

EPIDEMIOLOGY OF DIABETES MELLITUS IN EMIGRANT INDIANS

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The pathogenesis of diabetes mellitus is in some ways like a 'riddle wrapped in a mystery'. Shorn of all inessentials however, two factors can be identified-genetic and acquired. Epidemiological studies can help to unravel the varying contributions of each.

External migration telescopes the two factors into a short time span-the genes inherited in the land of origin and the acquired characters of the adopted land. Study of disease patterns in emigrants from a country thus provides a unique opportunity for analyzing the role of each in the cause of disease (Zimmet, P. 1982).

Historical perspective

Indian entrepreneurs are known to have settled in Eastern Archipelago and the Far East even before the second century A.D. (Dube, S.P. 1975).

However there had been no large scale settlement of Indians on new lands until the 19th century (Lemon A, 1980) due to restraining cultural factors. Travelling to a foreign land involved the risk of breaking caste rules. The Hindus believed that crossing the 'black waters' or *kala pani* endangered the soul.

Early in the 19th century compulsions within the country and outside led to a sustained stream of emigrants from India.

Negro slavery was abolished from British dominions in 1833-34, and when there began a dearth of labourers who worked in the plantations (Dube, 1975), India and China provided them with alternative sources of manpower.

About the same time the socioeconomic conditions in India deteriorated. Agricultural yields were low. Economic strain mounted as a result of famine, drought, soil erosion, pests and finally the silent march of the East India Company. Indian textiles could not stand up to the competition from machine made fabrics. In the North East and South India, community bonds were loosened by the wars which broke the Mughal Empire and later, the administrative reorganisation following British conquest.

With the village organisation disrupted and mounting poverty, rural Indians were often left with emigration to the British dominions as the 'only way out of difficult circumstances they could not control.' Indentured labour were mostly drawn from Eastern United Province, West Bihar and Southern province of Madras (Lemon A; 1980).

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They were recruited to work on the plantations for a fixed term and transported back at the end of the tenure. As generally happens not all of them would return.

There had been settlements in North America also; in Canada as lumberjacks, and in California as tillers

At the other end of the economic spectrum the Indian entrepreneur was exposed to Western capitalist economy and the commercial opportunities offered by retail trade. The 'passenger migrants', free groups of fellow villagers or kinsmen, left at their own expense to seek new ventures in foreign lands. These 'passenger migrants' were mostly drawn from the Northern district of Bombay province, Sind and Gujarat.

In the last two decades or so the pattern of emigration changed. Shortage of labour in some employment sections and economic opportunities abroad have lured the emigrant Indian.

By 1969, nearly 5.6 million Indians lived outside the subcontinent (Lemon, A. 1980). They had settled in many countries including South and East Africa, Fiji, United Kingdom, Singapore, Malaysia, West Indies Mauritius and in recent years, the middle east where they are mostly artisans.

Epidemiological study of diabetes among emigrant Indians, natives of the emigrated country and Indians who did not emigrate would provide insights into the relative role of environment and genetics in the pathogenesis of the disease.

Emigrant Indians in different countries

(1) Africa

Indians began to emigrate to Natal, South Africa in 1860. The emigration continued until the early 1900s when an ordinance barred permanent settlement of Indians in South Africa.

There were 41,142 Indians in South Africa by 1891. This figure rose to 100,142 by 1904 (Dube, 1975). Between 1860 and 1911 about 144,000 Indians had settled in South Africa (Lemon, 1980).

According to 1971 census, the total population of Indian origin in South Africa stands at 764,000 (Lemon, 1975). More than 70% of them are descendents of indentured immigrants.

Emigrants to East Africa were mostly drawn from west Bihar, Eastern United Provinces and Southern province of Madras. The present day Indian population is mainly composed of business entrepreneurs.

(2) Fiji

The Fiji population declined by one third following the measles epidemic of 1875. The resultant shortage of labour was sought to be replenished by Polynesians, who proved to be unsatisfactory, and by Japanese who suffered from beriberi and could not therefore work.

To fill in the deficit 600,000 indentured Indians came between 1879 and 1911 to work on the sugarcane fields and for the sugar industry (Lemon, 1980). Punjabi farmers and artisans from Gujarat came in large numbers until migration was stopped in 1928-30.

In : 1976 49.8% (293,000) of the Fiji population was composed of people of Indian origin.

(3) United Kingdom

The earliest permanent Asian immigrants to U.K. were seamen, mostly settled before 1949 (Lemon A, 1980).

Between 1955 and mid 1961, 75,070 Indians migrated to U.K.; many of them are employed as unskilled factory workers. According to the 1961 census there were 151,435 persons of Indian origin, including 76,000 'white Indians' (Lemon A, 1980).

Indians are concentrated in industrial towns, especially at the edges of inner central districts where housing is cheap.

By 1971 there were 322,670 British citizens of Indian origin, a figure which is considered under representative (Lemon A, 1980). Most of them are from Punjab and Gujarat where emigration is highly approved, and does not involve severance of ties with the motherland.

(4) Singapore

Nine percent of Singapore's population of 145,000 is composed of Indians.

(5) Other countries

Emigration to Trinidad began in 1844, and to Jamaica in 1845 (Dube, 1975). Malaysia and Mauritius also have a significant proportion of Indian population. Emigration to the middle east began recently, where many of the emigrants work as artisans.

Prevalence studies of diabetes mellitus in Emigrant Indians (Table 1)

(1) South Africa

In 1960 Wood reported the prevalence of diabetes mellitus in persons aged 20 and more in Natal, South Africa where most of the Indian population lives. The prevalence was 5.5% (Cassidy J.T., 1967).

In 1963 Campbell reported the prevalence of diabetes mellitus to be 4.2% among Asians in and around Durban, South Africa (Ahuja, 1976).

Recognizing that diabetes was more common in persons of Indian origin, and that it tended to be more virulent. Marine conducted a prevalence study on persons aged 15 years and above in Cape Town (Marine N, 1969). Of the 9,000 Indians living in Cape Town two thirds were Konkani speaking Muslims who originated around Bombay. They settled in Cape Town in the late 19th century where they had come as paying migrants. By contrast the Natal population comprised mainly of Tamil speaking Hindus from Madras, who came in as indentured labourers to work in the sugar plantations.

Table I
Prevalence of Diabetes Mellitus Among Emigrant Indians

S. No.	Country	Year	Prevalence of Diabetes in Indians (%)	Reference
(1)	South Africa	1960	5.5	Cassidy (1967)
		1963	4.2	Ahuja (1976)
		1969	10.4	Marine et al (1969)
		1985	11.1	Omar et al (1985)
(2)	Fiji	1967	5.7	Cassidy (1967)
		1984	12.5	Taylor et al (1984)
(3)	United Kingdom	1980	5.25*	Cruickshank (1980)
		1986	11.3**	Mather H.M. (1986)
(4)	Singapore	1976	6.07	Cheah et al (1978)
		1985	8.52	Thai et al (1986)
(5)	West Indies	1960	2 (British Guyana)	Tulloch (1962)
		1968	4.5 (Trinidad)	Zimmet P (1982)
(6)	Malaysia	1980	3.45*	Mustaffa (1982)

* Hospital admissions

** Age 49-79 y

The Cape Indians had retained the customs and food habits of their land of origin. They were economically better off than their fellows in India, and consumed more refined carbohydrate.

The prevalence of diabetes among Indians was 10.4%, which was significantly higher than in Malays (6.6%) and Africans (3.6%), who comprised the remaining segment of the population.

In 1985 Omar et al. reported a prevalence of diabetes of 11.1% among 866 Natal Indians, selected by cluster sampling (Omar, 1985).

(2) Fiji

Cassidy (Cassidy J. T., 1967) in 1967 published the results of diabetic prevalence in 1,000 Fijis of Indians origin aged more than 21 years; the overall prevalence in Indians was 5.7%. The survey was conducted in a suburb of Suva where persons of mixed social status resided. Diabetes was 9.5 times more common in Indians than in Fijis (0.6%).

In 1984 Taylor reported that the prevalence of diabetes in Fiji Indians was 12.5%.

(3) United Kingdom

Cruickshank in 1980 published the proportion of diabetes, heart attacks, stroke and hypertension in patients admitted to Dudley Road Hospital, Birmingham. 5.25% of patients from the Indian subcontinent had diabetes mellitus (Cruickshank, 1980).

In 1985 Mather published the prevalence rate of known diabetes mellitus in an area of Southall, West London. The prevalence between ages 40 and 79 was 11.3% (761/34,230) among the Asian population which comprised of Indians mainly from Punjab, and Gujarat (Mather H.M., 1985, 1986).

(4) Singapore

Cheah et al carried out a diabetes survey in Singapore in 1975. They found the prevalence of diabetes in Indians was 6.07%, which was significantly higher than in the remaining population (Malays 2.43%, Chinese 1.55%), (Cheah J.S., 1978).

When they repeated the survey 10 years later in 1985, the prevalence among Indians rose to 8.52% (Thai A.C., 1986).

(5) West Indies

In 1960-61 the prevalence of diabetes mellitus among the East Indians of British Guiana was 2% (Tulloch J.A., 1962).

Eight years later Poon King et al reported a 4.5% prevalence among Indians settled in Trinidad, West Indies (Zimmet P. 1982).

(6) Other countries

The prevalence of diabetes mellitus among Indian patients admitted to the General Hospital, Kuala Lumpur between January 1980 and May 1981 was 3.45% (Mustaffa B.E., 1982).

Discussion

Epidemiological studies on emigrant population provide a unique opportunity to analyze the role of genetic and environmental factors in the causation of disease. The rationale underlying migrant studies is as follows (Zimmet P., 1982) : emigrants leave for new lands where the social, cultural, economic and geographic environment is different, along with a change in life style in some cases. Comparisons can be made between the emigrants and those who did not migrate; differences in prevalence between the two groups could be attributed to environmental factors, which can be identified. Similarly, health changes of the migrants can be compared with persons of the host community. The role of environmental factors and inherited characters in the causation of disease can thus be recognised.

For such a study to provide meaningful information, the two populations under comparison must be comparable in all aspects other than the variable under study. This criterion is difficult to be fulfilled, particularly in cross sectional studies. In diabetes especially, diagnostic criteria evolve with time and hence the problem is compounded. Cohort studies are obviously difficult to carry out. These factors constitute inherent limitations of such studies.

The prevalence of diabetes mellitus in India has been reported to be 1.8% to 1.9% (Zimmet P., 1982; Ahuja M.M.S., 1976): By comparison the prevalence rates of diabetes among emigrant Indians is many fold higher-4.2% in South Africa (1963) to 14% in Fiji (1982).

Within South Africa itself, the prevalence rates of diabetes among Indians increased over time from 5.5% (1960) to 10.4% (1969) to 11.1 % (1985).

Similarly the prevalence in Fiji Indians increased from 5.7% (1967) to 12.5% (1984) over 17 years.

Prevalence rates in emigrant Indians are higher compared to not only that in India but also when compared to persons who originated in the host country.

This suggests a genetic susceptibility of Indians to diabetes mellitus; as well as environmental factors which act to increase the prevalence of the disease over time, in the presence of a genetic trigger.

The precise genetic component has not been identified: There is no marker which can be linked to susceptibility to diabetes. HLA studies have so far failed to show significant association with N.I.D.D.M.

Being close communities in a foreign land, marriages within the group are likely; this brings in the role of inbreeding, to explain the high prevalence of diabetes in emigrant Indians. (Ahuja M.M.S. 1976; Zimmet P., 1982).

Genetic factors alone, however, cannot account for the high prevalence of diabetes in emigrant Indians. Environmental factors that could be contributing to this pattern include the age structure of the population under survey, the degree of obesity, which has been established to be an independent risk factor for the development of diabetes, dietary habits, both quantitative and qualitative, degree of physical activity, possible food toxins, socio economic status and finally, psycho social stress as a result of modernization.

Environmental factors appear to be more responsible for the predisposition to diabetes mellitus. At the same time their effect seems to show a liner increase with time, for within emigrant Indians in the same country (South Africa, Fiji, West Indies), the prevalence of diabetes increased twofold over the course of about 10 years. Of course one must be cautious in interpreting such data because criteria for diagnosing are changing over the years. If these studies can be corroborated with mortality and morbidity data, a truer picture would emerge.

In a recent questionnaire enquiry by Goto (1985), from Asian countries 25 specialists out of 31 responded. The following trends were reported by-them.

- * 96% indicated increase in prevalence rate of NIDDM in their respective countries.
- * Of the factors relating to this increase in NIDDM, highest ranking was given to diet, increase in intake of total energy, westernization of diet habit; increase in animal protein and obesity. Less physical activity, sedentary life style and urbanization were next in score. Improved life expectancy, better diabetes detection, and precise laboratory methods were also contributory.
- * Further multivariate analysis brought out the first principal component of variance of nearly 1.0, relating to the increase in life expectancy (increase in elder population >65 yrs. ratio). Next in significance were BMI and consumption of animal products; animal protein intake, fats and oils and total energy consumption. Contrariwise cereal consumption, carbohydrate intake and sugar and sweets and labour hours were negative factors with an absolute value of less than 0.2. Interestingly registered automobiles, and electrical appliances were also found to be of weighted significance.

- * Thus in future epidemiological studies, defined analytical parameters need to be studied to attribute the role of population profile, dietary alteration, pattern of life style for their likely impact on human health and disease.

There is thus a great need to identify the precise environmental 'pathogen (s)' and attempt at primary prevention of diabetes mellitus by eliminating the causative factor.

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