MEDICINE

# Diabetes in India

**With the spread of fast-food outlets and more sedentary lifestyles, the prevalence of diabetes in India is rising alarmingly. But the subpopulations at risk and the symptoms of the disease differ from those in the West.**

JARED DIAMOND

India, the world's second most populous country, now has more people with type 2 diabetes (more than 50 million) than any other nation. The problem has been well documented in a battery of recent papers[1–6]. These publications were foreshadowed by studies of previously Westernized Indian populations elsewhere, and they illuminate distinctive features of diabetes in India.

Type 2 diabetes results from a genetic predisposition and from lifestyle factors, especially those of the so-called Western lifestyle, characterized by high calorie intake and little exercise. Also known as non-insulin-dependent or adult-onset diabetes, this form of the disease is far more common than type 1 (insulin-dependent or juvenile-onset) diabetes. Until recently, type 2 diabetes — henceforth simply 'diabetes' — was viewed as a disease of overfed, sedentary people of European ancestry. But it is now exploding around the world owing to the spread of Western habits.

Hints of trouble ahead came from observations of diabetes epidemics in emigrant Indian communities that achieved affluence long before Indians in India[1–3,7]. Those communities include ones in Fiji, Mauritius, Singapore, South Africa, Surinam, Tanzania and Britain. For instance, in the 1830s, Indians were brought to Mauritius for physically demanding work on sugar plantations. By the 1980s, the decline in world sugar prices had led the Mauritian government to promote industrialization and the export of manufactured goods, which in turn led to increasing affluence and decreasing physical activity for the local population.

As a result, between 1982 and 1986 deaths due to diabetes tripled, and by 1987 reached 13% in the Mauritius Indian community[7,8]. (By contrast, prevalence remained much lower in the even more affluent Mauritius European community, illustrating the role of genetic factors.) Today, Mauritius enjoys a per capita income four times that of India but suffers from the world's second highest national prevalence of diabetes, 24%. Those developments led Zimmet[8] to prophesy in 1996: "If over the next few decades the people in India become modernized to a similar level of those in Mauritius and other countries inhabited by Asian Indians, one could expect dramatically increased diabetes rates in India."

That prophecy has already been grimly fulfilled. In 2010, the average age-adjusted prevalence of diabetes in India was 8%, higher than that in most European countries[1]. By contrast, surveys in 1938 and 1959, in large Indian cities that are today diabetes strongholds, yielded prevalences of just 1% or less. Only in the 1980s did those numbers start to rise, first slowly and now explosively[5,6,9,10].

The reasons are those behind the diabetes epidemic worldwide. One set of factors is urbanization, a rise in living standards and the spread of calorie-rich, fatty, fast foods cheaply available in cities to rich and poor alike. Another is the increased sedentariness that has resulted from the replacement of manual labour by service jobs, and from the advent of video games, television and computers that keep people seated lethargically watching screens for hours every day. Although the specific role of TV has not been quantified in India, a study in Australia[11] found that each hour per day spent watching TV is associated with an 18% increase in cardiovascular mortality (much of it associated with diabetes), even after controlling for other risk factors such as waist circumference, smoking, alcohol intake and diet. But those factors notoriously increase with TV watching time, so the true figure must be even larger than the 18% estimate.

In India, a wide range of outcomes for different groups[9,10] is buried within the average diabetes prevalence of 8%. Prevalence is only 0.7% for non-obese, physically active, rural Indians. It reaches 11% for obese, sedentary, urban Indians; and it peaks at 20% in the Ernakulam district of Kerala, one of India's most urbanized states. Among lifestyle factors predicting the incidence of diabetes in India, some are familiar from the West, whereas others turn expectations upside down[9,10]. As in the West, diabetes in India is associated with obesity, high blood pressure and sedentariness. But prevalence of the disease is higher among affluent, educated, urban Indians than among poor, uneducated, rural people: exactly the opposite of trends in the West, although similar to the situation in other developing countries. For instance, Indians with diabetes are more likely to have undergone higher education, and less likely to be illiterate, than their healthy compatriots. In 2004, the prevalence of diabetes averaged 16%


D. SARKAR/AFP PHOTO/GETTY

**Figure 1 | Raising awareness of diabetes.** Participants on a 'walkathon' in Bangalore, India, in November 2010.

in urban India and only 3% in rural India[10]. That urban concentration of diabetes has also been reported in many other Asian countries.

The likely explanation for these paradoxes is twofold. First, in the West, poor rural people are better able to afford fast foods than their Indian counterparts. Second, educated Westerners with access to fast foods and with sedentary jobs are by now often well aware that fast foods are unhealthy and that one should exercise, whereas that advice has not yet made wide inroads among educated Indians (Fig. 1). Nearly 25% of Indian city dwellers (the subpopulation most at risk) haven't even heard of diabetes[9].

In India, as in the West, diabetes is ultimately due to chronically high levels of blood glucose, and some of the clinical consequences are similar. But whereas Westerners think of type 2 diabetes as an adult-onset disease appearing especially after the age of 50, Indians (and Chinese, Japanese and Aboriginal Australians) with diabetes exhibit symptoms at an age one or two decades younger than that. The age of onset in India has been shifting towards ever-younger people even within the past decade[9] — among Indians in their late teens, 'adult-onset' diabetes already manifests itself more often than does 'juvenile-onset' diabetes. In Britain, the prevalence of type 2 diabetes is 14 times higher in Asian than European children. And although obesity is a risk factor for diabetes both in India and in the West, the disease appears at a lower threshold of obesity in India, as is also the case in China, Japan and other Asian countries[10].

Symptoms also differ between Indians and Westerners: Indians with diabetes are less likely to develop blindness and kidney disease, but much more likely to suffer coronary artery disease at a relatively young age[9,12]. Just as Indians can't be lumped in with people of European ancestry, differences also appear among Asians: some, but not all, distinctive features of Indian diabetes apply to other Asian populations. For example, by worldwide standards, Chinese people with diabetes experience a low prevalence of coronary artery disease but a high prevalence of retinal and kidney damage. The relative roles of genetic and lifestyle factors in these ethnic differences remain to be teased out.

Although poor Indians are currently at lower risk than affluent Indians, the rapid spread of fast food exposes even urban Indian slum-dwellers to the risk of diabetes. Sandeep and colleagues of the Madras Diabetes Research Foundation[13] summarize the situation as follows: "diabetes [in India] is no longer a disease of the affluent or a rich man's disease. It is becoming a problem even among the middle income and poorer sections of the society. Studies have shown that poor diabetic subjects are more prone to complications as they have less access to quality health care. This presents an alarming picture…" Alas, that's true. ■

**Jared Diamond** *is in the Geography Department, University of California, Los Angeles, California 90095-1524, USA.*
*e-mail: jdiamond@geog.ucla.edu*

1. Shaw, J. E., Sicree, R. A. & Zimmet, P. Z. *Diabetes Res. Clin. Practice* **87,** 4–14 (2010).
2. Magliano, D. J. *et al. Diabetes Care* **33,** 1983–1989 (2010).
3. Jowett, J. B. *et al. Twin Res. Hum. Genet.* **12,** 44–52 (2009).
4. Ramachandran, A., Ma, R. C. W. & Snehalatha, C. *Lancet* **375,** 408–418 (2010).
5. Mohan, V. *et al. Indian J. Med. Res.* **131,** 369–372 (2010).
6. Pradeepa, R. *et al. Diabetes Technol. Therapeutics* **12,** 755–761 (2010).
7. Dowse, G. K. *et al. Diabetes* **39,** 390–396 (1990).
8. Zimmet, P. *IDF Bull.* **36,** 29–32 (1996).
9. Mohan, V. *et al. Indian J. Med. Res.* **125,** 217–230 (2007).
10. Mohan, V. *et al. Diabetes Res. Clin. Practice* **80,** 159–168 (2008).
11. Dunstan, D. W. *et al. Circulation* **121,** 384–391 (2010).
12. Unnikrishnan, R. *et al. Diabetes Care* **30,** 2019–2024 (2007).
13. Sandeep, S., Ganesan, A. & Mohan, V. *Development and Updation of the Diabetes Atlas of India* www.whoindia.org/LinkFiles/NMH_Resources_Diabeletes_atlas.pdf (2010).