Epidemiology of Diabetes in Indians

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Epidemiology is the study of the distribution and determinants of disease frequency in man. The application of epidemiology to the study of Non-insulin Dependent Diabetes Mellitus (NIDDM) has provided valuable information on several aspects of this disease such as its natural history, prevalence, incidence, morbidity and mortality in diverse populations around the world. In addition, it has led to the identification of the cause of the disease and the possible preventive measures that could be instituted to arrest or delay the onset of this disease which has reached epidemic proportions in both the developed and the developing nations [1].

Prevalence of NIDDM in Indians

The prevalence of NIDDM varies in different geographic regions and also in different ethnic groups [2]. The first authentic data on the prevalence of diabetes in India came from the multicentric study conducted by the Indian Council of Medical Research (ICMR) in the early seventies [3]. This study reported a prevalence of 2.3% in the urban and 1.5% in the rural areas. The criteria used in this study were different from those set by the WHO Expert Committee on Diabetes Mellitus.

Many epidemiological studies carried out in different parts of the world reported an interesting finding that Indian migrants settled abroad had a high prevalence of NIDDM [4] which was believed to be due to greater affluence and a change to a more sedentary life style as compared to the native Indian population. However, the local host populations living in identical environment in these countries still had only a low prevalence rate of diabetes. Assuming that Indians as an ethnic group have a high degree of genetic predisposition to develop diabetes, one could expect higher prevalence of diabetes among the native urban populations with a comparable affluent life style. Recent studies by Verma et al [5] using a questionnaire method reported a prevalence of 3.1% in an affluent area in Darya Ganj, New Delhi. Our own studies using the WHO criteria showed a prevalence of 5% in an urban township in south India [4, 6] (Table 1). The prevalence when adjusted to the age distribution of the migrant population in Southall, London [7] and in Fiji [8] increased to 10% and 9% respectively. These findings in the above studies clearly point to a rising prevalence of NIDDM in India which is probably related to improved living conditions and changing life styles in the urbanised regions.

Table 1
Epidemiological Studies of the Prevalence of Diabetes Mellitus in India

Year	Author	Place	Prevalence (%)
1971	Tripathy et al	Cuttack	1.2 (Urban)
1972	Ahuja et al	New Delhi	2.3 (Urban)
1979	Johnson et al	Madurai	0.5 (Urban)
1979	Gupta et al	Multicentre	3.0 (Urban)
			1.3 (Rural)
1984	Murthy et al	Tenali	4.7 (Urban)
1986	Patel	Bhadran	3.8 (Rural)
1988	Ramachandran et al	Kudremukh	5.0 (Urban)
1989	Kodali et al	Gangavathi	2.2 (Rural)
1989	Rao et al	Eluru	1.6 (Rural)
1992	Ramachandran et al	Madras	8.2 (Urban)

If environmental factors do have a significant role in unmasking diabetes, one would expect a lower prevalence in the rural areas where the populations follow a conventional life style. Such an urban-rural difference in the prevalence rate was found in a recent survey conducted by the Diabetes Research Centre in Madras on two populations belonging to the same ethnic group but with different socio-economic status [9]. The age-adjusted prevalence of diabetes was 8.2% in the urban and 2.4% in the rural populations with 8.4% in urban men and 7.9% in urban women. This study brought into focus the high prevalence rate in urban India which is comparable to that in migrant Indians. Age, body mass index (BMI) and waist:hip ratios showed positive association with diabetes in both populations. Despite the low BMI in the rural population, upper body adiposity and BMI were positive risk factors in this relatively non-obese population.

Prevalence of undetected diabetes

There is a vast difference in the percentages of subjects with known to unknown or undetected diabetes in urban and rural populations. The new to known ratio was 1:2 in an urban population while the corresponding data for the rural population was 3:1 [9]. Similar findings have been reported for

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urban and rural populations of migrant Indians [4]. These differences are probably due to marked changes that have occurred in the quality of the food consumed. Urbanisation has probably led to a transition from consumption of natural form of food to a more refined food. This in combination with less physical activity could probably lead to unfavourable adiposity and hence increase the risk of developing diabetes.

Factors influencing the prevalence of NIDDM Age and sex have been found to be the most positively associated parameters with NIDDM in both the urban and the rural populations surveyed in Madras [9]. The prevalence of diabetes was 41 % in the age group 55-64 years. It has been reported that in Southall, U.K., Asians aged 40-64 years had five times higher prevalence of diabetes as compared to the Europeans. Almost all the epidemiological studies have shown a male preponderance among the Indian diabetics inspite of increased rates of obesity in women.

Prevalence of Impaired Glucose Tolerance (IGT)

The ratio of the prevalence of IGT/Diabetes is variable in different populations and is usually around one. A high prevalence of IGT among Indians in Tanzania and Mauritius [10] has been reported. In our studies, we made an interesting observation that the prevalence of IGT was similar in both the urban and the rural populations (8.7% and 7.8%) despite a four fold lower prevalence of diabetes in the rural population (Table 2). This observation assumes significance

Table 2 : Age-adjusted prevalence of Diabetes and IGT in the two populations

	no.	Prevalence (%) Diabetes	IGT
Urban			
Total	900	8.2	8.7
Men	457	8.4	8.8
Women	443	7.9	8.3
Rural			
Total	1038	2.4	7.8
Men	520	2.6	8.7
Women	518	1.6	6.4

Diabetes	Urban vs. rural	$X^2 = 29.4$, P<0.001
IGT	Urban vs. rural	NS
Diabetes	Urban vs. rural men	$X^2 = 14.2$, P<0.001
IGT	Urban vs. rural men	NS
Diabetes	Urban vs. rural women	$X^2 = 21.1$, P<0.001
IGT	Urban vs. rural women	NS

in view of our earlier observation that about 35% of the subjects with IGT became diabetic during a mean follow-up period of 5 years [11]. With increasing urbanisation one would expect a higher conversion rate of IGT to overt diabetes and hence the prevalence rate of diabetes could be expected to rise in India in the near future.

Familial aggregation in NIDDM:

There are a number of epidemiological evidences to indicate a strong genetic component in the causation of NIDDM. Our studies have shown an increased familial aggregation of NIDDM with higher prevalence of NIDDM among offspring of conjugal diabetic parents (OCDP) [12]. A recent analysis of the family history of NIDDM patients attending our centre has shown a positive family history of 62% with 53% having first degree relatives with diabetes. An increasing risk of diabetes with increasing familial aggregation has been shown by the development of diabetes in the offspring two decades earlier than their parents. The cummulative risks of developing diabetes in the offspring by the age of 70 years increases from 41 % in families with one diabetic parent to 64% in those with positive family history on the non-diabetic parental side and to 73% in those with both parents having diabetes.

Evidences from epidemiological studies described so far clearly point out that Indians as an ethnic group have a very high risk of developing diabetes. With increasing urbanisation and increased life expectancy, a phenomenal increase like an epidemic of diabetes has been foreseen by many epidemiologists (Table 3) [13] which may pose a severe burden on the health care system in India. This calls for appropriate strategies to effectively tackle this problem.

Table 3
Projected number of people with Diabetes in some countries

Nation	Estimated number of people with Diabetes Year 1990 (Millions)	2000 (Millions)
People's Republic of China	6	14
India	15	35
Africa	7	20
United States of America	10	18

Prevalence of childhood diabetes

The incidence and prevalence of Insulin Dependent Diabetes Mellitus (IDDM) show wide variations in different geographical regions. Most of the data collected and reported so far are mainly from North America and Western Europe where IDDM registries have been set up. There are only a few reports from Asia and Africa and none from India except for some information available on the migrant Indian population in the United Kingdom.

Our study showed that the prevalence of IDDM in children is 0.26/1000 in an urban area in south India [14]. This is quite comparable to the prevalence of 0.27/1000 reported from Algeria [15]. Interestingly, it is higher than that reported from many other Asian countries namely Japan (0.06/1000) [16] and China (0.09/1000) [17]. Nevertheless, it is much lower than the prevalence reported from North Europe (2.1/1000) [18] and Sweden (1.54/1000) [19].

Our previous studies have shown that South Indian population may be a group with ethnic differences in susceptibility to IDDM. The risk of IDDM among the first degree relatives of IDDM probands in South India has also been found to be significantly lower than that in the European population [20]. Data on the incidence of diabetes in children in India are lacking and prospective studies are needed to estimate this.

CONCLUDING REMARKS

Similar prevalence rate of NIDDM in the migrant and native Indians in affluent areas suggest the high genetic risk for diabetes in ethnic Indians. Age, urban-rural factor, body mass index and abdominal adiposity (waist:hip ratio) were positively associated with NIDDM. Migration from rural to urban environment with changes in life style may have contributed to the increased prevalence of diabetes. The prevalence of IDDM was 0.26/1000 with a peak age of 12 years at diagnosis. This first population based study of prevalence of IDDM in South India has suggested that IDDM is not rare and is higher than that reported from many other Asian countries.

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