SOUTH PACIFIC COMMISSION

PRELIMINARY INVESTIGATION INTO THE RELATIONSHIP BETWEEN DIET AND DIABETES ON TARAWA, GILBERT ISLANDS

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FEASIBILITY STUDY, TARAWA, GILBERT ISLANDS

INTRODUCTION

Western influence has significantly changed the traditional dietary habits of many Pacific Islanders (1). With the change from a subsistence to a cash economy, imported foods have progressively replaced locally grown foods in the family diet. As a result, the overall nutritional and health status of these people appears to have been affected (1-5, 13).

Dietary studies (1) state that a correlation may exist between diabetes and the adoption of western-style eating habits in the Pacific. Other reports (3-6) have shown that some urbanized Polynesian and Micronesian populations display a high prevalence rate for diabetes while Melanesians maintain a low prevalence rate despite similar cultural changes. It has been suggested that Micronesians and Polynesians possess a genetic predisposition to a latent form of diabetes which becomes apparent when western influence alters the traditional lifestyle (1).

To try and substantiate this theory it was proposed by Dr Paul Zimmet (diabetes specialist, Southern Memoral Hospital, Victoria, Australia) to conduct a diabetes survey on another Micronesian population. The Gilbert Islands were selected as the survey area as the majority of its inhabitants are of Micronesian descent and the urban dwellers have been exposed to western influence for a long period of time.

A preliminary visit was arranged between 24th and 29th October 1977. The aims of this visit were

1. to determine the feasibility of conducting a diabetes survey in the Gilbert Islands;
2. to study the Gilbertese food habits in an urban area.

The team included Dr Paul Zimmet, Professor Tony Linnane, Chairman of the Biochemistry Department, Monash University, Victoria, and Jill Thompson, Public Health Dietitian, South Pacific Commission, Noumea.

The survey was based on the capital island of Tarawa (see map attached), the administrative and commercial centre of the Gilbert Islands.

Dietary habits were observed in the urban towns of Betio and Bikenibeu. A daily food intake was recorded from a total of 16 families - eight from Betio and eight from Bikenibeu. Owing to the limited time available a full dietary analysis could not be obtained. However meal patterns were comparable in each household and a general food intake was drawn up.

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GENERAL BACKGROUND

The Gilbert Islands extend as a chain of 16 coral atolls and reef islands across the Central Pacific. Tarawa atoll is composed of a series of islets enclosing a central lagoon. The islets are narrow and frequently very long. They extend over approximately 64 kilometres and cover an area of 920 hectares. The main export of the Gilbert Islands are phosphate and copra. Together they account for 99% of export earnings (7). The active labour force in 1973 was 17,596 out of 28,522 inhabitants over 15 years of age.

Before analysing the dietary habits of the Gilbertese it is necessary to highlight some of the problems they face in growing food.

1. Temperature and Rainfall

The Gilbert Islands experience regular high temperatures of 27°C (80°F). The islands lie in a dry belt and are subject to periodic variations in rainfall. Prolonged lack of rain often results in severe droughts which have been known to last for several years. Livestock and certain vegetation (babai, banana and breadfruit) rely on the continuous availability of fresh water and will die during periods of drought (8, 14).

2. Dispersion of Land

The Gilbert Islands occupy an area of approximately 5 million square miles and of this 684 square miles are land and the rest is ocean. The islands are widely dispersed making transport and communication difficult. Tarawa occupies an area of only 2023 hectars which are scattered over 20 different islets. Agricultural land is therefore scarce.

3. Land Tenure

The population density in urban areas is very high (see Table 1) and agricultural land is being continuously relinquished for commercial and private development (7, 8, 9).

TABLE 1

Population Density in Rural and Urban Tarawa (1973)+

Tarawa	Population	% Total Population	Person/square km
(a) Rural	2,368	3.92	154
(b) Urban	2,251	14.68	1,172
(i) Betio	6,382	11.04	5,057
(ii) Bikenibeu	2,878	5.59	NA
Gilbert Islands (1973)	51,500	-	-
Gilbert Islands (1977)	53,500	-	-

+ Population Census 1973 Provisional Report
NA: Not available.

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Excessive subdivision has resulted from the customary "inheritance law" which entitles each child to a share of his partents' land. This has caused widespread land fragmentation both on and between islands. Consequently agricultural output is low and continuing to decline.

4. Soil

The coral rock of the atolls is covered with a thin layer of sand and a scanty layer of topsoil. The soil is derived almost entirely from sediment composed calcium carbonate which supports a very restricted range of plant growth. This also limits the amount of livestock that can be maintained. Consequently a heavy reliance is placed on seafood to supply the bulk of the protein requirements.

5. Migration

Migration of the workforce to other islands has contributed to the lack of agricultural development. Thousands of young Gilbertese have moved from outer islands to urban Tarawa seeking work with the Government or with private companies (7). Emmigration to islands outside the Gilberts (Solomons, Nauru and the New Hebrides in particular) has also reduced the rural labour force. However the new emmigration laws have made this more difficult.

DIETARY HABITS

Traditionally the Gilbertese have lived on fish and coconuts supplemented with the foodplants babai and breadfruit. Fishing is a major family occupation in the Gilberts and locally caught fish and shellfish provide the major source of dietary protein. Even in urban Tarawa where working families are restricted to night or weekend fishing, or buying fish (10) seafood is eaten as frequently as in rural areas (12). Turtle, octopus, seabirds and their eggs are also eaten on occasions.

Other animal foods are restricted in both variety and number because of poor grazing conditions. The small numbers of pigs and chickens owned by some families are usually saved for special occasions.

Plant growth is also restricted on the majority of atolls. Lack of fresh water, iron and organic materials and excess calcium carbonate all place limitations on the variety of potential foodcrops (8) while the small landmass, its dispersion and an inadequate rural workforce impose restrictions on the quantities produced (9).

Coconut palms can grow almost anywhere and are found throughout the Gilbert Islands. Coconut is eaten in a variety of forms and toddy, the sap collected from the flowering coconut is drunk. The other main foodplants, babai and breadfruit constitute the staple food on some islands, although babai is usually reserved for festive occasions. On Tarawa small numbers of breadfruit trees grow naturally on the lagoon side and within the villages while babai must be cultivated in carefully prepared pits. (5).

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Food plants of secondary importance include tebero, pandanus, pumpkin, pawpaw, teboi, banana, fig, sweet potato and sugar cane (11). Edible green leaves (pumpkin tips, babai leaves, etc.) have a low prestige value and are rarely eaten despite their high nutritional value. However a few varieties (teboi, te mtea) are eaten during periods of famine. European settlement has created a demand for vegetables such as tomatoes, beans, cabbage, lettuce, etc. which are available in limited quantities.

Imported foods, make a significant contribution to the Gilbertese food intake particularly in the urban areas and are gradually replacing the use of locally grown products (10). (See Table II and III). Exports of phosphate and copra together with local employment in commercial firms and Government has increased the money available for purchasing imported foods, particularly on Tarawa. The most popular items include rice, flour, sugar, tinned meat and fish, beer, soft drinks and chewing gum.

Table II compares the family consumption of some imported food in urban Betio and Maiana, an island lying 20 miles South of Tarawa (13).

TABLE II

The weekly per capita consumption of some imported foods on Betio and Maiana

	Maiana 1953	Maiana 1968	Betio 1968
Flour (gms)	403	562	810
Rice (gms)	335	476	725
Sugar (gms)	326	512	743
Milk (gms)	10	1	68
Tinned meat (gms)	50	9	32
Tinned fish (gms)	14	23	86

Table III compares the family consumption of particular foods in Maiana and Betio (13).

TABLE III

Percentage of families consuming particular foods in Maiana and Betio

	Maiana 1953	Maiana 1968	Betio 1968
Bread (pudding, etc.)	40	9	41
Biscuits	-	28	15
Rice	30	47	52
Sugar	10	16	;
Taro	60	34	0
Breadfruit	60	41	40
Coconut	100	38	11
Kamaimai[+]	75	3	0
Toddy	95	94	48

[+]the concentrated sap of coconut palm toddy.

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Details from Table III were obtained from Wholesale Society orders. As much of the flour on Maiana remained unsold the figure may not reflect a true picture of the consumption.

Table IV compares the percentage daily food intake supplied by local and purchased food in Maiana and Betio in 1968 (10).

TABLE IV

	Calories from Imported Food	Total Calories from Imported Food	Total Calories from Local Food
Maiana	814	29.1%	71.0%
Betio	1,197	43.0%	57.0%

Table V (see next page) compares the percentage weights of imported foodstuffs from different centres in the Pacific.

Of these imported foods tinned meat and fish can provide a valuable source of protein. However the protein content varies significantly between manufacturers, especially for canned meats. Rice and flour also contribute some protein but the refining process removes the majority of vitamins and minerals. Fibre is also lost during processing and the loss of bulk increases total consumption and energy absorbtion rates of these foods (22).

Table VI compares the nutrients contained in 100 calories of some imported and locally grown foods (14).

TABLE VI

Food	Weight giving 100 calor.	Protein g	Calcium mg	Thiamine ug	Niacin ug	Riboflavin ug	Ascorbic acid mg
White flour	26	2.86	5.4	20	226	8	0
Polished rice	28	1.82	2.5	25	560	8	0
Polished, washed and cooked rice	28	0.56	2.5	5	390	2.8	0
Breadfruit	70	1.05	14.7	96	720	48	14
Taro	70	1.33	16.0	149	424	25	7

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TABLE V

Percentage Weights of Imported Foods from Total Price Index[a]

Country	Centre	Survey year	Cereal			Sugar	Canned meat	Canned fish	Soft drinks & cordials	Alcoholic[c] drinks
			Rice	Flour	All others[b]					
GILBERTS	TARAWA	1970	8.0	3.0	4.0	3.0	5.0	1.8	2.4	8.0
		1975	8.6	- 10.1 -		5.1	3.3	1.8	1.0	9.8
SOLOMONS	HONIARA	1977	8.5	0.3	6.2	2.5	3.0	4.0	1.0	5.0
NEW CALEDONIA	NOUMEA	*	1.6	0.4	4.1	1.2	1.65	0.5	1.7	4.2
FIJI	CENTRAL TOWNS	1974	2.0	2.1	2.6	0.6	0.2	1.4	0.2	4.7
	WESTERN TOWNS	1974	3.2	2.6	2.2	0.5	0.2	0.8	0.4	5.4
PNG	PORT MORESBY	*	13.0	1.6	6.2	4.2	8.9	5.4	2.3	6.3
W. SAMOA	APIA	1973	3.1	1.6	6.5	3.2	0.9	1.9	0.3	1.5
GUAM	GUAM	1972	-	8.3 -		0.7	NA	NA	NA	0.8
COOKS	RAROTONGA	1967	1.0	0.7	9.4	2.2	10.3	4.8	0.7	2.1

NA - figures are not available. * Indicates current index weights but no survey year known

(a) figures obtained from SPC Statistican 1978. (b) includes bread, cakes, biscuits etc. (c) includes kava, yagona, etc.

Most of the other popular imported foods have a high content of refined carbohydrate and contribute little more than calories to the dietary intake. Table VII compares the nutrient content of sugar and toddy.

TABLE VII

Level of Nutrient per 100 gm

Food	Calories	Protein	Fat	Carbo-hydrate	Calcium	Iron	Thiamine	Ribo-flavin	Niacin	Ascorbic acid
		g	g	g	mg	mg	mg	mg	mg	mg
Sugar	390	0	0	99.9	2	0.1	0	0	0	0
Toddy (concentrated)	272	0.8	trace	69	5	13	0.024	0.012	2.0	58.8

It can be seen from Tables VI and VII that the majority of locally grown foods have a far superior nutritional content than the imported carbohydrate foods.

RESULTS

After conducting a brief dietary survey on 16 Gilbertese families in Betio and Bikenibeu a generalised meal pattern was drawn up.

Breakfast - 2-3 thick slices bread with/without butter or pancakes/doughnuts/kabai(a)
(b) Tea, coffee or kamaimai

Lunch - Fresh fish or shellfish (c)(d)
Grated coconut
Rice or bread or breadfruit (e)
Tea, coffee, kamaimai or toddy (f)

Dinner - Similar to either breakfast or lunch.

Snacks eaten frequently during the day include raw pandanus, chewing gum, and biscuits while beverages include sweetened tea, soft drinks or beer.

(a) a boiled dough mixture made from flour, water, coconut cream and toddy;

(b) tea and coffee are often made with concentrated toddy to which additional sugar and evaporated milk or sweetened condensed milk is added;

(c) fresh fish is baked, grilled, fried or stewed in coconut milk and shellfish are eaten raw, boiled or baked;

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(d) tinned meat or fish may replace fresh fish once or twice a week generally at weekends. In 1977 the average weekly consumption rate of canned fish on South Tarawa was 0.4 tins/head of population;

(e) breadfruit is grilled, baked or fried. Occasionally breadfruit pulp is mixed with coconut and kamaimai and then boiled or baked to make a pudding;

(f) tea and coffee are consumed more frequently than kamaimai or toddy.

The actual quantities consumed by each family were difficult to determine accurately. An interpreter had to be used and time available for the interviews was limited. As a result only an approximate analysis could be obtained. The results however do show a calorie intake in excess of the recommended allowance with a high contribution coming from imported foods.

	Protein (gm)	Calories	Total calories from imported foods
Survey group	65	3000-3500	40-50%
Reference Female (14)	35	2050	
Reference Male (14)	39	2900	

SUMMARY

With the rapid change in lifestyle in the urban settlements of the Gilbert Islands, a subsistence way of life is no longer possible. Regular employment has reduced the time available for farming and fishing and increased the family income. There has been an associated increase in the consumption of imported foods and decrease in the consumption of locally grown foods. The imported foods are held in high regard by the Gilbertese who justify the high prices charged by their ready availability and easy preparation. Highly refined carbohydrate foods are particularly popular despite their poor nutritional content. The introduction of cars, buses and motor bikes on Tarawa has led to a reduction in physical activity. No obesity studies have been carried out in the Gilbert Islands but many of the Gilbertese in urban Tarawa appear to be overweight.

These changes have already occurred in both Nauru and Tuvalu (1,3) and obesity in particular is prevalent. Obesity has been frequently claimed a feature of the Polynesians and Melanesians but a progressive increase in consumption of imported foods (espacially refined carbohydrate foods) and a reduction in physical activity are believed to be responsible for the high degree seen on these two islands (1, 11). Diabetes is also prevalent and reports (1, 6) have suggested that the occurrence of diabetes in a genetically susceptible race may be related to obesity. A change from a high fibre to a low fibre diet has also been implicated (17).

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In view of the similarities that exist between the Gilbert Islands, Nauru and Tuvalu a diabetes survey in the Gilberts does seem warranted.

RECOMMENDATIONS

Regardless of the results from the diabetes survey, continued nutrition education is needed in the Gilbert Islands. Besides the progressive increase in the consumption of imported foods, childhood malnutrition and vitamin and mineral deficiencies are still apparent (10, 12, 13, 20).

Presently, in relation to other medical problems in the Gilberts, diabetes detection does not have a high priority. If a high prevalence rate of diabetes was found, treatment would impose a considerable financial burden on the country and a strain on the medical time and facilities available for its surveillance. Efforts must therefore be channelled into those areas affording the greatest return in the long term. This would include:

(1) An intensive nutrition and health education campaign in the schools, hospitals, training schools and women's clubs.

(2) Expansion of the agricultural programme to increase the production of viable food plants. This would stimulate the consumption of local foods while simultaneously boosting the home economy.

(3) Recommendations regulating food importation.

The accumulated effect from these programmes may not be felt immediately but could ultimately help to improve the dietary habits of the Gilbertese. Action has already commenced in some areas where central bodies have become aware of the nutritional problems associated with westernization.

(a) The wholesale food company in Betio which supplies Co-operative stores throughout the Gilberts has been buying products from the outer islands to sell in the urban areas. Government authorities have allowed free transportation of these goods anywhere within the island group. Local produce is now sold at three markets on Tarawa including one at Betio and Bikenibeu. Attempts were also made to introduce brown rice but this was not well accepted by the local inhabitants.

(b) The King George V Secondary School in Bikenibeu has incorporated a nutrition and home economics course which extends over six years. Preliminary talks were held during this visit to discuss the content of these classes. The emphasis is placed primarily on the value of local foods and methods of preparation. WHO has also funded a five year skim milk/milk biscuit programme in return for a guarantee that nutrition education will be included in the primary school curriculum.

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(c) The agriculture department is presently trying to stimulate an interest in growing vegetables such as tomatoes, carrots, cabbages, etc. using the chemical hydroponics which acts as a soil substitute. Efforts have also been made to breed pigs and poultry but so far results have been limited.

(d) The women's club organisation based at Bikenibeu hospital employs a group of health workers who have been trained at CETC, Suva, Fiji. They are responsible for teaching general nutrition, health and hygiene to women's groups throughout the Gilbert Islands. However, with only a small group covering a large area, the short time availalbe for each follow-up visit has limited the effectiveness of their work.

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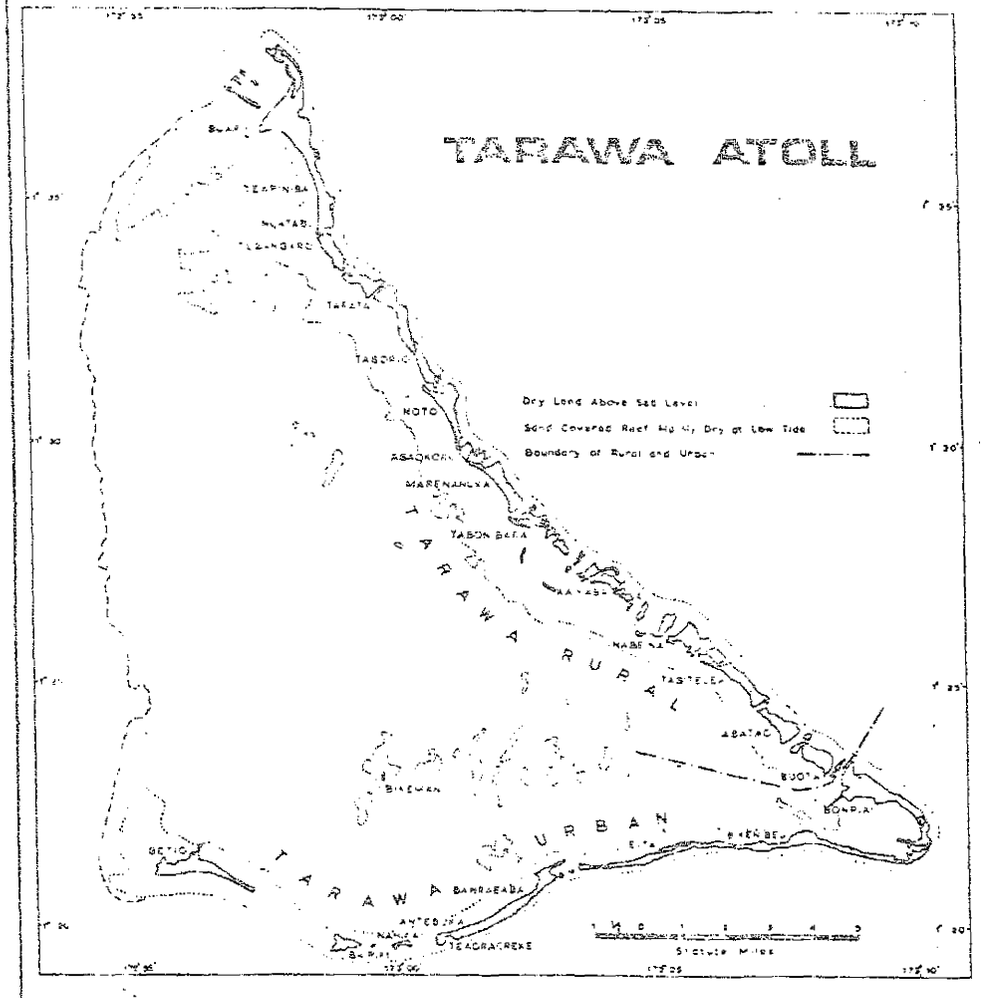
Census Boundaries of TARAWA ATOLL



SOUTH TARAWA
Betio and Urban Tarawa

Approximate Census Boundaries

1 Temakin
2 Temaneku
3 Tetatuki
4 Korontewa
5 Takironga