleviate the situation.

The written report was based on information from the trip to Kiribati, library research in the United States and Kiribati, and consultation with experts with work experience in South Pacific atolls.

II. BACKGROUND FINDINGS

A. Infant Malnutrition in Kiribati

1. Limited observations suggest infant growth has a good start.

Birth weight and weight gain the first five to seven months tends to be above the reference median. Nearly all mothers breast-feed for six to twelve months, many longer, suggesting good breast-feeding practices and adequate maternal fat reserves prior to and during pregnancy to support excellent lactation capacity.

2. Starting the second semester of life, rate of weight gain tends to fall relative to the reference and morbidity and mortality increase. Mean weight as percent of the reference median falls from above 100% to 80% after 3 years of age. Infant mortality rates are 87/1000. After seven months of age infants succumb to infections not frequently fatal in well-nourished populations.

3. One to five year olds also suffer from diarrhea, anemia, night blindness, and poor resistance to infections.

4. A contaminated, shallow underground water supply increases exposure to infection.

B. Infant Feeding Practices

1. Currently, most infants are breast-fed from birth to at least 6 months. Some are nursed up to 18 or 24 months.

2. Boiled toddy, the fresh juice of palm flower buds, is the first substance given in addition to breast milk, starting the first few weeks of life.

3. Young coconut, breadfruit, pandanus, and rice, and pumpkin and papaya when available, are fed in small amounts, beginning at three to seven

months of age. Fish is sometimes given at eight or nine months of age, but not frequently until one year.

4. The foods, if fed regularly and in sufficient quantities, have the potential to support normal growth. However, irregular feeding, especially during illness when food is withheld and appetite diminished, combined with declining breast milk intake and increased nutrient requirements as the child ages, leads to inadequate dietary intakes and slowed growth.

5. When a child appears thirsty or unsatisfied he is given a bottle of sugar water or very dilute sweetened condensed milk.

6. Mothers seem knowledgeable about good childhood nutrition but fail to incorporate the information in their feeding practices.

7. A major reason for termination of breast-feeding at young ages is employment of the mother outside the home. This occurs despite a Kiribati law which provides for daily breast-feeding leave.

8. Increasing urban migration dramatically alters infant feeding practices on Tarawa. Urban living eliminates family land resources for food production and forces dependence on commercial foods. The general social and emotional stresses of uprooting exacerbate negative changes in food availability.

III. RECOMMENDATIONS FOR WEANING DIETS

A. Encourage prolonged breast-feeding beyond 6 months. If the nursing is growing at a rate equivalent to reference values, feeding substances such as palm flower toddy before 5 months of age should be discouraged. On the other hand, if there are strong cultural reasons to continue this practice, education

to minimize contamination should be provided.

B. Diets in late infancy and childhood could be improved simply by increased intake of local foods - especially fish, young coconuts, coconut milk, papaya and pumpkin.

C. Encourage the feeding of fish by 7-8 months of age, keeping in mind the potential for fish poisoning, the cultural interpretations of fish intake, and the traditional pattern of food distribution within the household. It is necessary to develop a marketing and distribution system for fish so that it is consumed beyond the locale where it is caught.

D. The feeding of sweetened condensed milk, diluted or otherwise, the first two years of life should be vigorously discouraged by education programs and by clear communications on the cans. Powdered whole milk is recommended to supplement breast milk or the local diet after weaning. The feasibility of marketing smaller, less expensive quantities of powdered milk should be investigated.

E. Coconut water is recommended as a sterile fluid to satisfy thirst for rehydration, and to dilute powdered milk.

F. Encourage use of coconut in various forms. The soft flesh of young coconut is an especially good snack food suited to needs of young children. Encourage the use of coconut cream and oil to cook pumpkin and other Vitamin A-rich vegetables.

G. Promote feeding of Vitamin A-rich foods such as pumpkin and ripe papaya. Vitamin A fortification of a dietary staple, such as salt, should be considered.

H. Promote feeding of enriched rice as a replacement for the traditional, less nutritious, indigenous staples (breadfruit, panadas, and toro). This has

advantages of better nutrition and decreases the time and fuel required for preparation.

I. Encourage increased feeding of dependable local sources of iron-breadfruit, coconut, and other fruits and vegetables. Intake of iron and the B vitamins could be additionally increased by required enrichment of rice and flour with thiamin, riboflavin, niacin, and iron.

J. Baibai, the giant taro root, is a good source of calories.

IV. NUTRITION EDUCATION - MOTHERS' GROUPS AS A MEANS TO PROMOTE NEW WEANING DIETS

A. The Potential of AMAK Mothers as Nutrition Educators

The women's group known as AMAK (Aia Maea Ainen Kiribati or Women's Ring of Friendship) is the only formally organized such women's group and is comprised of young persons selected for training in home economics. They are considered to be talented community oriented young women who understand the culture and are accepted as peer educators. At the same time they require continuing encouragement and professional supervision in developing local programs, a function presently performed by a staff member of the Foundation for the Peoples of the South Pacific resident in Kiribati.

AMAK is in a position to promote nutritional, health and economic activities. It is supported by many of the women leaders of Tarawa and other islands. Because it is not related to any denomination, it is able to bring together women from different church groups. As an indigenous organization, AMAK is in a good position to incorporate dietary goals into various aspects of Gilbertese culture.

B. Recommendations Concerning a Training Curriculum

1. Extensive development of formal educational materials is not recommended since the Women's Groups function casually and within small numbers.

Focus on development of effective communication skills would be more appropriate. A few posters, concentrating on a single concept, could be used to reinforce information discussed in these working groups.

2. AMAK workers should select a relatively small number of objectives and messages and concentrate on these in short sessions, rather than tackle many problems in lengthy sessions, as they appeared to be doing.

3. AMAK workers should adapt experimental approach, modifying techniques used elsewhere to Kiribati traditions, rather than imposing techniques successful in other countries. Possibly reinforcement methods adapted to the Kiribati way of thinking would be useful.

V. ADDITIONAL RECOMMENDATIONS FOR FOLLOW-UP

A. Encourage mothers to boil rapidly all drinking water and scald all feeding utensils used by babies. The development of cisterns would improve water quality.

B. Encourage citizens to develop a marketing and distribution system for local foods, such as fish, coconuts, breadfruit, banana and papaya. Better distribution, both within neighborhoods and between islands, would improve diets of consumers and incomes of producers and middlemen.

C. Promote regular household production of papaya, as well as a distribution and marketing system. Promotion should include instructions for planting of trees in appropriate locations, pruning, staggering fruit-bearing times. School children could be encouraged to plant 2-3 papayas near their homes.

D. Support research for improved methods to raise egg-laying hens in atoll conditions and to encourage egg consumption.

E. Promote chilled young coconuts as an alternative snack beverage to carbonated beverages.

F. Promote improved cultivation practices for baibai, the giant taro root, including earlier harvest, provision of mulch and water, and increased awareness of banana bug problems.

G. Improve methods for growing vegetables in inhospitable island conditions. Initial efforts should focus on producing crops most likely to succeed, such as pumpkin, kankang and chinese cabbage, and not risk failure. Promote improved inter-island transport for distribution of produce to islands where gardening may be difficult (southern islands). Promote education to overcome prejudices against consumption of indigenous leafy plants which could provide critical Vitamin A, Vitamin C, and riboflavin.

Introduction

This report deals with observations made during a visit to the Republic of Kiribati from January 5 to January 14, 1983, under the auspices of the HCVIPREP (Home and Village Prepared Weaning Foods) Project, a cooperative activity of the MIT-Harvard International Food & Nutrition Program and the U.S. Department of Agriculture Office of International Cooperation and Development, with support by the U.S. Agency for International Development Office of Nutrition. The trip was made in response to a request from the Foundation for the Peoples of the South Pacific.

The three principal purposes of the trip were (1) To identify potentially adequate weaning diets made up from locally available foods in this island country; (2) to assess the suitability of a mothers group in Kiribati to serve as nutrition educators in a weaning food program; and (3) to prepare a report to HCVIPREP and the Foundation making recommendations for followup activities resulting from this consulting assignment.

The authors, a nutritionist and a psychologist, have had extensive experience in field studies in the Philippines, a country with somewhat comparable culture and geography and with similar nutrition and economic problems.

The information on which this report was based was obtained from 1) library research at the Pennsylvania State University, the Smithsonian Institution, the University of Hawaii and the National Library of Kiribati in Tarawa, 2) consultation with individuals with expertise in medicine, public health, geography, nutrition, and cross cultural studies, all of who had experience working in Kiribati and/or other south Pacific atolls, and 3) a two week visit to Kiribati including visits to Tarawa, the main urban center, and Abemama one of 16 outer islands. This included consultation with health personnel--physicians, nurses and medical officers and personnel of community development and volunteer agencies. A complete list of resource personnel is included in Appendix A.

The country

Kiribati (formerly the Gilbert Islands) a Micronesian country which achieved independence from Britain in 1979, consists of 619 sq. km of land (half of which is Christmas Island), spread over 16 coral atolls in an ocean mass of 5 million sq. km located 200 miles both north and south of the equator near the international date line. The soil on all islands is primarily coral with a high calcium and marginal iron, manganese and copper content on which coconut is the major crop. The northern islands with an annual rainfall of 120 inches are able to support the growth of cabbage, banana, sweet potato and beans in addition to the coconut, pandanus, breadfruit, babai, and papaya grown in the less moist central islands. The southern islands, with an annual rainfall of only 40 inches, suffer from periodic droughts. They are less productive, with coconut the only dependable crop. Thus the availability of food and the potential for increased agricultural productivity vary greatly throughout the islands.

The livestock industry is not yet well developed, although the raising of pigs and chickens is being promoted with marginal success. There are many problems and frustrations, including difficulties in transporting stock to the outer islands, lack of appropriate care, and the need to import a large portion of feed rations for good growth and productivity. Fishing is practiced by practically all I-Kiribati, with the size and dependability of the catch a function of the weather, phase of the moon, and the availability of manpower within the family. (The term I-Kiribati meaning Gilbertese is used as either a noun or an adjective.)

Fresh water, with some salinity, is obtained from rain water that collects as a water lens on top of the water table of more dense salt water. It can be tapped from wells no more than 10 to 15 feet deep. Some homes have built their

own rainwater catchment systems but these require galvanized iron rather than the traditional thatched roofs.

The population of 58,812 (1978 census) is concentrated on the island of Tarawa. A birth rate of 34/1000 population coupled with a death rate of 14/100 results in an annual population increase of 2.2%. Forty-one percent are under 15 years of age. Twenty-five percent of the population function within the cash economy, 67% in the subsistence economy and the remainder are dependent on others. Although 80% do attend school, only one tenth of these succeed in qualifying for admission to the public or private secondary educational system. At the time of the 1978 census, 194 people held post secondary degrees or diplomas.

The Gilberts have a high population density ($192/\text{km}^2$) for a country relying on a subsistence economy. The only export produced is copra, 10,000 tons of which were produced in 1980. With the collapse of the world copra market this source of foreign exchange is seriously threatened. With a drop in the local price from \$.70 to a British government subsidized \$.10/lb. in 1983 there is little incentive for copra production. An anticipated drop to \$.05 when the subsidy expires this year will further reduce local income. This comes at a time when I-Kiribati are becoming increasingly accustomed to imported food and consumer goods such as rice, flour, motor bikes, radios, petroleum products, beer etc.

Nutritional status of infants and young children

Information on the nutritional status of infants and young children was obtained from 1) reports of studies of weights and growth of infants and children, 2) records of age and cause of death in Tarawa, 3) discussions with health personnel regarding health problems of infants and children, 4) interviews with mothers of young children, 5) visits to health clinics. The

incidence of growth retardation and night blindness was the most common direct evidence of malnutrition, while the incidence of anemia and diarrhea, and mortality among infants and children under five from conditions that normally would not be fatal, have provided indirect evidence of malnutrition.

Two studies provided an indication of the relative severity and incidence of malnutrition in Betio, a crowded urban area on Tarawa, and Abemana, an island 200 miles south of Tarawa, a much more isolated rural and sparsely populated area with access to sufficient food.

A 1980 survey showed that at all ages children in Abemana (N=116) were slightly larger and had a much lower percentage (19% vs 32%) with a Middle Upper Arm Circumference (MUAC) indicative of undernutrition than those on Betio (N=79). (R. Buswell) A subsequent study of 145 children on Abemana in the spring of 1982 showed that 14.5% were below 80% of the appropriate age weight standard (Harvard) and 13% had a MUAC of less than 14 cm. Weight data was similar to that found in 1980 (116 children with 13.8% below standard) but there were fewer children with low MUAC (13% vs 19%). Ten children fell below on both measures--of these, two had night blindness, four hookworm, and one TB with failure to thrive. Both studies concluded that improvements in health are more likely to result from improvements in nutrition and hygiene than through an emphasis on providing treatment when the child gets sick. (Franks, 1982)

A 1980 study of the use of MCH clinics on Betio and Abemana showed that 83% of the infants under one year were seen on Abemana but only 42% of those on Betio. The use of the clinic declined with age to 22% and 5% of the 4-5 year olds. This study on Abemana showed that children under five had an incidence of disease four and one half times that of persons over five. The most common problems were skin disease (24% of all illnesses) lower respiratory tract infection (18%), diarrhea (15%) and upper respiratory tract infection (12%).

Comparable rates for those over 5 were 18, 12, 9 and 8%. Morbidity/1000 population for these conditions were 282, 212, 128 and 140 in those under 5, and 63, 43, 32 and 29 for those over 5.

Observations by physicians on Beru, a relatively rural southern island, and Abemana, a more central island, and by a nurse in more urban Tarawa all showed that birth weights were on the high side of acceptable and that growth for the first five to seven months when the infant was breastfed surpassed 100% of the Harvard Growth Standards of weight for age. After this time weights began to level off but, because of their good start, generally remained in the 80 to 100% range until some stress such as diarrhea or infection caused them to fall still further, in many cases below 80% of the expected weight for age.

(Table 1)

Physicians routinely report a high incidence of night blindness in one to five year olds based on mothers' reports that the children cannot see at twilight and consistently bump into objects. It seldom, if ever, advances to keratomalacia. This problem reflects the failure to make use of fruits and vegetables or eggs in children's diets. Fish liver which could provide ample vitamin A is considered a status food and, when available, is given to the adult males. Night blindness is treated by intramuscular injection of vitamin A and dietary counseling to increase the use of vitamin A-rich foods such as pumpkin or papaya.

Anemia, characterized by hemoglobin levels as low as 3 to 5 gm/100 ml in a few cases, is relatively common but occurs most frequently among children from islands with high rainfall and resultant hookworm infestation and loss of blood. On other islands such low hemoglobin is usually associated with some other blood disorder. With the almost complete lack of a dietary source of heme iron and limited use of fruits and vegetables, enriched rice, breadfruit

and coconut are the most dependable sources of iron. Treatment with ferrous sulphate will usually effect an increase in hemoglobin although the culture generally rejects medication that requires more than a three day compliance.

Infant mortality

A tabulation of causes of infant deaths on Tarawa from 1977-1982 (Table 2) showed that after seven months of age infants were succumbing to conditions such as measles, meningitis and pneumonia and other respiratory infections which would not be as frequently fatal in a well-nourished population of this age. A measles epidemic in 1978 was particularly devastating for children over two years of age.

In six cases the cause of death was recorded as malnutrition, kwashiorkor or marasmus. In 29 cases the cause was diarrhea, or high fever, both of which may be a problem for well-nourished as well as poorly nourished infants when the water supply is contaminated. The poorly nourished child however, has less defense against the causative organism under these circumstances and hence is much more likely to succumb to it.

Infant morbidity

Skin infections ranging from scabies to ringworm are common in children between two and four years of age. It is possible that the failure of epithelial tissues to heal may be due to nutritional problems such as vitamin A deficiency. Alternatively, protein deficiency reflected in failure of antibody production may be a contributing cause. However, skin problems are equally likely the result of lack of water for normal hygienic practices and a contaminated environment where water is in scarce supply.

Colds as evidenced by runny nose and persistent coughs seem endemic among small children again reflecting the marginal environmental sanitation and low resistance to infection.

Health services

Each atoll regardless of population is provided with a least one rural dispensary staffed by a village health worker and nurse. Each village has a trained maternal child health aide selected by the village and trained by the dispensary staff. Observations suggest that these workers are more successful at family planning and immunization activities than at counselling change in current food and feeding practices. This is believed to result from many other factors influencing food practices in the home. Programs developed by staff of the women's organization AMAK are often directed to health concerns and have potential for having considerable impact on health and feeding practices.

Infant feeding practices

Practically all I-Kiribati children are breastfed for a least 6 months, many for 12 months, and some for as much as 18 to 24 months. Almost all I-Kiribati mothers, as is true of most adults, are of normal or above normal weight and appear to have fat reserves to meet the high energy demands of successful lactation. This is confirmed by satisfactory growth of infants. (Table 1) Although breast milk alone seldom supports good growth after 6 months, its continuous should be encouraged since it often provides the only consistent source of good quality dietary protein and the sole source of calcium up to 2 years of age. Supplemental foods are generally poor sources of these nutrients. Growth data show that I-Kiribati children grow very well for 6 to 7 months. The most common health problem during this period is diarrhea. Since this seldom occurs in babies who are given no food or beverages other

than breast milk, there are strong reasons to encourage the use of breast milk as the only source of food for the first 5 to 6 months of life. If it is of sufficient quantity to support growth, the quality will remain satisfactory.

The major reason for earlier termination of breast feeding or lactation is that the mother is working. Kiribati law requires that a mother be given 6 week maternity leave and that, following return to work, she be allowed to return home at 10 a.m. and 2 p.m. for half an hour to feed her baby. Because of the great length (20 miles) of Tarawa Island this may be logistically difficult and/or disruptive to her job efficiency unless the mother lives close to her work.

Another less common cause for termination of breast feeding is that the baby has been 'bubuti'd' or has gone to live with someone else. In the I-Kiribati culture it is possible for a person or family to ask a mother of a young infant for her baby. It is reported that to refuse to give up the baby is considered shameful; as a result most mothers agree when asked. This is part of a general pattern known as "Polynesian fosterage" in which children are adopted into other families. usually but not always relatives. Unfortunately, the baby, separated from its biological mother, may suffer severe nutritional consequences as he is not only removed precipitously from the breast but, in the absence of a tradition of wet nursing, must be given a bottle. This usually involves an inferior product (sweetened condensed milk) or one prepared in an unsanitary way--i.e. in improperly cleaned bottles, or improperly diluted with unboiled water.

Toddy, the unfermented juice of the palm flower, collected twice a day is traditionally the first supplement to breast milk. Initially it is given in such small amounts (1 tsp. diluted with 2-3 tsp. water) that any benefits from its vitamin C content which is adequately provided by breast milk are almost

certainly outweighed by the hazards of contamination due to unboiled toddy, unboiled water or a poorly cleaned bottle, spoon or cup. On the other hand, vitamin C in the toddy is reduced if the toddy is boiled. In older infants, toddy that is three to four hours old and which has a slightly higher thiamin content is often recommended. Again, if the toddy is boiled the content of these water soluble, heat labile vitamins is reduced.

The foods available and used to supplement breast milk have been breadfruit, pandanus and babai (taro). Unfortunately, breadfruit is available only seasonally; pandanus has little nutritional value beyond energy and requires a high energy input to prepare, and babai is too fibrous for an infant, and is harvested primarily for festive or ceremonial occasions. Thus, there is little reason, other than possibly economic, to be concerned that these traditional foods are being replaced by rice imported from Australia. Almost all of this rice is enriched with thiamin, riboflavin, niacin and iron and has more protein of superior amino acid composition than any of the indigenous staples. Because it must be purchased in large quantities, cost is the major drawback to its use.

Papaya, considered a suitable food for infants but not for toddlers and adults, represents an excellent source of vitamins A and C and, in season, makes a significant contribution to the nutritional needs of infants after five months. The use of papaya should be encouraged not only in infancy but beyond, especially throughout early childhood when night blindness is observed. This will require efforts to promote the planting of more trees, staggering them so that they are bearing throughout the year and the provision of a marketing mechanism whereby the surplus from one family may be made available to those without trees bearing at that time, or to those who do not own land on which they are motivated to introduce improvements such as food-bearing plants.

Mechanisms to circumvent the cultural stigma of 'begging' associated with selling surplus produce to a friend, neighbor, or relative must be an essential consideration in setting up a marketing system.

The use of fish as a protein source for infants is logical in a country surrounded by seas. While many mothers are willing to use fish for infant feedings, others report a wide range of reasons why it is inappropriate. Some believe that a child given fish before one year of age will grow up to be 'lazy like a fish, swimming aimlessly in the water'; others report that once a child is given fish he will want it every day, which presents a problem when the fishing is bad because of the weather or because no adult male is available to go fishing.

Some of the small shellfish which can be harvested at low tide by the women are inappropriate for use with young children because they are too tough and rubbery for a child to chew or must be pre-masticated by the mother. An additional concern about feeding fish to infants and children is the danger of ciguatera poisoning which occurs at unpredictable times in a variety of reef fish but not in pelagic fish. The resulting neurological symptoms, and nausea and diarrhea which are debilitating but seldom fatal for adults, may be much more serious for infants. In spite of these concerns the use of appropriate fish by seven to eight months of age should be encouraged as it represents the only readily available source of good quality protein.

While there seem to be no cultural taboos regarding the use of fish in the diet of 2 to 5 year-old children, the social patterns of families in which men, guests and infants are fed first followed by adolescents, women and young children mean that the young child may have limited opportunity to share in the family supply of fish and may instead have to fill up on the dietary

staple--rice, breadfruit or taro. This increases the possibility of nutritional inadequacies.

Again, only on Betio is there a formal marketing mechanism for fish. Even these fish markets are functional only when the catch is good. On most islands a very informal exchange of fish occurs--with some families trading with neighbors and relatives and others having a select clientele to whom they offer to sell their fish.

Families without access to fresh fish are making increasing use of canned mackerel available in almost every small village store. From a strict nutritional standpoint this product is quite acceptable. Unfortunately at \$1.25 per pound it is from two to three times as expensive as locally caught fish. Part of this may be offset by the decreased time and effort needed to prepare the tinned fish. For unemployed mothers the savings can seldom justify its use.

The cost of family-caught fish varies depending on whether it is done with a pole on the reef or shore, or from a local canoe, or whether it involves the use of a motorized fishing boat for which the cost of petrol at 78 cents per liter may amount to \$15 to \$20 for a four hour trip. The success of the catch varies with the winds, the phase of the moon which influences the feasibility of night fishing and, of course, the run of fish. Surplus fish are preserved by sun drying and salting or are shared with neighbors and relatives. Some are frozen by the families who own kerosene or electric freezers. When locally caught fish is unavailable there are few feasible alternative sources of animal protein. Pigs and chicken are generally used only on special occasions. Canned corned beef is a popular item but a 12 oz. can provides little more than flavor for an extended family of 20 or more eating together.

Eggs, which provide not only good quality protein but dietary iron, vitamin A and riboflavin, all of which are limiting in the post-weaning diet, are an underutilized resource in the diet of children. Their increased use would have important nutritional benefits. Beliefs that the use of eggs is 'stealing' since each has the potential of becoming a chicken is one reason given for their limited use. The cost of eggs (20 cents each against a daily income of \$2 to \$3) put them in a luxury class. Local eggs are often sold hard cooked as a snack food in stores or to school children at noon. Although they would make an appropriate and ideal weaning food for infants and it would seem logical to promote their use, until they are readily and consistently available they do not represent a feasible solution to the problem. This may occur when agriculturists have had success in raising chickens under atoll conditions and encouraging individual families to establish small flocks for their own use.

Attempts to encourage the rearing of laying hens have been discouraging, plagued by failures to provide feed adequate in both quantity and quality, or sufficient water, and problems with adequate caging to assure that eggs are laid in an accessible location rather than hidden in the bushes where they are very difficult to find and where they remain at hatching temperatures. Research has demonstrated that coconut meal remaining after the extraction of oil can be substituted for 25% of the usual imported cereal ration for laying hens without any reduction in egg production or size. Hens which are allowed to range part of the day have adequate access to calcium in Tarawa where the soil is predominantly calcium carbonate.

Perhaps the most economically and nutritionally unsound infant feeding practice relates to the use of sweetened condensed milk. This product, in which 60% sugar is added as a preservative to evaporated milk, was never intended as a substitute for milk as a beverage but rather as a base for

desserts and for use in tea and coffee. Its appeal in the tropics comes from the fact that the high sugar content prevents spoilage once the can is opened. The practice of bottle feeding this to young infants, usually diluted as much as 7:1 with water, means the child is getting little more than sweetened water, and then often polluted water in an inadequately cleaned bottle. Sweetened condensed milk serves no defensible role in the diet of infants and young children. Its use should be actively discouraged and the can more clearly labeled as 'unsuitable for infant feeding.' An educational efforts to alert mothers to the limitation of its use should be part of any ongoing health education program. The alternative, if fluid is needed, is locally available coconut water which is a safe and moderately nutritious beverage. Furthermore, the soft flesh of an immature coconut has a nutrient density relatively close to milk and is an excellent infant food.

The use of dried whole milk, readily available and with similarly good keeping qualities, provides a nutritionally superior beverage with no added sugar. A 300 gram can which makes 2-1/4 liters of whole milk provides three times as much 'milk' as 2 cans of sweetened condensed milk for the same price. The possibility of marketing dried whole milk powder in smaller less expensive units, e.g., foil pouches, should be investigated and, if feasible, encouraged.

Indigenous foods

Coconut at various stages of maturity serves many important dietary functions in addition to providing many families with their only cash income when it is harvested, dried and sold as copra.

In infant feeding, toddy from the palm bud has been traditionally used as an early supplement to breast milk. Because of the risk of contamination and the resulting diarrhea from the use of unboiled toddy, unboiled water, improperly cleaned spoons, cups or bottles, it is unlikely that the benefits

warrant the risks. Boiling the toddy to inhibit fermentation and to reduce possible contamination, also destroys vitamin C. In addition, because of the very small amounts (1 tsp.) used initially and the fact that breast milk is always adequate to meet the infant's needs, it is likely more expedient to continue to give lactating mothers preferential access to the family toddy supply and rely on her breast milk to provide the infant with vitamin C until 5 months of age. If however there are strong cultural reasons to continue its use, mothers should be encouraged to take steps to prevent contamination.

Coconut water is a reliable source of a sterile fluid to replace that lost through perspiration in the high temperatures of the tropics. Its electrolyte content makes it useful in rehydration. It is a safe fluid that could also be used as a carrier for powdered milk if it was necessary to provide supplemental milk to young infants. Concern that the use of young coconuts for water would reduce the future copra crop may be less of a deterrent to their use at a time when the price of copra is greatly deflated. Under these circumstances, it would also be desirable to encourage the use of green coconut water and meat for toddlers and school children as a nourishing snack; the fluid and meat of one coconut compares very favorably in nutrient profile and nutrient density with 1 cup of milk as a snack food. The success elsewhere in Micronesia of promoting the sale of chilled young coconuts as a snack beverage rather than carbonated beverages should be considered a model to be replicated in other atolls. (Rody, 1980)

Coconut cream, prepared by extracting the fat and other solids from grated coconut, provides a good source of dietary fat, especially useful in facilitating the absorption of vitamin A when it is used in cooking pumpkin or vegetable greens. There is little or no cause for concern about the saturated fat content of coconut oil since most of the other fat in the diet comes from

relatively unsaturated fish oil and the total fat is relatively low. The cholesterol content of the diet is of little or no concern among children who get practically no milk or eggs and little animal fat.

Mature coconut is eaten mainly as a condiment or in confections. It plays little part in the diet of infants and children except as the basis for preparing coconut milk. However, one mature coconut (300-400 grams of meat) providing 1400 kilocalories, 14 g. protein, 140 g. fat, 50 g. carbohydrate, 7.0 mg. iron, makes significant contributions to the daily nutrient requirement of the adult male.

Coconut oil, extracted by boiling grated coconut meat with water until the fat rises to the top, provides an acceptable oil for frying foods such as fish and breadfruit. Some prefer imported 'drippings'--either pork or beef fat which has a milder flavor. The remaining relatively indigestible coconut meal with a favorable protein content is not used as human food but provides a good food supplement for chickens and pigs. The technology for converting coconut meal for infant feeding does exist but has not proven economically feasible nor nutritionally valuable in other countries.

Pandanus, when eaten raw by sucking the juice and pulp from the very fibrous fruit segments, provides some vitamin A. In this form it is suitable for use by adults and older children. Its health benefits may be largely due to its detergent action on the teeth. Occasionally it is used as a food for infants after the plant has been boiled and the starchy portion squeezed out and strained to remove the fibers. Its value in infant feeding is limited to its energy content and vitamin A. It is available only a small portion of the year but is preserved in sheets in a very labor and energy intensive process for use in a tasty coconut cream/pandanus confection of little nutritional value other than energy.

Breadfruit appears to grow well; most families even in crowded urban Betio have access to the fruit of at least one tree. During its season it serves as a supplement to rice as a dietary staple. Although it is nutritionally inferior to rice, when breadfruit is fed along with some fish, the impact of its use instead of a staple with more protein will be minimum. It is possible to cook, sun dry and grind breadfruit and bury it for use in the off season. Such a product could be utilized in infant feeding largely as a calorie source especially if rehydrated with coconut milk or water.

Pawpaw (papaya) is potentially a useful source of vitamin A and C in the diet of infants. Unfortunately most families who own their own land have only one or two trees which bear fruit for a relatively short period of time each year. These families will have a surplus at some times and none at others. There is no marketing system by which surpluses can be sold, nor is it possible for a family to purchase it when their supply is depleted. Since papaya is not considered an adult food and since among some groups there is a cultural bias against eating any raw food, families have little motivation to cultivate it. As a result few take the relatively few simple steps necessary to increase its productivity, such as planting close to the water table, pruning excess fruit and selecting good quality cuttings. A proposed plan to encourage school children to plant two or three papayas near their homes should be encouraged.

Babai, a giant taro root, is cultivated in especially prepared boggy pits which are dug to a depth to provide access to the water table. Although it may be large enough to eat after 6 to 8 months, many are allowed to grow for several years before harvesting. Successful cultivation requires the provision of a good mulch or compost in addition to adequate water. Since it is susceptible to a banana bug that eats the tuber there is concern that only inspected banana cuttings be planted near babai. Babai, used primarily on

special occasions, plays little role in infant feedings--a matter of little concern since its major nutritional contributions are starch and calories.

The successful cultivation of bananas requires both potassium in the soil and a relatively good rainfall. Since one or both of these are limited on many islands, except Butaritari, bananas which would make an excellent weaning food are limited and cannot be considered a dietary staple. Attempts to market Butaritari bananas on populous Tarawa have been thwarted by uncertainty of the subsidy for air freight and a poorly developed and uncertain marketing mechanism once they arrived. Growing bananas near babai pits which would provide the needed moisture is discouraged because, as noted above, certain banana cuttings may carry a banana bug which attacks and destroys the babai tubers.

An obvious lack in the I-Kiribati diet is vegetables. Difficulties encountered in growing them in an inhospitable soil are formidable but not insurmountable. Those who have used compost and/or seaweed to enhance the fertility and tilth of the soil have had reasonable success in growing pumpkin, kankong and chinese cabbage, all of which make important contributions to the diet of children, especially when cooked with a fat source such as coconut cream. Gardens, even in the central islands, require constant care, especially watering. In the northern islands gardens do better but there is no reliable, reasonably priced form of interisland transportation to move this produce to other islands. There have been successful demonstrations of growing other vegetables such as cucumbers, tomatoes and beans, but the work involved in relation to their nutritional merit suggests that it would be better to concentrate initially on promoting crops for which there is a reasonable probability of success rather than risking failure and total rejection of

gardening. In Southern islands with irregular and low rainfall, it is questionable whether it is reasonable to encourage gardening at all.

Almost all islands have some indigenous edible plants which have in the past been used as food but which are no longer utilized. Some, such as portulaca, have come to be regarded as pig food although it is a palatable nutritious food. Many other leaves from bushes and other plants are potentially good food sources. The use of even small amounts of green leafy material in rice and fish dishes could make the difference between marginal and acceptable vitamin A and possibly vitamin C intakes. Many would also contribute riboflavin, a lack of which may be responsible for some of the cheilosis reported in young children whose diet is low in or devoid of eggs or milk.

Imported Foods

For well over 100 years Kiribati has been importing rice which serves as the dietary staple when breadfruit and babai are not available and supplements them when they are in limited supply. It has likely been responsible for food sufficiency as population pressures have mounted. At 30 cents per pound rice costs slightly over 2 cents per 100 Kcal, essentially the same price as less nutritious sugar. Enriched rice does, however, contribute significant amounts of thiamin, riboflavin, niacin, iron and protein which justify its use from a nutritional standpoint. It has the additional appeal in that its preparation requires less work, time and fuel than the preparation of indigenous breadfruit, or pandanus.

Imported flour is readily available and used primarily in making bread, doughnuts, and pancakes. Many homes have ovens fashioned out of oil drums and heated by coconut husks and many women sell these baked products in their neighborhood. Although flour based products appear to constitute a relatively

small part of the diet, their nutritional merit would be enhanced by a policy requiring enrichment of all imported flour with thiamin, riboflavin, niacin and iron. A flour thickened water paste is sometimes served as a porridge. It may be topped with grated coconut. The perishability of whole wheat flour precludes its use in the humid tropical weather on an atoll.

Social influences on infant feeding

The current state of infant nutrition is to some extent a function of social changes occurring within the society. As in almost all developed and developing countries, there is in Tarawa a migration toward the city--in this case Betio, the only port and government center. This has resulted in crowded housing with attendant problems of inadequate sanitation but, more importantly, it has forced many families to abandon their access to family lands and the food traditionally provided to them as they switch from a subsistence to a cash economy. Thus they are forced to turn to commercially produced foods with which they are less familiar. Additionally, the stress of unemployment or underemployment, responsibility for large and often extended families (over twice as many households of 10 or more and as in the rest of South Tarama) and crowded housing frequently result in disruption of the family. Physicians report that social disruption in some form or other is almost always a factor in malnutrition of infants and children. In many cases the disruption of the family is the result of excessive use of alcohol which, although expensive, reaches high levels on bi-weekly pay days, indicative of the diversion of family income from the food and health needs of the family.

In spite of the hardships associated with life in the urban area those who migrate in search of work, find it very difficult to return to the less stimulating rural environment where the access to family lands provides them with a more dependable but much less varied diet.

Table 1. Malnutrition in Children Under Five Years, Weight $\leq 80\%$ Ideal Weight for Age

Age in Months	Abemama			Betio		
	N	Wt. $\leq 80\%$	Ave ¹	N	Wt $\leq 80\%$	Ave ¹
0-3	10	0	121	20	3	110
4-6	21	2	107	34	0	113
7-9	12	1	97	27	0	105
10-12	15	1	95	17	0	96
13-15	9	1	97	11	1	98
16-18	15	2	88	12	5	84
19-24	24	5	91	16	6	88
25-30	17	4	84	15	7	82
31-36	18	1	95	8	4	85
37-42	11	1	94	4	3	80
43-48	12	2	91	6	4	80
48-60	10	0	97	7	3	77

¹ Average percentage of ideal weight for age.

Table 2. Causes* of Infant Mortality in Tarawa - 1977-1982

Age (Month)	<1	1-6	7-12	13-24	25-60	
Malnutrition			3	1	2	6
Fever		1	7	3	1	12
Diarrhea	1	2	8	5	1	17
Meningitis	3	1	2	2	2	10
Measles**			3	8	8	19
Pneumonia	1	4	9	3	3	20
Respiratory failure	6	2	2	1	2	13
Gastroenteritis			4	2	1	7
Heart failure	1	2	1	1	5	10
Prematurity/ Stillbirth	9	1				
Other	3	2	7	3	10	25
Unknown or not specified	3	2	6	6	2	19
	<u>27</u>	<u>17</u>	<u>52</u>	<u>35</u>	<u>37</u>	<u>168</u>

* As recorded in death register. Mortality rate reported as 87/1000 in 1978 census.

**All in 1978.

Role of AMAK Women's Group

The Women's Federation of Kiribati represents the only formally organized group of women accessible to the whole population. This is a dedicated group of women with a paid staff of 5 to 7 who currently function under the direction of Kathy Nast, an American with a master's degree in Community Work employed by the Foundation for Peoples of the Pacific. The group's major activities involve planning and presenting programs for small groups of village women on homemaking and food production skills and health concerns similar to the activities of the Extension Home Economist in the United States.

Each year one or two members are sent to Sewa for training in Home Economics. This is a very prestigious assignment which affords the young woman considerable community status by singling her out as a particularly qualified person. Since this opportunity may provide a motivation for women to continue their involvement with AMAK, it should not be curtailed without consideration of all the ramifications for the membership. It does also provide a level of training not available in a country with no post-secondary education. There is certainly now a cadre of qualified leaders who could train 'peers' to carry out and reinforce their programs at a community level but there is much to be gained through the interaction at a more global level.

The leaders may lack the courage of their convictions about what constitutes a meaningful program objective. Support in selecting program goals from outside consultants would be helpful but once the objective was clear the women leaders themselves are quite capable of identifying the appropriate and effective approaches.

In the area of health/nutrition, it is very important that their messages be compatible with and reinforce those of the health personnel who make frequent visits to communities to conduct clinics--largely to deal with acute health problems and make medical referrals. They pay little, if any, attention to preventative

health programs--an area in which AMAK could have maximum impact.

In short, AMAK women are bright and talented community oriented young women who understand the culture and are accepted as peer educators. They need encouragement in selecting an activity and in developing effective educational strategies but are quite capable of delivering the programs and in training peer groups within far flung communities to carry out local programs. There is need for constant reinforcement because even one minor setback is often considered as a reason for abandoning a program rather than as a challenge to find alternative approaches and solutions. In as much as other South Pacific Island countries have similar problems, the AMAK program could be considered a model and might well serve as a center for practicum experience for women from other countries. Reinforcement and guidance from outside consultants would be beneficial but program implementation should be a local initiative.

Given the conditions described in this report, it becomes necessary to confront the question of the scope of activities one might reasonably expect the AMAK group to perform in the area of a weaning food intervention. Some background information on AMAK is provided in a report by Foundation staff member Kathy Nast:

"The very first women's groups began soon after the arrival of the first American missionaries who brought Christianity to the Gilbert Islands in 1857. They did not receive official government recognition, however, until 1963 when two local women were sent to Suva, Fiji to be trained to work specifically with women's groups. In 1968 the formation of Homemakers' Clubs began in the outer atolls. Village clubs formed island Women's Club associations, and in 1976 the Ministry of Health and Community Affairs formed a National Women's Federation. The idea behind forming a National Women's Federation was to have a national organization which would link the women's clubs with other island associations and government agencies, as well as provide a national speaking voice for the women.---"

Objectives of WAK include the promotion of the well being of the people in their homes and communities, to encourage and increase and maintain the special kiribati skills and traditions, and all that is good in the local culture. In 1978 members of the Federation made an effort to improve sanitation in the country following the cholera epidemic by encouraging every member throughout the islands to have water-sealed latrines, and to improve their drinking wells. They also held a one-day workshop on Tarawa concerning public health education with representatives from every club and missions' women's groups on Tarawa attending (Nast , 1982).

Many needs have been recognized in the National Health Services Program Plan for the 1982-1986 National Development Plan. Of the 15 problem areas targeted in the plan, many affect children directly and all at least indirectly. They include:

1. Overpopulation problems
2. Respiratory tract diseases
3. Diarrhoeal diseases
4. Wounds and sores
5. Eye diseases
6. Skin diseases
7. Ear diseases
8. Communicable diseases
9. Anemia
10. Malnutrition
11. Fish Poisoning
12. Parasite infestation
13. Dental diseases
14. Alcoholism
15. Non-communicable diseases

While the curative or treatment elements with respect to the problems may be largely medical, the major emphasis must be

preventive. To achieve reduction and control of these disorders all citizens must follow improved sanitary practices and improve their diets within the limits of local food resources. AMAK can play a central role in promoting better sanitation, and improved food production and selection. Medical personnel, by themselves, can never begin to bring about the changes that are needed. There are problems, however, in any program to promote preventive practices. While successful treatment of an illness is both dramatic and satisfying, prevention, even if effective, does not yield such apparent benefits. Maybe the child would not have been sick anyway. Furthermore, violation of sound preventive practices does not always lead to illness.

The implication of these contingencies is that prevention requires more teaching, and preventive practices that must be followed every day required more social support than does acceptance of a treatment to relieve a current distress. Maintenance of good practices can sometimes be supported by posting indications of the benefits of improved practices, such as reductions of automobile accidents as a function of a safe driving campaign. Similarly, in Kiribati, the reduction in the incidence of diarrhea, anemia, or parasite infestation could be displayed prominently in villages to show the benefits of improved practices and to remind citizens that these scourges can be reduced by their efforts.

The problem of malnutrition in infants and young children can be approached by AMAK. While a marasmic two-year-old is in a medical crisis and needs a physician's attention, the vast majority of Kiribati babies are not in immediate danger but they do need improved foods supplemental to breastfeeding beginning about the fourth month, and improved use of weaning foods in the second year. We believe that these improved diets can be taught to use them. Furthermore, conditions can be established that will help mothers maintain these satisfactory feeding practices. At the same time they can be encouraged to follow improved sanitation practices such as boiling all water that family members drink.

Specifically, mothers should be encouraged to take certain steps:

1. Make more use of coconut in various forms, especially young coconut which is especially suited to the needs of infants and coconut oil which has high caloric density.
2. Plant and use papaya, a fruit that will bear heavily the year round.
3. Raise chickens and feed the eggs to children.
4. Make more use of fish and crustaceans.
5. Boil water.
6. Improve sanitary practices.

These suggestions can be implemented within the resources of the mothers.

At the same time it must be recognized that poverty is a major cause of malnutrition here as elsewhere in the world. Copra is the principal export and major source of foreign exchange of Kiribati and of many other countries in the Central and Western Pacific. With international copra prices low in 1983 and not likely to reach normal levels in the near future, emphasis should be placed using food that can be produced in Kiribati.

AMAK staff members have been giving consideration to the promotion of markets on South Tarawa where the urbanized population can buy fish, coconuts, breadfruit and papaya, products that are underutilized or wasted under the traditional patterns where each family grows only what it needs on its family-owned land. Under that system the migrant is forced to become dependent on imported canned food because he is more or less cut off from his ancestral lands that often lie on distant atolls.

Of course, there are patterns of informal exchange of surplus foods among neighbors and relatives but these patterns usually do not include the migrant families who have congregated on South Tarawa. Markets are needed to make selling respectable. Under traditional patterns one who accepts money for surplus coconuts, taro or breadfruit may be seen as begging. That marketing systems can and do evolve in a developing country is outlined by Stanton (1971) in her study of a Philippine

rural market. Probably a majority of the world's people buy at least some of their food at traditional markets. The markets emphasize locally grown fresh vegetables, fruit and meat and, as small-scale units, they provide a livelihood for many people. Vending is often the largest occupation in a traditional community. The establishment of local markets on South Tarawa would provide paid work for several hundred people who currently are underemployed.

It should be emphasized that traditional marketing is different in many ways from a European or North American grocery store. A traditional market is made up of individual entrepreneurs who are buying and selling among themselves as well as to customers. Rarely does a customer buy directly from a primary producer. Finally, women, who often make up the majority of market personnel, have a major opportunity for independent activity and expression.

Several government departments, schools, and private foundations are doing important work developing solutions to local problems with local means. The Ministry of Natural Resources especially, has selected strains of chickens and hogs that survive well in Kiribati on Kiribati foods. It has also done important work on vegetables and fruit. The tarawa Technical Institute has developed roofing and tank materials that enable citizens to collect rain water that is free of the contamination that besets underground water. Mr. Ken Baer of Save The Children Foundation has an imaginative program underway concerned with utilizing local plants as vegetables and, developing roofing and tank materials that are inexpensive. AMAK can and does draw on these resources and has a unique opportunity to transfer these improvements directly to women who need them.

In her 1982 report, Nast, reports:

For example, some projects being planned include building demonstration chicken coops of local materials, pig pens, fish drying trays, making local chicken feed, making soap from all local materials. The women's interest workers are receiving specific training in these areas from the Ministry of Natural Resources. They have, so far, built their own chicken coop to make sure that

it can be done by the village women. It is also planned that the women's interest workers will receive assistance from the Tarawa Technical Institute to learn the construction of inexpensive rain water catchments. The women's interest workers will then teach the skills to the village women by actually building a catchment during their touring workshops. Both the Fisheries, Livestock and Gardening Divisions of the Ministry of Natural Resources have expressed their interest in collaborating with the Federation on such a continuing basis to reinforce their own programs in rural communities."

AMAK is in a unique position to promote the nutritional, health and economic activities that we have described. It is supported by many of the women leaders of Tarawa and other islands. Because it is not related to any denomination, it is able to bring together women from different church groups. AMAK has supported the training of a number of leaders who now have the skills to help AMAK undertake some of its projects. As an indigenous organization, AMAK is in a good position to promote the maintenance of various aspects of Gilbertese culture.

Finally, we believe that our experiences in the Philippines, where we have been concentrating on getting mothers to feed babies better using food available in the community, is germane to the situation in Kiribati. In their second semester and second year of life, I-Kiribati children do not do as well as in the first six months. Mothers can be induced to make better use of local foods and their improved feeding habits could be strengthened by reinforcement techniques of various sorts. Similar strategies could be used to promote acceptance and maintenance of family planning practices. We improved diets and we improved contraceptive practices in the Philippines, adaptations of these methods could well be considered in Kiribati where such procedures are well within the capabilities of AMAK.

Since the Women's Groups function on a somewhat informal basis working with small groups, there seems to be little reason to develop extensive

educational materials. A few posters, concentrating on a single concept, that could be displayed in the community to reinforce the information emphasized in working groups would seem appropriate. The AMAK workers should be encouraged to select a relatively small number of objectives and concentrate on these in relatively short sessions rather than tackle many problems in lengthy sessions as they appeared to be doing. Help in developing effective communication skills appears to be more needed than educational materials per se. Perhaps more important, workers should be encouraged to adopt an experimental approach using techniques congenial to Kiribati traditions rather than bringing in techniques used in other countries.

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Appendix A. Consultants and Informants

1. University Park, PA

Brian Riordan, Foundation for Peoples South Pacific, New York
 Gloria Renda, Foundation for Peoples South Pacific, Suva, Fiji

2. Washington, D.C.

Dr. Anne-Marie Sacht, Atoll Research Smithsonian Institution

3. Honolulu, Hawaii

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 Dr. N. Wenkam, Dept. of Nutrition and Food Science, Univ. of Hawaii
 Dr. Terrance Rogers, Dean Medical School, Univ. of Hawaii
 Dr. Ewing Soetjahja, WHO, Country Liaison Officer, Kiribati
 Dr. Nancy Lewis, Dept. of Geography, Univ. of Hawaii
 Dr. Nancy Rody, Dept. of Science, Univ. of Hawaii
 Dr. Peter Hammitt, Pacific Island Development Program, East-West Center
 Dr. Jean Hankin, Nutritionist, School of Public Health, Univ. of Hawaii

Bueri Eritaia, Minister of Cultural Affairs, Kiribati
 Dr. Ward Goodenough, Dept. of Anthropology, Univ. of Pennsylvania
 Dr. Fay Ala ilima, Economist/Educator, Hawaii/Samoa
 Val Ala ilima, Samoan Chief
 Dr. Leonard Mason, Dept. of Anthropology, Univ. of Hawaii
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4. Tarawa

Dr. Marten Busk, District Medical Officer, Beru
 Richard Avery, Chief Librarian, Tarawa National Library
 Atanroae, Barteke, Roaming Ambassador, Secretary of Foreign Affairs
 Claire Barteke, President of Women's Federation

Kathy Nast, Field Director Foundation People's South Pacific
 Cathy Comey, Community Nurse AMAI (Women's Organization)
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 Anaueva Eritaia, Nutrition Field Worker
 Mr. John Pitchford, Formerly Health Educator
 Mr. Eric Bailey, In charge of 1978 Census
 Dr. Tawito Tira, Secretary of Health
 Miss Rosito Tite, Chief Nursing Tarawa Hospital
 Miss Vickey Hess, WHO, Consultant
 Mr. Nakibae Teuatazo, Secretary Home Affairs and Decentralization
 Mr. Nanimatang Karova, Senior Community Affairs Officer
 Bruce Buriti, Dept. of Agriculture, Chairman Nutrition Board
 Dr. Rui Williams, Chief Agricultural Officer, Dept. of Agriculture
 Dr. Gordon Groves, Atoll Research Institute
 Dr. Joseph Cobb, Physician Tarawa Hospital, Pediatrics
 Dr. Anthony Daniels, Psychiatrist, Tarawa Hospital
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Mary Chaire Marriott, Home Economist Women's Organization
Dr. Susan Turner, Family Health Physician, Tarawa Hospital
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Derrick Rendle, Chief Livestock Officer
Kenneth Baer, Director, Save the Children's Fund

5. Abemana:

Dr. Anthony Franks, District Health Officer, Abemama
Ms. Cindy Jurgison, Peace Corps Volunteer, Abemama
Father Joseph, Catholic Mission, Abemama

6. Dr. Robert Hagenmeier, Food Scientist, Philippines

Appendix B. Selected Characteristics of Living Conditions in Kiribati*

	% Households			
	All Kiribati	Abemama	Tarawa	Betio
Electric lights	22	10	45	65
Cooking - wood fire	72	95	52	36
electricity	5	---	---	6
Water - well	65	78	46	15
rain	12	---	19	28
Sanitation - zone	50	33	75	78
Refrigerator or freezer	9	2	17	32
Persons/acre		.35	4.6	20.1
Households with >40 sq. ft./person	74	33	75	78

*From 1978 census

Appendix C. The Environment of an Atoll

It is estimated that atolls of the Western Pacific, such as Kiribati and the Marshall Islands, have been inhabited for at least two thousand years. Evidence is difficult to find because of the structure of the islands, but it does include carbon dating of campfire remains on Majuro in the Marshalls. This means that inhabitants were able to find enough food on land and in the sea to support themselves long before Western traders arrived. But that food is limited in amount and especially in variety, as a description of an atoll will make clear. Over unrecorded centuries populations were stabilized by the ravages of droughts, infrequent storms and interisland warfare.

An atoll is an unusual landform to most people who have lived in North America and Western Europe but one that appears commonly in varying sizes in the Western Pacific in areas close enough to the equator to promote coral growth. We shall describe Tarawa, one of about 16 atolls that make up the Republic of Kiribati (pronounced Kiri boss), known until independence in 1979 as the Gilbert Islands. Tarawa atoll, a thin strip of land shaped like a C or an L (backwards), is some 50 miles in length but only 100 to 500 yards wide in most places. This narrow strip partially encloses a shallow lagoon of more or less 150 square miles. The entire island is surrounded by a living coral reef that is just at sea level when the four-foot tide is at its lowest point. The edge of the reef, a half mile to two miles from shore, is clearly marked by the breaking waves from the open sea. It is now believed that atolls were formed when volcanoes rose above the sea, developed fringing reefs and then sank or were eroded leaving the growing reef that once surrounded them. Support for this theory emerged when volcanic rock was found at three to four thousand feet in drilling done at Kwajalein and Eniwetok atolls.

Papaya trees will grow well, especially on the edge of pits, but papaya is defined as baby food and not taken by many after the age of two years. We understand that there is a policy against bringing in exotic plants so that few other fruits are available other than a few citrus being grown experimentally, at least in Central Kiribati. Nutritionally few if any could match papaya.

The major vegetable throughout Tarawa is the pumpkin that can be encouraged to grow under light shade as well as direct sunlight. This is an important source of Vitamin A.

The sea is the other major source of food. Fish are taken by nets along the shore of the lagoon and in the shallow waters over the reef on the ocean side. Larger fish are taken in the lagoon on handlines from men in boats. There are also stone fish weirs on the reef. At low tide women and children gather shellfish on the exposed floor of the lagoon. Larger fish are taken beyond the reef in the open sea, but this involves heavier equipment and greater danger from the waves and from sharks. It is difficult to assess how much fish is consumed by a typical family. The supply depends on whether men have the equipment and the time to fish and on whether tides and weather permit. By and large, fishing is a family affair; there are few full time fishermen, except in Betio. There is an informal sale and exchange of fish among and within extended families but only a very limited dispersal of fish through markets. Certain varieties of fish are subject to a disease, ciguetera, in which a neurotoxin causes a painful reversal of hot and cold sensations, muscle pains, diarrhea and other unpleasant symptoms in human beings. Island residents believe that they can identify affected fish and may avoid them but they do not otherwise restrict the use of fish except for young infants. The central hospital reports treating 2 to 3 new cases of ciguetera each week. Undoubtedly many more are not treated medically.

The thin ribbon of land, two thirds of the way around a central lagoon, that is Tarawa, is broken in many places by passages through which the tide rushes twice each day in each direction. In South Tarawa several islets are joined by causeways and the last islet at the end of the chain, Betio, is linked by a one hour ferry ride. Betio is important because it is the only islet where it has been possible to build a pier for oceangoing vessels. At the other end of the connected string of islets is Bonriki Airport whose runway can accommodate large commercial jet aircraft. These conditions have led to a concentration in South Tarawa of the governmental and commercial activities of the republic. North Tarawa, the continuation of islets, is separated by passages too wide and deep to cross except by boat and is quite isolated from the population center even though it may be visible from many points along the shore.

One hears the expressions "high islands" and "low islands." Hawaii, Samoa and Tahiti, whose profiles are familiar from tourist brochures, are high islands, raised by volcanic eruptions over untold centuries and, in some cases, still growing. Atolls are low islands; Tarawa's highest point may be ten feet above high tide. Soils are also very different. That of Tarawa is coral sand with very limited organic material from rotting vegetation. This structure limits the water supply which consists of a few feet of water on the top of a deeper underground supply of salty sea water. Rain drains immediately through the sand to the water table or lens with the result that the soil is dry much of the time in spite of up to 80 to 120 inches of rain per year. In some parts, soil fertility and frequent intervals of dryness make it difficult to grow vegetables and fruit trees.

A very small number of different plant forms are indigenous to this ecosystem. Of nutritional significance are coconut and breadfruit trees and

the pandanus palm. In addition, but of no significance as food, are low sea grape and mangrove trees near the shore. The coconuts have been cultivated intensively to produce copra, the principal export and a major component of the islanders' diet. In addition to the meat of mature nuts with which most of us are familiar which is a source of coconut milk and oil, the soft white flesh of immature nuts is used as a food for babies. Furthermore, by cutting the tip of the blossom structure of the coconut it is possible to collect a sap called toddy. Certain trees of intermediate height and sturdy trunks are set aside for toddy because shaving the tip of the blossom twice each day destroys current fruiting. Parenthetically, an outsider cannot but be fascinated by the skill with which older boys and men climb the trees twice each day to get a little more than a pint of toddy from the two or three taps in each tree. The whole performance is enhanced by the fact that toddy cutters sing or whistle as they work. Very little toddy is permitted to ferment to become an alcoholic drink as is the case of tuba in the Philippines.

In centuries past a solution to dryness was developed in which the people dug large pits six to ten feet in depth to a point just above the fresh water level. Giant swamp taro or babai, a starchy root, is grown in these pits. More recently the islanders have added bananas and other plants to this pit culture.

The pandanus palm, sometimes called a pineapple tree, grows near houses, near babai pits or near the sea. The fruit contains a sweet starchy substance that can be eaten raw or can be boiled, dried and stored. It seems most unlikely that pandanus ever supplied more than a confection and no significant portion of the food of islanders' families. Quite the converse is true of the great spreading breadfruit trees whose seasonal starchy fruits in fried or boiled form are still an important component of the diet.

Domestic animals are limited to chickens and pigs. The government agricultural program has found breeds of chicken that survive well foraging around houses and under coconut trees. Islanders supplement chickens' diets by breaking mature coconuts for them and offering table scraps. Few eggs are found; as soon as a hen has laid a dozen she becomes broody, sets and hatches six to ten chicks. Pigs are kept in pens and given coconut, table scraps, forage gathered by adults and children, and often some imported commercial hog feed. Both chickens and pigs are eaten on special occasions with few finding their way into the very limited commercial channels for local foods.

The Department of Agriculture has an active research unit near Bonriki Airport that supplies 6 to 8 week old chickens not only to South Tarawa but to other islands as well. Similarly, they have been selecting and developing strains of hogs that do well under the conditions of rural Kiribati. With respect to both chickens and hogs the department has been experimenting with local foods including copra meal and various forms of fish and fish by-products as extenders of imported chicken and hog feed. Preliminary results suggest that as much as one half of rations can be produced locally without sacrificing weight gain or meat quality. In addition to being high in cost, imported animal feeds are difficult to ship to outer islands, the result of an unsatisfactory interisland shipping situation to be discussed below.

There are rather marked differences in the ecology of the northern and southern Gilberts. Butaritari, several hundred miles north of the equator, with heavy rainfall can support the culture of bananas and vegetables of the humid tropics such as cabbages. On the other hand, Beru, an equal distance south of the equator, is too dry for many plants other than coconuts and breadfruit, at least with current cultivation practices. Important experimental work with various plants and varieties, combined with

fertilization, composting, and watering, is being carried out by the Department of Agriculture under the direction of Bruce Buriti and by Ken Baer of Save the Children Foundation. They have been able to produce good crops of such nutritionally valuable vegetables, as tomatoes, and squash and also cucumbers.

A major impediment to agriculture is the infertility, alkalinity and deficiency in some trace elements of the soil. Iron, for instance, is so lacking that many coconut fronds have a yellow tinge. I-Kiribati and expatriate researchers are working on methods of providing trace elements to coconuts and other plants and on improving fertility through mulching and the use of nitrogen-fixing plants.

In addition to locally produced foods, the people of Kiribati are quite dependent on imported rice, wheat flour, sugar and salt. They have also acquired a taste for canned fish, beef, and pork and canned fruits. Most of these foods are from Australia. In South Tarawa, there are a half dozen stores that are modeled after Western supermarkets complete with frozen food sections, imported wines, and soft drinks. But much more numerous are roadside stores that carry canned fish, corned beef, beef drippings, canned and dried milk in various forms, sugar, rice, flour, soap and canned fruit, especially pineapple.

It must be pointed out that these stores sell virtually no local foods⁴ such as coconut, breadfruit, or fish. Locally made bread products are usually available. These merchandizing patterns reflect persistence of the habits of a subsistence economy in which each family owns a strip of land across the island from the lagoon to the ocean. Each family produces its own coconuts and breadfruit and the thought of selling them to neighbors is the equivalent of begging. The system worked well until there was an influx, especially into Betio, of people seeking employment. Removed from family and neighborhood connections, these squatters and renters had to adopt in large part diets of

imported foods. There are vegetable and fish sales facilities but they seem to be patronized by few citizens. Any program designed to improve diets through greater use of local foods would need to take into account and improve the distribution and sale of fish, coconuts, breadfruit, pumpkins and papaya.

The diets and growth of infants, that was the focus of our visit, are affected by many factors. Having presented the foregoing material, we can now list some of those factors and relate them to the ecology, the social traditions and the economy of Kiribati.

1. Infants grow very well for at least the first six months supported by mothers' milk. Because the mothers enter pregnancy with good fat reserves and gain well during pregnancy, they are able to support good lactation. They report few worries or rituals concerned with assuring milk production that is adequate in amount and in quality. These conditions prevail also on Abemama where mothers are much more dependent on traditional foods than is the case on Tarawa.

Breastfeeding is extended, especially on the outer islands, often well into the next pregnancy. The government supports breastfeeding by giving nursing mothers time off in mid-morning and mid-afternoon to feed their babies. Appropriate milk substitutes are available in the form of evaporated and powdered milk, as well as infant formula in many of the larger stores. These entail the risks of dirty water, poorly cleaned bottles and excessive dilution that occur elsewhere. Attempts to limit the sale of feeding bottles have had little impact. Unfortunately, sweetened condensed milk, with its 60 percent sugar, is also used, inappropriately, as an infant food, diluted 7:1 so that it is of little nutrient value. Less diluted, it would still be mostly sugar but it bears the name milk and it is white. This occurs despite the fact that the

label says that it is not suitable for use with children under 12 months of age.

2. Pure water is a serious concern on all islands. A sewage system under construction may improve the situation in South Tarawa. But there and elsewhere there is the problem of a tenuous water supply with questionable *E. coli* counts, and exposed to a great deal of fecal contamination. It has proven difficult to get families to always boil all water that is offered to infants, both water by itself and in conjunction with other food. One solution to the water problem is the use of cisterns that hold rain water from galvanized iron roofs or the new roofs being developed of cement slates. The Technical Training Institute and Save the Children have also developed inexpensive cement cisterns. With 100 inches of rain per year, a relatively small roof area collects a great deal of water.

3. The inter-island transportation system faces many logistical and economic problems and fails in turn to provide transportation for vitamin A and vitamin C rich foods that can be produced on wetter islands such as Butaritari. Shipment by air is costly, shipping by sea is made difficult by the considerable distances involved, by high costs of fuel and by the fact that atolls virtually preclude harbors and piers, forcing lightering by canoe and barge. Limitations of transportation also inhibit movement of chickens, pigs and animal feed from South Tarawa to other islands. Just-hatched chicks can be sent by air, but a 100 lb. pig is a poor passenger.

4. As we have implied at several points, the migration to South Tarawa, especially Betio, has led to a breakdown of the traditional food distribution procedures within extended families in which different members took responsibility for fishing, cutting toddy, gathering coconuts, breadfruit and shellfish, and caring for pumpkins and other vegetables. The migrants have

left their ancestral land holdings and are almost totally dependent on a cash economy in which they are obliged to buy more expensive imported foods because marketing mechanisms are not well enough developed to handle the real and potential surplus of fish, coconuts, and breadfruit that lies just a few miles or an island away.

The use of imported foods such as rice and canned mackerel to replace the indigenous foods such as breadfruit and fresh fish will seldom result directly in a nutritionally inferior diet. They are often used because they are more convenient. Unfortunately, they are usually more costly with the result that less food and hence fewer nutrients are available to the family with limited resources.

On the other hand, the traditional diet of coconuts, rice and fish can be extremely monotonous if one has experienced the more varied tastes and textures of imported foods. Just as people from rural areas all over the world find it difficult or impossible to return to the farm once they have come to enjoy the variety and action of the city, so people become accustomed to the varied flavors of commercial products, finding it difficult to return to a simpler fare that requires more preparation that is characteristic of traditional diets.

5. Kiribati and almost all other nations in the Western Pacific are dependent on the export of copra or coconut oil as a source of foreign exchange. For many groups of islands copra is the only source of outside money. In recent years, and especially as of 1983, the world price of copra has sunk to very low levels, from 70 cents to 10 cents a pound. Furthermore, there is strong reason to fear that coconut oil will be permanently replaced on world markets by less saturated vegetable oils of lower cost. The full impact of this catastrophe has been avoided, or more likely merely delayed, by a system of government

subsidies. These, in turn, are dependent on continuing support from the United Kingdom in the case of Kiribati. The implication is that Kiribati consider steps that would make maximum use of local foods for infants and children because imported foods may become unaffordable.

6. The geographic isolation of Kiribati and the fact that imported rice and flour must pass through Betio is in one respect an asset. The single port of entry makes it feasible for the government, if it chooses to do so, to require that imported foods be enriched with those vitamins and trace elements that are deficient in the local diet. This may be a cost-effective method of dealing with many of the deficiencies.

7. Observations during a two-week stay must inevitably be superficial and subject to error. This is especially so if one attempts to make comments on the social traditions. There is one pattern, however, that appears elsewhere in the world as well, that should be mentioned. At mealtime, the men, guests, and older women and infants are fed first, followed by adult women, adolescents and children. As a result of this practice, many of the choice foods and often those of most nutritional significance are consumed early in the meal and the young children are left the starchy, less preferred, but filling foods. In any program to improve diets of infants and young children, attention should be paid to this pattern of behavior and consideration might be given to designate as "children's food," such food as papaya that is now called "baby food."

8. If an attempt is made to get mothers to make better use of local foods to enhance weaning diets consideration should be given to using some system of reinforcement such as we have used in the Philippines (Guthrie, et al., 1982) to help mothers maintain high levels of improved practices. In the Philippines babies grew better when mothers were reinforced with such items as T-shirts or a Kodacolor print of the baby if the mother improved the baby's diet and

obtained a good weight gain each month. Knowledge of good practices, by itself, did not produce improved growth.

9. The ecology and problems of Kiribati are similar to those of dozens of other atoll communities. A major difference from one to another, even within Kiribati, is the annual rainfall. Given the overall similarities, much can be gained from the exchange of information among atolls. Efforts by such organizations as the South Pacific Commission and the University of the South Pacific in Fiji should be encouraged.

10. The problem of the numbers of children cannot be separated from their health and growth. Kiribati has experienced rapid population growth in the past so that major resettlement schemes have been undertaken. Current techniques of limiting the number of children are widely accepted throughout the world in both rich and poor countries. At the current rate of growth the population in Kiribati will double in 25 to 30 years. The welfare of children born in the coming decade is in jeopardy unless that rate of growth can be markedly reduced. The resources of food and water and the funds to import rice, flour, sugar, and salt will be severely stressed by a continued rapid increase in the number of people to feed.

11. The people of Kiribati and the citizens of other atoll republics have evolved over the years a remarkable accommodation to the resources and demands of the environment. First contacts with outsiders brought diseases for which they had little resistance. More recent contacts have led to a desire and a need for processed foods, transportation and fuel, manufactured goods and alcohol. The impact of each and all of these goods is complex and not always beneficial. The people of Kiribati face a new version of the age-old problem

of adjusting to a new environment. The old, unrecorded conquest of the atoll took centuries, the current transition must be accomplished in a few years or decades.