

Original Article

Dietary trend and diabetes: its association among indigenous Fijians 1952 to 1994

Jimaima V Lako MS

Food and Textiles Department, The University of the South Pacific, Suva, Fiji

The dietary trends of indigenous Fijians have changed drastically in the past 50 years. Deviating from the traditional food consumption pattern and traditional lifestyle may have increased the incidence and prevalence of non-communicable diseases. The aim of this study is to examine the dietary trends of the indigenous Fijians in relation to the prevalence of diabetes from 1952 to 1994. The data used were obtained from the Naduri Nutrition Survey reports of 1952 to 1994, the Fiji National Nutrition Survey reports of 1983 and 1993, and the two diabetes survey reports of 1965 and 1980. Results indicated an increased consumption of introduced foods, which may be associated with an increased prevalence of diabetes. The total energy derived from cereals and sugar increased dramatically with a reduction in consumption of traditional foods. The prevalence of diabetes among the urban indigenous population in 1965 was very low compared to the 1980 figure, while the National Nutrition Survey of the same ethnic group showed a 433% increase of urban diabetes from 1965 to 1993. The hospital diabetes admission cases of 1952 to 1982 also showed an increased trend.

Key words: diabetes, dietary trends, indigenous Fijians, introduced foods, traditional Fijian foods.

Introduction

Diabetes mellitus is one of the most common non-communicable diseases and affects about 3% of the world population.¹ The prevalence rate varies widely between different countries and ethnic groups. For example, the Pima Indians and the Nauruans have the highest prevalence rate of about 40%.^{1–3} In Australia the prevalence rate is 2–3% of Caucasian population and 11% of Aborigines.^{2,4} In Tuvalu the prevalence is about 11%.³ Although genetic predisposition and environmental factors have been established to precipitate diabetes in susceptible individuals studies have also indicated that excessive calorie intake and marked obesity appear to be associated with the prevalence of diabetes.^{2,3}

In Fiji, diabetes is now a serious and increasing problem for the two major races as approximately 15% of the Indo-Fijian and 7% of the indigenous Fijian are affected.² It appears that the spread of western influence has led to marked changes in the lifestyle of the indigenous people, which have resulted in the development of diabetes.

The traditional Fijian diet was extremely varied with a nutritionally sound food pattern of root crops, dark green leaves, fish, seaweeds, shellfish, crabs and assorted seasonal fruits. Food and drinks are social symbols of the Fijian society. Communal feasting and complex customary obligations relating to food remain an integral part of its culture whereby preparation of more than adequate food supply is still very much a norm. These traditional practices interact with modern diet and put alongside a reduction in the level of physical activity, which have played a major role in the excess calorie intake and thus high body mass index (BMI).

The arrival of missionaries, indentured Indian laborers and food aids have undoubtedly been contributing factors in the deterioration of traditional diet.^{5,6} Modernization, changing lifestyles, increased urbanization, westernization

and greater emphasis on cash cropping tend to be media of dietary changes.^{5,6}

Materials and methods

Archival research was conducted to examine the relationship between dietary trends and the prevalence of diabetes from 1952 to 1994.

Dietary data

The dietary data used were obtained from:

1. Longitudinal Surveys in Naduri.^{7–10}

Since 1952, dietary surveys have been conducted approximately every 10 years aimed at determining dietary and life style changes in a rural village (called 'Naduri'). Methods used include actual weighing of all household food intake and measurements of heights and weights of all family members.

2. National Nutrition Surveys.^{11,12}

The two national surveys were conducted in 1980 and 1993. The survey sites were selected from the four divisions (north, east, west and central) which included three rural areas and two urban areas. A total of 2216 indigenous Fijians, 2130 Indians and 260 people of other races were interviewed about their dietary patterns, socioeconomic indicators, household characteristics and determination of anthropometry, biochemical and clinical examinations.

Correspondence address: Jimaima Veisikiaki Lako, Food and Textiles Department, School of Applied Sciences, The University of the South Pacific, Private Mail Bag, Suva, Fiji.
Tel: +679 212 317; Fax: +679 303 413
Email: lako_j@usp.ac.fj
Accepted 4 November 2000

Table 1. Estimated available foods, 1952–94: Naduri Rural Longitudinal Survey

Main food component	Food since 1952	Frequently consumed foods		Declined traditional food 1963–1994
		Common 1952–1994	Introduced 1963–1994	
Carbohydrate				
Root crops	Cassava Plantain Yams Taro Breadfruit Tannia Wild yam Sweet yam	Cassava	Potato	Wild yam Sweet yam Corn Plantain Taro Breadfruit
Cereals	Biscuit Bread Flour Corn	Biscuit Bread Flour Cake	Bun Pancake Rice	
Noodles			Maggie noodles	
Sugar	Sugar	Sugar		
Fats and Oil	Coconut cream	Coconut cream	Dripping Butter Cooking oil Margarine	
Protein	Fresh fish Shellfish Eel Crab Prawns Octopus Canned fish	Fish Canned fish Chicken Canned beef Canned mutton	Beef Egg	Octopus Shellfish Eel Crabs Prawns
Fruits and vegetables	<i>Bele</i> * <i>Rourou</i> † Amaranth Fern Watercress Tomato	Citrus Pawpaw Amaranth Tomato Chinese cabbage English cabbage	Pumpkin Eggplant Carrot Onion	<i>Bele</i> <i>Rourou</i> Watercress Fern
Beverages	Unsweetened lemon leaves, Weak tea with sugar, Coconut juice	Tea	Milk	Unsweetened lemon leaves, Sweetened lemon leaves, Coconut juice
Cooking method	Boil <i>Lovo</i> ‡ Soup	Boil Fry	Curry	<i>Lovo</i>

**Bele*, *Abelmoschus manihot*; †*Rourou*, taro spinach (*colocasia esculenta*); ‡*Lovo* is a traditional cooking method whereby food is cooked on the hot stones, covered with green leaves and buried with soil for at least an hour.

Diabetes mortality and morbidity

Diabetes mortality and morbidity statistics were obtained from:

1. The 1965 Diabetes Survey.¹³

This was the first diabetic survey that aimed at assessing and comparing the types and prevalence of diabetes among the two major races in the country (approximately 1000 adult indigenous Fijians and 1000 adult Indians were included in the survey). The methods used included glycosuria and oral glucose tolerance test.

2. The 1980 Diabetes National Survey reports.¹⁴

A total of 1340 indigenous Fijians and 1298 Indians were surveyed from both rural and urban areas. The methods used included oral glucose tolerance test, anthropometry,

health status, medical history and socioeconomic status.

3. The 1993 National Nutrition Survey.¹²

During the national nutrition survey, subjects were asked if they suffered with diabetes. Their responses were confirmed with hospital records.

4. The 1952–1982 Hospital admission for diabetes.¹⁵

These were the records of diabetic patients who were admitted at the three major hospitals in the country.

Results

Dietary trend

Table 1 shows the trends in the consumption of traditional and introduced foods and drinks from 1952 to 1994. The

1952 rural food consumption pattern in general was based almost entirely on traditional foods whereby root and tree crops, seafoods, fresh water proteins, fruits and vegetables were frequently consumed which provided maximum nutrients. *Cocos nucifera* (coconut) was the major source of fat and there were limited amounts of store foods or so-called 'introduced foods' consumed by families.

Most of the frequently consumed foods from 1963 to 1994 were introduced foods, which include cereals such as bread, biscuits, flour and sugar. The high calorie introduced spreads were butter and margarine and cooking oil as the common frying medium. Consumption of noodles also became very popular. Buns, pancakes, rice or other flour-based products were consumed as additional carbohydrate sources apart from root staples.

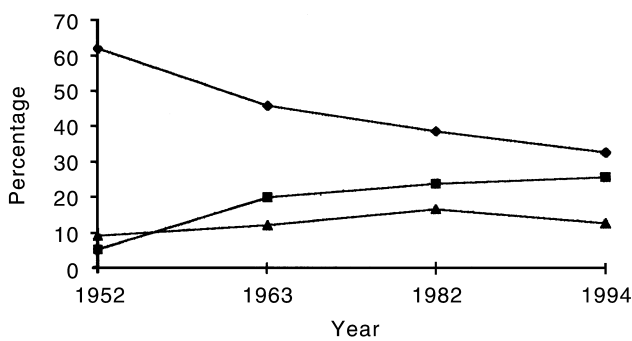


Figure 1. Distribution of energy (%) from major carbohydrate sources. (◆), staple crops; (■), cereals; (▲), sugar. Source: NFNC (1996).

Table 2. Body mass index of adults in Rural Longitudinal Survey (1952–94)

Year	Male BMI level		Female BMI level	
	Mean	Lower and upper limit	Mean	Lower and upper limit
1952	24.30	16.42–25.07	23.76	21.12–36.00
1963	24.56	16.47–30.87	23.36	20.59–37.03
1982	25.45	NA	26.57	NA
1994	25.33	17.73–25.78	26.50	25.48–30.88

Source: FNFNC (1996). NA, not available; BMI, body mass index.

Table 4. Nutritional status (*n* = 2184)

Area Type	Underweight	Healthy weight	Overweight	Obese
	Percentage of males			
Urban	14.4 (<i>n</i> = 26)	51.1 (<i>n</i> = 92)	25.6 (<i>n</i> = 46)	8.9 (<i>n</i> = 16)
Rural	19.3 (<i>n</i> = 72)	57.6 (<i>n</i> = 215)	19.0 (<i>n</i> = 71)	4.0 (<i>n</i> = 15)
	Percentage of females			
Urban	14.0 (<i>n</i> = 33)	36.9 (<i>n</i> = 87)	26.4 (<i>n</i> = 62)	22.9 (<i>n</i> = 54)
Rural	14.2 (<i>n</i> = 57)	39.4 (<i>n</i> = 158)	29.2 (<i>n</i> = 117)	17.2 (<i>n</i> = 69)

Source: FNFNC (1995). Underweight, body mass index (BMI) < 22; Healthy weight, BMI ≥ 22 < 27; Overweight, BMI ≥ 27 < 32; Obese, BMI ≥ 32.

Table 5. Percentage of diabetes mellitus and impaired glucose tolerance for Fijians: 1965, 1980 and 1993

Area Type	1965 DM ⁽¹⁾	1980 DM	1980 IGT ⁽²⁾	1980 DM + IGT	1993 DM (known cases) ⁽³⁾
Urban (%)	0.6	5.4	10.4	15.8	3.2
Rural (%)		1.1	7.1	8.2	1.4

Sources: Cassidy J.T. (1985), Ram P. (1982), NFNC (1995). DM, diabetes mellitus; IGT, impaired glucose tolerance; DM (known cases), hospital confirmed diagnosed cases. 1965 (*n* = 1000), 1980: urban, (*n* = 863) rural, (*n* = 477), 1993: urban, (*n* = 416) rural, (*n* = 778)

The percentage difference in the reduction of traditional staples and the concurrent increase in the consumption of refined carbohydrates and sugars is shown in Fig. 1. It shows that the total energy derived from staple crops dropped from 62 to 33% from 1952 to 1994. Concurrently, the energy derived from sugar and cereals increased. The energy from sugar rose from 9 to 13% from 1952 to 1994, and the energy derived from cereals increased from 5 to 26%. This confirms the evidence of a dietary shift.

Effect of dietary shift

The effect of the dietary shift (Table 2) shows an increase in the mean BMI from 24.3 to 25.3 kg/m² for males and 23.8 to 26.5 kg/m² for females from 1952 to 1994. These exhibit a parallel increase in the total calorific intake (Table 3) and the BMI level. The increase in BMI (Table 2) may be as a result from the increased intake of protein (8–12%), fat (10–18%) and refined cereals accompanied by an increased intake of sugar, which automatically elevated the total calorie intake from 2098 to 2898 kcalories from 1952 to 1994.

Table 4 shows the prevalence of either overweight or obese among females (> 48%) compared to males (> 28%), and shows obesity being more prevalent in the urban community than the rural area.

Trend in diabetes

Table 5 shows the prevalence rate of impaired glucose tolerance and diabetes from three different surveys. Although the different surveys are not distinctly comparable, because of different methods used for diagnosing diabetes, they can be used to show trends.

Table 3. Distribution of energy among major nutrients (1952–94)

Year	Protein (%)	Fat (%)	Carbohydrate (%)	Total calorie (Kcal)
1952	8	10	82	2098
1963	10	13	77	2993
1994	12	18	70	2898

Source: Fiji National Food and Nutrition Committee (1996)

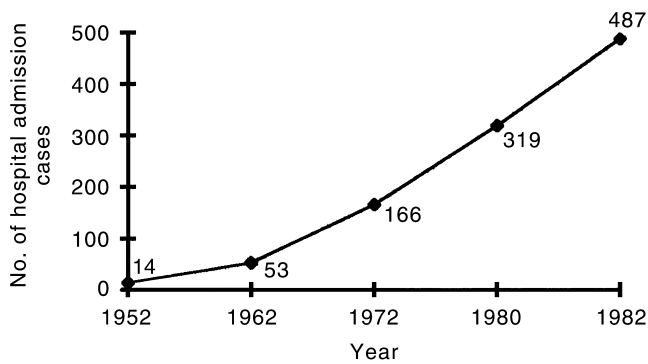


Figure 2. Diabetic hospital admission trend for Fijians (1952–1982). Source: Ram P *et al.* (1991).

The prevalence of diabetes in the urban area in 1965 was only 0.6% and increased to 5.4% in 1980. However, for the rural area it had only increased to 1.1% in 1980. When impaired glucose tolerance (IGT) and diabetes prevalence of 1980 were combined, the urban and rural rates were 15.8 and 8.2%, respectively. The 1993 known diabetic cases were 3.2 and 1.4% in the urban and rural areas, respectively.

A comparison between the 1965 and 1980 urban studies revealed that there were approximately 2500% or a 25-fold increase in the impaired glucose tolerance or diabetes prevalence. The 1965 and 1993 rate had a 433% or fourfold increase, however, the 1993 figures were the only known cases (Table 5). This may not reflect the true prevalence rate, and thus there could have been more undetected diabetes in the community.¹⁶ This speculation is quite valid, as usually the majority of Fijians do not visit hospitals for general check-ups as they have a strong culture of dependency on alternative remedies. It is only when the disease has become very severe that they then seek medical assistance, by which time it is often too late.

Likewise the hospital admission for diabetes mellitus from 1952 to 1982 is shown in Fig. 2, which illustrates an increase rate of 3379% (34-fold). According to Ram's estimation, about 1000 adults (all races) could develop diabetes each year and more than 50% could still remain undetected.¹⁶

An inherited disposition to diabetes only manifests as diabetes if the environmental conditions are conducive. In the 1950s and before, diabetes was rare, even though the same heredity factors were present.

Discussion

The traditional diets of the Fijians have been modified and changed. The movement to western lifestyles, the accompanying change in work habits and eating patterns affect the dietary pattern. The availability of cash has also resulted in the change of traditional breakfast from root staples to cereals especially cereals taken with hot sweet tea.^{6,7} It seems that prosperity has brought about an increase in the energy intake.⁶

The high consumption of cereals and flour-based products has increased the consumption of butter, margarine and sugar and the use of cooking oil for frying. These indicate a shift in dietary pattern however, some traditional foods were still consumed especially *Manihot esculenta* (cassava).

The decline in consumption of traditional foods has resulted in more than a 50% drop of complex carbohydrate

and a 25% drop of sea- and freshwater proteins as shown in Table 1. These complex carbohydrates were mainly traditional root crops, which are high in fibre and also provide ample anti-oxidants such as vitamin C and flavanoids. The most evident traditional crops and vegetables that declined in consumption were *Dioscorea nummularia* (wild yam), *Dioscorea esculenta* (sweet yam), *Abelmoschus manihot* and *Colocasia esculenta* var leaves (taro spinach). These vegetables are good sources of anti-oxidants, iron, calcium and proteins.

Factors that are thought to have promoted the dietary transition from the Fijian traditional-based pattern to a more western pattern are manifold and often integrated. Listed below are a few major factors:

1. Ethnic pluralism.¹⁷

The increasing immigration into the country such as the arrival of early explorers, traders, missionaries, Europeans, indentured Indian laborers and the Chinese have resulted in ethnic plurality and a multicultural society.⁵ These immigrants successfully imported or grew their preferred foods.⁵ Mingling and interaction of indigenous people with other ethnic groups and their cultures affected not only what they ate, but also the culture of their eating.¹⁸

2. Overemphasis on cash economy.^{5,6}

The shift from traditional subsistence agriculture to cash crop farming has affected the food pattern by changing the sources of food supply which thus subsequently altered the composition of diet. The overemphasis on cash cropping by the government encouraged successful farmers to grow new introduced crops and has resulted in the staple crops being shifted to a more inferior-infertile land.^{5,6} This tended to increase deviation from the traditional agricultural system, traditional food preservation methods and thus the consumption of traditional foods decreased. Increasing wealth and purchasing power tended to be paralleled by the dietary shift in the rural community.⁶

3. Urbanization or urbanized lifestyle.^{5,6,19}

The frustrations of gardening efforts, the bright city life and education led people to search for cash employment in the urban centres.⁵ The exodus of rural people to urban areas resulted in reliance on the cash economy for all food needs. This meant that more imported processed foods were consumed and such cases the low-income earners were mostly affected.

Associated with urban life was a decreased physical activity in the form of a decrease or absence of subsistence agricultural activities with a concomitant use of transport, labour-saving machines and greater consumption of processed foods. This was observed in the diabetic survey where more sedentary lifestyles and light activities in the urban areas (49%) compared to 91% who engaged in heavy activities in the rural areas.^{14,20} These resulted in a high diabetes prevalence of 3.5% in the rural areas compared to their rural counterpart of 1.1% in 1980.²⁰ A similar study on activity level also showed less urban people engaged in heavy activity (26.8%) compared to the rural dwellers (62.7%).¹²

Decreased physical activity, the increased dependency on manufactured goods, unhealthy fatty foods and the diminished consumption of traditional foods have all aggravated the reduction in energy expenditure coupled with excess calorie intake leading to the development of obesity. The

interaction of traditional food practices of communal cultural obligations in preparing excess food with the popularity of modern diet and general inactivity further exacerbated the situation.

4. Food aid.⁵

The regularity of cyclones and hurricanes has exposed and allowed the rural people to acquire the new taste of food aid in the form of white flour, butter, cooking oil, rice, sugar, and canned foods. This has resulted in the preference of younger generation for the taste of the imported foods and a tendency towards diminishing the traditional preservation techniques, which in turn has led to a loss in interest in the taste of traditional preserved foods.

5. Changing values of prestigious food.¹⁸

The availability of cash economy, imported foods and acquiring a new taste for imported foods changed peoples' views. They feel that imported foods are only available to those with money. This has made such foods appear more prestigious than traditional foods.¹⁸ The increased availability of such imported foods provides a wider range of food choices, thus affecting the food habits of the people.

6. Global food industry

The increasing globalization of the economy over the past few decades means that there is a greater reliance worldwide on manufactured and processed foods, and an increasing tendency to grow food for export rather than local consumption. In Fiji the change in the agriculture policy from subsistence focus to a more export orientated focus increased the demand of nutritious rootcrops in the export market thus, reducing the local supply.²¹

Conclusion

As Fiji's lifestyle approaches that of western societies, there was a concomitant decline in the traditional food pattern and an increase in the consumption of imported foods. This pattern has been seen in a number of Pacific countries and is recognized as a factor in the increased prevalence of diabetes incidence.

Development had brought about changes in the lifestyles of people, especially the sources of food supply, which affected the constituents of diet and their culture of eating. Availability of cash and increasing wealth had increased the purchasing power for imported foods and a shift in dietary habit.¹⁰ The marked dietary shift in the urban areas was accompanied by a rapid increase in the BMI levels and diabetes incidence, in comparison to the rural community.

Exposure to more exotic imported foods in Fiji is nonetheless inevitable because of its multiethnic population. However, indigenous people need to be aware of the effects of their traditional lifestyle and nutritious traditional diets. Steps to increase manual activity and consumption of their own fresh natural ethnic food would also be advisable.

To decrease the incidence of diabetes in Fiji, there is a need to control and limit the importation of inferior quality

foreign foods, and encourage the production of traditional foods and to promote healthy lifestyles. Traditional diets could be further documented, made available in the vernacular, advertised more and taught in schools so that they can be referred to and their continued consumption be encouraged, especially for the younger generations. This would enable the indigenous people to acknowledge the value of their own traditional foods over the imported ones, and to consume them more regularly.

References

1. Leslie R. Molecular pathogenesis of diabetes mellitus, Vol. 22. Front Hormone Research. Basel: Karger, 1997; 131–156.
2. Zimmet P. The global epidemiology of diabetes mellitus. *Tohoku J Exp Med*, 1983; 141: 41–54.
3. Wicking J, Ringrose H, Whitehouse S, Zimmet P. Nutrient intake in partly westernized isolated Polynesian population: The Funafuti survey. *Diabetes Care* 1981; 4: 92–95.
4. Hetzel B, Michael T. The lifestyle factor: Lifestyle and health. Melbourne: Penguin, 1987.
5. Thaman RR. The evolution of the Fiji food system. In: Jansen AAJ, Parkinson S and Robertson AFS, eds. Food and nutrition in Fiji: a historical review, Vol. 1. Suva: University of the South Pacific, 1990; 23–107.
6. Parkinson S. Food intake. In: Jansen AAJ, Parkinson S. & Robertson AFS, eds. Food and nutrition in Fiji: a historical review, Vol. 1. Suva: University of the South Pacific, Fiji, 1990; 172–330.
7. Langley D. Dietary surveys and growth records in a Fijian village, Naduri. Suva: South Pacific Health Service, 1952.
8. Wilkins R. Dietary survey in a Fijian village, Naduri, Nadroga. Suva: South Pacific Health Service, 1963.
9. John J, Bolabola C, Pollock N. Report on nutrition survey Naduri village. Suva: Fiji National Food and Nutrition Committee, 1982.
10. Fiji National Food and Nutrition Committee (FNFNC). Report of the fifth decennial Naduri nutrition and health survey: June 24 – July 2, 1994. Suva: NFNC, 1996.
11. Johnson JS, Lambert JN. The national food survey of Fiji. Suva: National Food and Nutrition Committee, 1982.
12. Fiji National Food and Nutrition Committee (FNFNC). 1993 National nutrition survey main report. Suva: NFNC, 1995.
13. Cassidy JT. Diabetes in Fiji. *NZ Med J*. 1967; 66: 167–172.
14. Ram P, Banuve S, Zimmet P, Taylor R, Raper LR, Sloman G, Hunt D. Diabetes in Fiji: The results of the 1980 national survey. *Fiji Med J* 1982; 10: 4–13.
15. Ram P, Cornelius M. Diabetes mellitus. In: Jansen AAJ, Parkinson S and Robertson AFS, eds. Food and nutrition in Fiji: a historical review, Vol. 2. Suva: University of the South Pacific, 1991; 380–447.
16. Ram P. Diabetes mellitus: How does this concern Fiji? *Fiji Med J* 1983; 11/12: 186–194.
17. Finau SA. Health care in the Pacific: who would bell the cat. *Pacific Health Dialog* 1989; 1: 44–45.
18. Ravuvu A. A Fijian cultural perspective on food. In: Jansen AAJ, Parkinson S and Robertson AFS, eds. Food and nutrition in Fiji: a historical review, Vol. 2. Suva: University of the South Pacific, 1991; 623–635.
19. Byers T, Julie A. The emergence of chronic diseases in developing countries. *SCN* 1995; 13: 14–18.
20. Taylor R, Ram P, Zimmet P, Raper LR, Ringrose H. Physical activity and prevalence of diabetes in Melanesia and Indian men in Fiji. *Fiji Med J* 1985; 13: 256–260.
21. Fiji National Food and Nutrition Committee FNFNC. Suva: Nutrition Country Profiles, 1999.