Urbanization- Impact on prevalence of Diabetes in India

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Abstract:

*In this paper we discuss the urbanizations Impact on Diabetes prevalence in India**.** Diabetes is the most common non-communicable disease globally. Today, there are 387 million people living with diabetes. A further 316 million with impaired glucose tolerance are at high risk from the disease – an alarming number that is set to reach 471 million by 2035, of these 80% live in developing countries, the largest numbers on the Indian subcontinent and in China.[1] Approximately 85–95% of all cases of diabetes are type 2 diabetes and the worldwide explosion of this disorder is a major health care burden.*

Key words: diabetes, burden of diabetes; urbanization, prevalence of diabetes; prevention of diabetes

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Introduction

India is one of the 6 countries of the IDF (International Diabetes Federation) South East Asian region. Out of the 387 million people with diabetes in the world, 75 million people reside in the SEA region; by 2035 this will rise to 123 million. There were 66.8 million cases of diabetes in India in 2014.

The increased number of diabetics in India is likely to be due to a significant increase in the incidence of type 2 diabetes, caused by unprecedented rates of urbanization, which results in environmental and lifestyle changes. According to World Health Organization (WHO) estimates, by 2030, nearly 46% of India's population will be living in urban areas.[3]

The projected increase in regional diabetes prevalence to 10.1% in 2035 is a consequence of on going large-scale urbanization and increasing life expectancy(in India, the proportion of the population over 50 years is expected to increase from 27% to35% between 2013 and 2035).

Although several infectious and parasitic diseases have been controlled successfully in India, non-communicable diseases are becoming increasingly common, resulting in an enormous burden on the health care system.

Epidemiology of diabetes: changing trends

A multicenter epidemiological study performed by the Indian Council of Medical Research (ICMR) in the early 1970s reported that the prevalence of diabetes in the urban and rural populations ≥14 years of age was 2.3% and 1.5%, respectively.[6] Since then, over the period 1971–2000, studies from different parts of India have reported a 10-fold increase in the incidence of diabetes in the urban area (from 1.2% in 1971 to 12.1% in 2000).[6–24]

A series of epidemiological studies performed in Chennai, southern India, showed an increasing prevalence of diabetes and impaired glucose tolerance (IGT).[10,14,15,17,23,24] This trend was considered to be a phenomenon of the urban environment because many studies showed wide urban–rural differences. Studies over the period 1990–2000, using standardized WHO[5,27] or American Diabetes Association (ADA) criteria,[28] have demonstrated that the prevalence of diabetes in India has increased from 5% to 15% among urban populations, from 4.2% to 6.2% in semi-urban populations, and from 2% to 5% in rural populations, with wide regional disparities related to urban and rural settings.[26]

Urban areas

Most studies since 2000 have used either recent WHO criteria[27] or ADA criteria.[28] The highest prevalence of diabetes and/or IGT was reported for the southern state of Kerala, which had undergone widespread and rapid urbanization.[19,29] The lowest prevalence rates for diabetes and IGT among an urban Indian population were found in Kashmir[18] (north India), with crude prevalence rates (based on WHO criteria) of 6.1% and 8.1%, respectively.

National data

A national urban diabetes survey performed in six major cities in representative samples of subjects ≥20 years of age and using WHO criteria[27] showed age-standardized prevalence rates of diabetes and IGT of 12.1% and 14.0%, respectively . The prevalence of diabetes varied from 9% to 16.6% in different regions, with the southern region of India having higher prevalence rates than other parts of India.[24] Another national survey performed by Reddy et al.[30] in 2002–2003 in industrial workers and families (mean age 40 years) reported an age-adjusted prevalence of diabetes of 8.4%.

The Prevalence of Diabetes in India Study (PODIS)[32] reported , the final estimated prevalence of diabetes as similar (33 million) to that derived from earlier studies.

North India

In the national urban diabetes survey,[24] the prevalence of diabetes and IGT in Delhi was found to be 11.6% and 8.6%, respectively. In a later study performed in 2005 in northern parts of India, the crude prevalence of diabetes among men working in industries was found to be 15%.[33] A large proportion (37%) of these subjects had either IGT or impaired fasting glucose (IFG). A 2003 study from Jaipur using ADA criteria[28] reported an age-standardized prevalence of diabetes of 8.6%[34] .

South India

A series of epidemiological studies from southern India have shown a trend for the increased prevalence of diabetes since 2000. All studies have used WHO criteria[27] and most have reported age-standardized prevalence .

Recent studies in Chennai, in southern India, made the interesting observation of a rapid increase in diabetes with a marked reduction in the prevalence of prediabetic conditions. In Chennai, the prevalence of diabetes was found to be 13.5% in 2000,[24] which increased to 14.3% in 2004,[35] and increased further in 2006 to 18.6%.[36] Interestingly, the prevalence of IGT had decreased from 16.8% in 2000[24] to 10.2% in 2004[35] and further still to 7.4% in 2006.[36] In 2006, the prevalence of diabetes and IGT in the town of Kancheepuram were 16.7% and 4.3%, respectively.[36] The escalating prevalence of diabetes from 2000 to 2006 is an indication of a rapid conversion of susceptible individuals, especially those with IGT and/or IFG, to diabetes . This hypothesis is supported by the rather unexpected decrease in the prevalence of IGT and IFG over the same period of time.[36] Asian Indians with IGT have a high conversion rate to diabetes (55% in 3 years).[37]

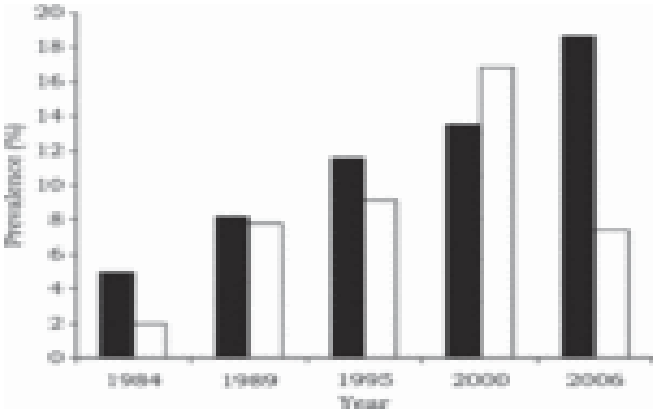

Figure 1. Changing prevalence of diabetes (■) and impaired glucose tolerance (□) in urban southern India.

Rural areas

Presently, India is largely a rural nation, but according to WHO estimates, by 2030 urbanization is expected to reach 46%.[3] Therefore, in the future, rural areas that are currently undergoing rapid urbanization could make a considerable contribution to the overall diabetic population. Improved socioeconomic conditions in rural India have resulted in an explosion of metabolic disorders, such as diabetes, CVD, and hypertension.[36,39] Figure 2 shows temporal changes in the prevalence of diabetes and IGT over the period 1989–2006. Similar trends have been described for neighboring countries, such as Thailand, Malaysia, Bangladesh, and Pakistan.[1] Two studies in urbanizing rural areas found an IGT:diabetes ratio of >1,[39,40] indicating a large pool of prediabetic subjects. In 2006, the prevalence of diabetes in peri-urban villages (PUV) was 9.2%,[36] whereas the prevalence of IGT had decreased from 7.2% in 2003[35] to 5.5% in 2006[36] (Fig. 2). A national survey conducted in 2005 found that the self-reported prevalence of diabetes (known diabetes) in rural areas was 3.1%.[38] Another two recent studies in rural areas of southern India reported a high prevalence of diabetes and IFG.[41,42] In rural Tamilnadu, the crude prevalence among adults of diabetes and IFG is currently 5.1% and 13.5%, respectively.[41] In Andhra Pradesh, Chow et al.[42] reported a high crude prevalence of diabetes (13.2%; 6.4% known) and IFG (15.9%) in 2006. These are probably the highest prevalence rates reported for a rural area. Until 2000, the prevalence of diabetes in rural areas had been reported to range from 1.5% to 4.0%;[26] in 2006, Deo et al. reported a rural prevalence of diabetes of 9.3% in western India.[43]

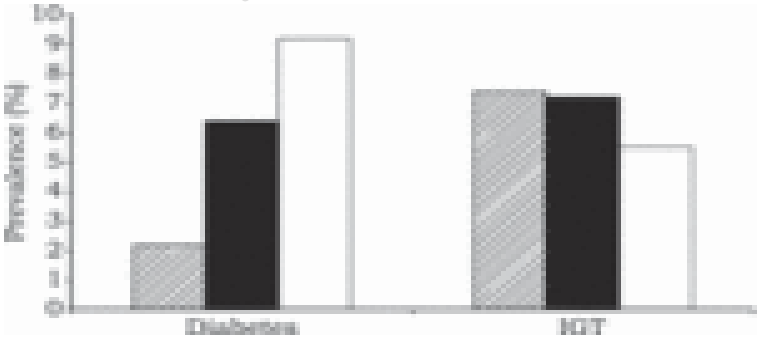

Figure 2. Changing prevalence of diabetes and impaired glucose tolerance (IGT) in rural populations in southern India from 1989 (▨), through 2003 (■), and to 2006 (□).

Impact of urbanization

Urbanization is occurring rapidly on the Indian subcontinent. Lifestyle changes involving major changes in dietary patterns, decreased physical activity due to improved transportation, the availability of energy saving devices, and the high level of mental stress are associated with modernization. Weight gain and decreased energy expenditure contribute further to the existing insulin inertia.

Lifestyle transitions in the rural population have a significant effect on the prevalence of obesity and glucose intolerance.[39,40] The prevalence of diabetes has increased from 2.4% in 1989[14] to 9.3% in 2006.[36] Important risk factors associated with this increase are a lack of physical activity and increased upper body adiposity. Similar observations were reported in Singapore[62] and Malaysia[63] during the stages of urbanization.

National and regional heterogeneity in the occurrence of diabetes may be more strongly related to recent environmental events rather than to genetic factors, which change very slowly.[64] The present generation has easy access to agricultural, industrial, and technological devices that are already developed, unlike older generations. This may explain, in part, the sudden spurt of lifestyle disorders in urban populations in developing countries[1]

Stress factors

The impact of stress, both physical and mental, is very strong on diabetogenesis, especially in those with a strong genetic predisposition.[65]A clinic-based prospective study clearly showed the effect of stress on diabetes.[66] The impact of stress, the lack of physical activity, and unhealthy diet habits are observed frequently among the present, economically thriving, urban professionals.[67] In addition, there is a high prevalence of lifestyle disorders in this group.

Cardiometabolic risk factors

Indians have higher rates of cardiometabolic risk factors, such as abdominal obesity, dyslipidemia (especially low high-density lipoprotein–cholesterol and hypertriglyceridemia), and insulin resistance.[24,36,68–70] The prevalence of abdominal obesity is higher than that of general obesity. The prevalence of cardiometabolic risk factors is strongly associated with obesity, particularly abdominal obesity. These associations explain the high prevalence of metabolic syndrome in the Indian population, as defined by any of the existing criteria. Abdominal obesity and general obesity have been shown to exhibit familial inheritance in the southern Indian population.[71]

A strong association between overweight and the increased prevalence of diabetes was noted.[74,75] Overweight, in turn, was correlated with a lack of physical activity and with a high

socioeconomic background Obesity is one of the major risk factors for diabetes, yet there has been little research focusing on this risk factor across India.[12] Despite having lower overweight and obesity rates, India has a higher prevalence of diabetes compared to western countries suggesting that diabetes may occur at a much lower body mass index (BMI) in Indians compared with Europeans.[12,13] Therefore, relatively lean Indian adults with a lower BMI may be at equal risk as those who are obese.[6] Furthermore, Indians are genetically predisposed to the development of coronary artery disease due to dyslipidaemia and low levels of high density lipoproteins;[14]these determinants make Indians more prone to development of the complications of diabetes at an early age (20-40 years) compared with Caucasians (>50 years) and indicate that diabetes must be carefully screened and monitored regardless of patient age within India.[14]

An upsurge in number of early-onset diabetes cases is also responsible for the development of various diabetic complications due to longer disease duration. A recent international study reported that diabetes control in individuals worsened with longer duration of the disease (9.9±5.5 years),[15] with neuropathy the most common complication (24.6 per cent) followed by cardiovascular complications (23.6 per cent), renal issues (21.1 per cent), retinopathy (16.6 per cent) and foot ulcers (5.5 per cent).[7] These results were closely in line with other results from the South Indian population.[17-21] Poor glycaemic control, a factor that has been observed in the Indian diabetic population,[18] is responsible for micro- and macro vascular changes that present with diabetes, and can predispose diabetic patients to other complications such as diabetic myonecrosis[22] and muscle infarction.[23].

Prevention of diabetes

India needs to implement preventive measures to reduce the burden of diabetes, because it poses a medical challenge that is not matched by the budget allocations for diabetes care. A genetic–environmental interaction leads to the final expression of the disease. Although the genetic component cannot be corrected, many of the environmental factors are modifiable. Obesity, diet, and physical activity are modifiable risk factors. The interaction between diet and exercise influences the body fat pattern, which has a significant role in determining insulin sensitivity. Traditional lifestyles, characterized by a diet including less saturated fat and complex carbohydrates, and greater physical activity may protect against the development of cardiovascular risk factors and diabetes, even in the presence of a potential genetic predisposition.

Conclusions

Diabetes mellitus is reaching potentially epidemic proportions in India. The level of morbidity and mortality due to diabetes and its potential complications are enormous, and pose significant healthcare burdens on both families and society. Worryingly, diabetes is now being shown to be associated with

a spectrum of complications and to be occurring at a relatively younger age within the country. In India, the steady migration of people from rural to urban areas, the economic boom, and corresponding change in life-style are all affecting the level of diabetes. Yet despite the increase in diabetes there remains a paucity of studies investigating the precise status of the disease because of the geographical, socio-economic, and ethnic nature of such a large and diverse country. Given the disease is now highly visible across all sections of society within India, there is now the demand for urgent research and intervention - at regional and national levels - to try to mitigate the potentially catastrophic increase in diabetes that is predicted for the upcoming years.

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