

## DIABETES STUDIES IN FIJI

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The island nation of Fiji is located centrally in the Southwest Pacific approximately halfway between Australia and Hawaii. Of 300 islands only about 100 are permanently inhabited with 90% of the population on the two main islands, Viti Levu (80%) and Vanua Levu (10%). The islands are scattered over 424800 square kilometers of ocean between latitudes 15 to 20 degrees South and longitudes 177 degrees West to 178 degrees East. The total land area is 18,272 square kilometres.

Fiji was ceded to Great Britain in 1874 and became a crown colony. Following the failure of other ethnic group work force to work in plantations, Indian labour was introduced shortly after cession. The first group of indentured labourers arrived from India in 1879 to work in the British owned cotton, sugar and coconut plantations. When indenture ended in 1916, 64000 Indians had landed in Fiji and the majority (40,000) chose the option of staying on after the work contracts expired. Now virtually all Indians are second or third generation descendants of indentured labourers.

In 1970 Fiji became an independent nation as a British style parliamentary democracy. Seventeen years later, in 1987 following two Military coups it was declared a Republic.

The population of Fiji was 715000 in 1987 with Indians constituting 48.8% (349,000), ethnic Fijians 46% (329000) and other ethnic groups 5.2% (37,000). The capital city of Suva on Viti Levu has a population of 70,000 and if the periurban areas are included the population is

150,000 or 22% of the total population.

The economy is mainly dependent on agriculture and tourism with sugar cane being the most important item accounting for 55% of the total domestic export.

### **Epidemiological/Clinical Studies in 1964-1965**

Diabetes mellitus was relatively rare 30 years ago but in recent years it has become a major public health problem. The first major study on diabetes was carried out by Cassidy<sup>1</sup> in 1964 - 1965.

He screened 1000 adult Indians (>21 years) and 1000 adult Fijians from urban and periurban areas. The urines passed an hour after the main meal was checked for glycosuria with clinistix. Those found to have glycosuria had fasting blood sugar or random blood sugar estimations. A fasting blood sugar of 120mg or more or a random blood sugar of 180mg% or more was regarded diagnostic of diabetes. Those with fasting blood sugar of 100-120mg% had a glucose tolerance test using 50 gram glucose load and a 1 hour level of 120mg% or more was regarded as diabetic.

The overall prevalence of diabetes was 3.1% with Indians having a very high rate of 5.7% and Fijians relatively low rate of 0.6% (Table I). The ratio of known diabetics : new cases was 2:1 (42:21); this ratio was same in both ethnic groups. He also studied 410 hospital admissions to the Colonial War Memorial Hospital, the main referral and teaching hospital in the country. Juvenile diabetes was extremely rare. There

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**Table I**  
*Prevalence of Diabetes Mellitus—Fiji 1964-1965*  
**Result of survey on 1000 adult Indians and 1000 adult Fijians**

Ethnic Group	Clinistix Positive	Proved Diabetics	Pre-valence(%)
Indians	97	57	5.7
Fijians	13	6	0.6
<b>TOTAL</b>	110	63	3.1

were only six cases of diabetes below 20 years and the majority (283,69%) were in the over 40 years age group (Table II). In ethnic Fijians there were no diabetics below the age of 20 years.

Using weight tables from the Statistical Bureau of the Metropolitan Life Insurance Company of New York showed that almost half of the diabetics were 10% or more overweight. The obesity was most marked in Indian females and Fijian males. Sixty-seven percent of Indian females were overweight and actually 22% being 30% or more overweight. Fifty eight percent of Fijian males were overweight.

**Table II**  
*Age of Onset of Diabetes..Fiji*  
**Analysis of 410 hospital admissions in 1964-65**

Age of Onset (years)	Number	Percentage (%)
< 10	1	0.2
10—20	5	1.2
20—30	24	5.9
30—40	97	23.7
>40	283	69.0
<b>TOTAL</b>	410	100.0

There was striking difference in the clinical presentation. In Indians, 50% presented with classical symptoms of polyuria,

polydipsia and weight loss, 25% with complications and 25% were asymptomatic and detected on routine urine testing. In Fijians 44% presented with diabetic sepsis mainly of lower limbs, 19% had classical symptoms and 25% with complications. Vascular complications were more frequent in Indians and infection in Fijians. Retinopathy, neuropathy and nephropathy occurred with equal frequency in both ethnic groups.

Diabetic coma was extremely rare even under the stimulation of major sepsis. In the whole series there was only one male who was admitted repeatedly with diabetic coma.

### **1980 National Diabetes and Cardiovascular Diseases Survey**

A major national diabetes and cardiovascular diseases survey was carried out in 1980 by the Ministry of Health with assistance from the World Organization and two Melbourne Hospitals.<sup>2,3,4</sup> Both urban and rural samples were included as well as Lakeba in the Lau Group. The ethnic Fijians are Melanesians whereas those in the Lau Group are of mixed j Melanesian-Polynesian stock.

The target population were all residents 20 years and over. The lists of all names for the selected areas were obtained from 1976 census, j and updated just prior to the survey by house to house visit by nursing staff. A few days I before the survey nursing staff visited each j area, explained the study and requested the 1 selected participants to attend on a given day. Extensive publicity appeared in the local news-1 papers and on radio. Letters were written to the employers of all subjects selected for the Suva area.

All subjects were asked to fast and be present at the Survey Centre between 7.30 am and 9.30 am. Participants were asked to bring their invitation letter and on arrival were given a number and information on their age, sex marital status, ethnic origin and fasting status was recorded. A fasting blood sample was taken and a 75 gram glucose load was administered. Following this record of family history of diabetes, occupation, cigarette and alcohol consumption, current and past medical illness, socioeconomic data, current drug therapy and obstetric history was obtained. Height, weight, biceps skin fold thickness and blood pressure (with the subject seated for at least 10 minutes) were recorded.

The subjects then waited at the Survey Centre, and two hours after the glucose load a further blood sample was taken. The plasma glucose was measured using Yellow Springs Instrument Glucose Analyser, which used a glucose oxidase method. The recently proposed World Health Organization diagnostic criteria for abnormalities of glucose intolerance<sup>6</sup> was used **i.e.**

1. Impaired glucose tolerance (1GT)  
Two hour plasma glucose (2h PG) 140 to 199mg/dL
2. Diabetes Mellitus (DM)  
2h. PG<200mg/dL or known diabetic.

### Response Rates

Table III shows the number of people examined in each survey area and the response rates (%) Good response rates were obtained in Lakeba (90.5%) and the urban population (88-89%). The lower response rate in the rural population (Sigatoka valley) was influenced by heavy rain due to Cyclone Wally which caused

flooding of rivers in Sigatoka area.

Non-responders in each survey area were visited by health centre staff to establish reasons for non-attendance and whether they were known to have ischaemic heart disease, diabetes or hypertension.

**Table III**  
**Attendance and Response Rates : 1980**  
**National Survey**

Ethnic Group	Number on Census	Attendance	Response Rate (%)
<b>FIJIANS</b>			
Rural	573	477	83.2
Urban	986	863	87.5
Lakeba	475	430	90.5
<b>INDIANS</b>			
Rural	540	452	83.7
Urban	944	846	89.6

### Overall Prevalence of IGT and DM

Table IV shows details of age standardized IGT and DM prevalence rates and combined IGT and DM rates. In Fijians the IGT prevalence ranged from 4.7 to 10.4% with lowest in Lakeba and highest in urban areas. For diabetes, the rural prevalence rate was 1.1% and was approximately 5 times higher in Suva and Lakeba (5.4. and 5.7% respectively). The prevalence of IGT and DM in rural and urban areas were similar in Indians. The DM rates were 11.7% in rural and 11-8% in urban areas.

Comparing the DM prevalence in the two ethnic groups, the prevalence in rural areas was almost 11 times higher in Indians and in urban areas more than twice as high.

**Table IV**  
**Prevalence of Impaired Glucose Tolerance and Diabetes Mellitus in Fiji : 1980 National Survey. (Males and Females 20 years and over combined)\***

Ethnic Group Examined	Number	Prevalence (%)		
		IGT	DM	IGT & DM
<b>FIJIANS</b>				
Rural	477	7.1	1.1	8.2
Urban	863	10.4	5.5	15.8
Lakeba	430	4.7	5.7	10.4
<b>INDIANS</b>				
Rural	452	9.9	11.7	21.6
Urban	846	10.4	11.8	22.2

\*Age standardized to 1976 Census

### Sex Specific IGT and DM Prevalence

Sex specific IGT and DM prevalence rates are shown in Table V. Fijian females tended to have higher IGT rates than Fijian males. The DM prevalence rates were similar for men and women in rural areas but the prevalence in urban females was higher than males-7.1% compared to 4.7%

In Indians the prevalence rate for IGT and DM were similar in urban and rural males and in females except for higher IGT in urban females-11.8% compared to 8.8%.

### Obesity and Diabetes Prevalence

There were differences in the degree of obesity in Fijians between rural and urban areas as well as in Indians. The impressive difference in DM prevalence between rural and urban Fijian and between Fijians and Indians did not alter following adjustment for obesity.

**Table V**  
**Sex Specific Prevalence of IGT and DM in Fiji: 1980 National Survey (subjects 20 years and over)\***

Ethnic Group	Number		Prevalence (%)					
	Examined		IGT		DM		IGT + DM	
	M	F	M	F	M	F	M	F
<b>FIJIANS</b>								
Rural	242	235	5.7	8.5	1.1	1.2	6.8	9.7
Urban	401	462	7.3	13.2	4.7	7.1	10.8	20.3
Lakeba	214	216	4.5	5.0	7.0	6.0	9.9	11.0
<b>INDIANS</b>								
Rural	214	238	10.2	9.6	12.1	11.3	22.3	20.9
Urban	384	462	8.8	11.8	12.9	11.0	21.7	22.8

\*Age standardized to 1976 Fiji Census

## Physical Activity and Diabetes

The influence of degree of physical activity on diabetes prevalence was assessed in Fijian and Indian males. Physical activity was classified as sedantary, light, moderate and heavy. Sedantary was applied to those who had office jobs, and light occupations to medical or hospital workers and drivers.

Moderate activity jobs included those who worked as tradesmen Heavy occupations involved considerable manual labour eg. agricultural and public works employees. After-hours sporting activities was taken into account in instance where it was substantial.

The DM prevalence was lower in those engaged in moderate or heavy physical activity compared to those in the sedentary group (Table VI). This difference was present in both ethnic groups and maintained when age, obesity and urban/rural status were taken into account. This indicates the role of physical inactivity as an independent risk factor for non-insulin dependent diabetes in Fiji.

**Table VI**  
**Physical Activity and DM Prevalence in Fijian and Indian Males (20 years & over).<sup>1</sup>**

Ethnic Group	Number Examined	Diabetes Prevalence (%)	
		Sedantary and Light Activity	Moderate and Heavy Activity
<b>FIJIANS</b>			
Rural	242	2.3	1.0
Urban	397	5.9	2.1
Lakeba	214	7.9	2.2
<b>INDIANS</b>			
Rural	214	23.9	11.2
Urban	384	14.7	8.8

\*Age standardized to 1976 Fiji Census

The survey also showed that more than 50% of diabetics in the community remain undetected. The ratio of known diabetics to new cases was less than 1 (Table VII).

**Table VII**  
**Ratio of known : New cases of Diabetes in the various survey areas**

Survey Area	Diabetics		
	Known	New	Ratio Known: New
<b>FIJIANS</b>			
Rural	2	8	1 : 4
Urban	18	37	1 : 2
Lakeba	14	19	1 : 1.4
<b>INDIANS</b>			
Rural	23	34	1 : 1.5
Urban	54	56	1 : 1
Total	111	154	1 : 1.4

## Trend in Diabetes Mellitus

The above and a number of other clinical studies<sup>5, 6, 7, 8, 9, 10, 11</sup> show that diabetes mellitus has become a major public health problem.

If the IGT and DM rates are combined in the 1980 study, the results can be compared with those from the earlier study in 1964-65. The comparison shows almost three fold increase.

The hospital admissions for diabetes in the last 30 years show similar increase.<sup>18</sup> In fact hospital admissions have doubled every 10 years for 170 admissions in 1952 to 356 in 1962, 677 in 1972 and 1335 in 1980. The percentage increase was greatest in ethnic Fijians in whom there was a 34 fold increase over this period (Table IX.)

**Table VIII**  
**Prevalence of diabetes in Fiji :**  
**A comparison between results from the**  
**1964 and 1980 diabetic survey**

Population	Prevalence (%)		Percentage Increase
	1964	1980	
Urban Fijian	0.6	15.8	2533
Urban Indians	5.7	22.2	289

**Table IX**  
**Hospital admission for diabetes mellitus**  
**in Fiji (1952-1982)**

Ethnic group	1952	1962	1972	1982	% change between 1952-1982
Fijians	14	53	166	487	3400
Indians	151	283	484	815	490
Others	5	20	27	31	520
<b>TOTAL</b>	<b>170</b>	<b>356</b>	<b>677</b>	<b>1333</b>	<b>682</b>

Complications of diabetes are frequent in hospital patients as well as in clinical practice. Diabetic sepsis accounts for more than 50% of all major sepsis requiring hospitalization and when combined with gangrene is the most common cause of limb amputations. One-quarter of all recent myocardial infarctions occurred in diabetics. Diabetic retinopathy is the cause of blindness in 5 percent of registered blind. Cataracts tend to be common in diabetics and 40 percent of all cataract operations carried out at the Colonial War Memorial Hospital annually are in diabetics. It is the third most common cause of endstage kidney disease in the country. Diabetes is directly responsible for 9 percent of all deaths in those people over 40 years of age.

### Follow up Study

A follow up study of the cohort of urban residents from the 1980 survey is in progress. This study was commenced in 1982 and is directed towards assessing the occurrence of the specific events of death and the attendance at health centres, the CWM Hospital and general practitioners.

A nurse who had previously worked with both populations and with the 1980 survey team is responsible for surveillance of the survey population. Surveillance is undertaken through personal interview with subjects and review of attendance at CWM Hospital (for inpatient, outpatient and casualty presentation,) at general practices and health centres serving the areas of Suva survey. The diagnosis is recorded for each attendance by the attending physician. Mortality is documented following a review of death certificates, which are collected centrally at the CWM Hospital and at the Ministry of Health.

An analysis of data for the first four years (1980-1984) show that diabetes is associated with several adverse health outcomes<sup>13</sup>.

Death observed according to the degree of glucose intolerance for each age, gender and ethnic group have been analysed. The age standardized death rate is higher in diabetics than in non diabetics. For both ethnic groups males have higher age-adjusted mortality rates than females.

Cardiovascular deaths were the major cause of mortality in both sexes and in both ethnic groups (Table X).

**Table X**  
**Cause Specific Mortality (1980-1984)**

Mortality Cause	Melanesians		Indians		Total n=1708
	Males n=399	Female n=463	Males n=383	Females n=463	
Cardiac	11	7	10	9	37
Malignancy	5	6	1	0	12
Cerebrovascular	5	2	1	0	8
Other	5	5	6	4	20
<b>TOTAL DEATHS</b>	26	20	16	13	77

### Conclusion

Several epidemiological and clinical studies in diabetes in Fiji in the last 30 years indicate worsening trend in diabetes prevalence, incidence, morbidity and mortality. This trend is largely related to rapid changes in the life style. There is an increasing urbanization and westernization resulting in adverse change in eating habit, physical activity, alcohol consumption and psychological stresses, all of which contribute to the emerging problem of non-communicable diseases such as diabetes.

To combat this trend diabetes activities were intensified. A National Diabetes Centre was established in 1984 to control diabetes in the country by promoting and integrating diabetes care. The Centre has broad aims and objectives and in particular it aims to educate the health care professionals, the diabetics and their relatives and the public, to be a resource centre and to provide guidance on, coordinate and conduct diabetes related research.

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