Diabetologia (2001) 44: 1094–1101

Diabetologia

Articles

High prevalence of diabetes and impaired glucose tolerance in India: National Urban Diabetes Survey

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Abstract

Aims/hypothesis. There has been no reported national survey of diabetes in India in the last three decades, although several regional studies show a rising prevalence of diabetes. The aim of this study was to assess the prevalence of diabetes and impaired glucose tolerance in six major cities, covering all the regions of the country.
Methods. Using a stratified random sampling method, 11216 subjects (5288 men; 5928 women) aged 20 years or above, representative of all socio-economic strata, were tested by OGTT. Demographic, anthropometric, educational and social details were recorded using a standard proforma. Physical activity was categorised using a scoring system. Body mass index (BMI) and waist-to-hip ratio (WHR) were calculated. Glucose tolerance was classified using the 2-h values (WHO criteria). Prevalence estimations were made taking into account the stratified sampling procedure. Group comparisons were done by *t*-test or analysis of variance or Z-test as relevant. Univariate and multiple logistic regression analyses were used to study the association of variables with diabetes and impaired glucose tolerance.
Results. Age standardised prevalences of diabetes and impaired glucose tolerance were 12.1% and 14.0% respectively, with no gender difference. Diabetes and impaired glucose tolerance showed increasing trend with age. Subjects under 40 years of age had a higher prevalence of impaired glucose tolerance than diabetes (12.8% vs 4.6%, $p < 0.0001$). Diabetes showed a positive and independent association with age, BMI, WHR, family history of diabetes, monthly income and sedentary physical activity. Age, BMI and family history of diabetes showed associations with impaired glucose tolerance.
Conclusions/interpretation. This national study shows that the prevalence of diabetes is high in urban India. There is a large pool of subjects with impaired glucose tolerance at a high risk of conversion to diabetes. [Diabetologia (2001) 44: 1094–1101]

Keywords Type II diabetes, impaired glucose tolerance, Asian indians, burden of diabetes.

Diabetes epidemiology has had a profound impact on diabetes research, care and prevention in the last two decades [1]. Diabetes and its complications pose a major threat to future public health resources throughout the world [1–3]. Based on a compilation of studies from different parts of the world, the World Health Organisation (WHO) has projected that the maximum increase in diabetes would occur in India [2]. Considering the large population and the high prevalence of diabetes, the burden of diabetes in India could become enormous.

Since the publication of the national survey of diabetes by the Indian Council of Medical Research (ICMR) in 1975, [4] no national study has been reported. Regional studies from various urban areas of

Received: 14 February 2001 and in revised form: 30 March 2001

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Abbreviations: SES, socio-economic strata; WHR, waist-to-hip ratio

India have shown a several fold increase in the prevalence of Type II diabetes in the last two decades [5–13]. However, the variations in the methodologies make comparisons difficult.

The National Urban Diabetes Survey (NUDS) reported here, was carried out by the Diabetes Epidemiology Study group in India (DESI) in six major cities of India, covering all the regions of the country. The guidelines laid down by the World Health Organisation (WHO) for epidemiological studies in diabetes [14] have been followed.

Subjects and methods

The survey was done between January and August 2000. Sample selection for each city was done by the Operation Research Group (ORG), an organisation for social research, a division of Operation Research Group-Market and Research Group (ORG-Marg), India and the screening was also done by their staff members who were trained at the Diabetes Research Centre, Madras, India. They were taught to measure the anthropometric variables by standard procedures, to administer the glucose load to the study subjects and to collect the blood samples at appropriate times. They were trained to fill in the proforma by asking appropriate questions to the study subjects. Inter observer coefficient of variance for the measurements were < 5 %. From each city, a representative sample was selected. The sample size varied from 1500 to 2500, depending on the population size, and the total targeted sample size for the 6 cities was 12500. In each city, the sample population was drawn so as to get a fair representation of all the socio-economic strata (SES), the details of which were available from the Indian Readership survey for each city which is based on Indian census. The SES were determined based on the educational and occupational status. The city was divided into wards based on the electoral list. After selecting a random number and sampling interval, the sampling areas were selected. Households in these areas were randomly selected (every second household). From each selected house, one member was chosen using a random table to ensure no selection bias. This procedure was used till the total sample for each city was reached.

The screening was done by a house to house visit. The proforma containing the details of demography, anthropometry, medical history, educational and social details including monthly family income, occupation, educational status and physical activity levels was ascertained by personal interview. Height and weight were measured and BMI was calculated (wt in kg/ht in m^2). Waist and hip measurements were made and waist-to-hip ratio (WHR) was calculated by standard procedures reported previously [7, 8]. The cutoff values for normal were derived from the non-diabetic, healthy southern Indians as mentioned in an earlier study [7]. A scoring system was used to quantify the physical activity, from the levels of activity at work and during leisure time. To reduce the number of categories, unemployed and retired subjects were combined in one group and housewives and students in another as the activity levels at work in the combined groups were similar.

Fasting and 2-h-postprandial blood glucose were measured in known cases of diabetes. All other subjects underwent an OGTT, after an overnight fasting. Fasting and 2-h-post glucose blood concentrations of glucose (75 gm anhydrous glucose load) were measured in capillary blood using "One-touch" glucose meter (Life scan Johnson and Johnson, Mumbai, Maharashtra, India). Quality control check on the blood glucose measurement was done by measuring the 2-h plasma glucose values with glucose oxidase peroxidase method in every tenth case, in a reference laboratory which adopted regular quality control measures. The correlation between the two glucose measurements was calculated using Pearson correlation method. The regression equation was as follows: glucometer reading = $4.33 + 0.95 \cdot$ plasma glucose, $r = 0.91$, $p < 0.0001$. In all the cities, the correlation between the laboratory and glucometer values was 0.9 or higher.

Categorisation of glucose tolerance was made on the basis of the 2-h values obtained at the test site, using the WHO criteria [14].

Statistical analysis. Prevalence estimations for the total population and for each city have been age and gender standardised taking into account the special, stratified sampling scheme. Prevalence of diabetes and impaired glucose tolerance (IGT) in all groups were age-standardised to the urban population of India using the latest available census data (1991) and the direct standardisation method. The population statistics were provided by the census department of India. Prevalence in each city was standardised for age and gender using the census data for the urban Indian population. Weighted mean of the six city specific prevalence within respective age and gender stratum with weights according to the proportion of city-specific sample size to the total number of subjects in each social stratum has been used for calculating age and gender standardised prevalence. Prevalence data for IGT and diabetes stratified by income, occupation and physical activity were also standardised for age and gender on similar lines.

The Z test was used to compare the prevalence within groups categorised according to age, occupation, physical activity and monthly family income. To compare group means, Student's *t*-test was done and the *p* value was adjusted for multiple comparisons by Bonferroni correction method.

In logistic regression analyses, odds ratios (OR) were calculated taking the stratified sampling design into consideration.

Considering the possible interaction of the variables with age and gender, association of each variable with diabetes and IGT was tested independently after correcting for age and gender by univariate logistic regression models. In the multiple logistic regression analyses using diabetes or IGT as the dependent variable, interactions between physical activity and other independent variables were also tested. Independent variables were age, gender, BMI, WHR, family income, occupation, family history of diabetes and physical activity. In the regression analyses, the units used for categorisation were : age in 10 units, BMI in 2 units, WHR in 0.05 units, income in units of rupees 5000. Physical activity scores were in quartiles, the first quartile being sedentary. Quartile 4 (heavy) was used as the reference category. A *p* value of less than 0.05 was considered significant.

Statistical analyses were done using Stata version 6.0 package. [Stata Corporation, Stata Press, Tex, USA)

Results

A total of 11216 subjects out of the 12500 chosen, (5288 men and 5928 women) were studied in the six cities. The response rate was 89.7 %. The demographic and anthropometric variables were similar in the responders and non-responders with respect to the age, BMI and the SES distribution. Table 1 shows the prevalence of IGT and diabetes in the total group

Table 1. Prevalence (%, with 95% confidence intervals in parentheses) of diabetes and IGT in the urban population in India (Total 11216; M:F 5288:5928)

	Diabetes			IGT		
	No. of cases	Prevalence[a]	Age-std[b]	No. of cases	Prevalence[a]	Age-std[b]
Total (n = 11216)	1684	13.9 (13.2–14.6)	12.1 (11.5–12.7)	1631	14.4 (13.7–15.1)	14.0 (13.3–14.8)
Men (n = 5288)	813	13.8 (12.8–14.8)	12.5 (11.6–13.4)	776	14.6 (13.5–15.6)	14.0 (13.0–15.0)
Women (n = 5928)	871	14.0 (13.0–14.9)	11.9 (11.1–12.7)	855	14.3 (13.4–15.3)	14.1 (13.1–15.1)

Age-std. – Age standardised
[a] Estimated taking into account the stratified sampling procedure
[b] Age-standardised using the urban Indian population

Table 2. Age- and gender-specific prevalence of Type II diabetes and IGT

Age group (years)	Total group				Diabetes				IGT			
	Diabetes		IGT		Men		Women		Men		Women	
	n	%	n	%	n	%	n	%	n	%	n	%
20–29	60	2.4	301	11.5	31	2.3	29	2.4	139	10.7	162	12.2
30–39	212	7.0	400	14.6	98	7.3	114	6.8	171	13.8	229	15.3
40–49	441	16.5	381	15.4	211	16.0	230	16.9	195	17.0	186	14.1
50–59	463	26.3	248	14.6	217	25.2	246	27.3	125	16.1	123	13.3
60–69	364	29.1	194	16.4	179	31.1	185	27.6	91	16.7	103	16.2
> 69	144	25.9	107	19.3	77	26.3	67	25.5	55	19.2	52	19.4

Estimated taking into account the stratified sampling procedure

Table 3. Age at diagnosis of diabetes (new and known cases)

Age group (years)	Total group		Men		Women	
	n	%	n	%	n	%
20–29	91	5.4	44	5.4	47	5.4
30–39	332	19.7	166	20.4	166	19.1
40–49	488	29.0	230	28.3	258	29.6
50–59	452	26.8	208	25.6	244	28.0
60–69	233	13.8	120	14.8	113	13.0
> 69	85	5.0	42	5.2	43	4.9

(IGT 14.0%, diabetes 12.1%) and also in men and women separately. Gender differences were not seen in the prevalences of IGT and diabetes. Of the diabetic patients 69.8% were known cases with records of treatment.

Age and gender specific prevalences of diabetes and IGT are shown in Table 2. Prevalence of diabetes increased with age and a maximum prevalence was seen in the patients between 60 and 69 years of age. Maximum prevalence of IGT was found in the age group over 69 years. The prevalence of IGT was significantly higher than that of diabetes in subjects under 40 years of age (IGT 12.8% vs diabetes 4.6%, $p < 0.01$). In the age group of 20–39 years 12.8% of the patients had IGT and the prevalence of diabetes was 4.6% ($p < 0.0001$). In the older age group (i.e. 40 years or more) prevalence of diabetes was higher (IGT 16.0%, diabetes 23.8%, $p < 0.0001$).

Table 3 shows the age at diagnosis for the total diabetic group. The maximum number of cases were diagnosed in patients between 40 and 59 years of age with no significant difference between the genders.

Positive family history of diabetes was reported in 1896 subjects (16.9%). Age and gender adjusted prevalence of diabetes was significantly higher in those with the family history (28.1%) than in those without family history (11.4%) ($p < 0.0001$) (Table 4). Age and gender adjusted prevalence of IGT was similar in both groups. (IGT 14.6% and 13.8% respectively) (Table 4).

There was a rising trend in the prevalence of diabetes with increasing family income (Table 4). When categorised according to occupation, the maximum prevalence of diabetes was found among the unemployed and retired subjects (Table 4).

Table 4. Prevalence of diabetes and IGT in relation to family history, monthly family income, occupation and physical activity

	Total	IGT[a]		Diabetes		Intra-group differences in diabetes *p* value
		n	%	*n*	%	
Family history						
Negative	9311	1374	14.6	1135	11.4	< 0.0001
Positive	1896	257	13.8	541	28.1	
Income (rupees)						
≤ 5000	8001	1161	14.5	1029	12.5	< 0.001
5001–10000	2644	398	14.6	522	18.5	2 ,3 vs 1
> 10000	571	72	11.7	133	21.6	
Occupation						
Unskilled	1038	145	14.4	110	10.6	< 0.001
Skilled	1254	179	14.2	118	9.6	3,4,5 vs 1
Office jobs	2579	380	14.7	427	15.5	< 0.0001
Housewife/						3,4,5 vs 2
students	5389	773	14.2	785	13.8	< 0.0001
Unemployed/retired	952	154	15.6	242	22.5	3,4 vs 5
Physical activity						
Sedentary	3664	541	14.3	658	16.8	< 0.02
Light	2025	277	13.9	290	13.5	2,3 vs 4
Moderate	2776	437	15.6	413	13.2	< 0.0001
Heavy	2751	376	13.8	323	11.0	1 vs 4

All percentages are age and sex adjusted (*Z* test was used for group comparison)
[a] No significant differences in IGT between the groups

Table 5. Characteristics of the study subjects in relation to glucose tolerance

	NGT	IGT	Diabetes
M:F (*n*)	7 901,3699:4202	1631,776:855	1684,813:871
Means, SEM			
Age (years)	39.1, 0.17	43.0,0.40[a]	51.2,0.34[a,b]
BMI (kg/m^2)			
Men	21.9,0.07	22.9,0.18[a]	24.4,0.18[a,b]
Women	23.0,0.08	24.5,0.20[a]	25.7,0.20[a,b]
WHR			
Men	0.88,0.001	0.90,0.002[a]	0.92,0.002[a,b]
Women	0.84,0.001	0.85,0.003[a]	0.87,0.002[a,b]

[a] $p < 0.001$ vs NGT
[b] $p < 0.001$ vs IGT

Prevalence of diabetes was significantly lower in the higher quartiles of physical activity, (16.8 %, 13.5 %, 13.2 % and 11.0 % respectively, $p = 0.02$).

Table 5 shows the age and anthropometric details in the study group, according to the glucose tolerance status. Subjects with diabetes were older, had higher BMI and WHR compared with NGT and IGT ($p < 0.001$ in all cases). Subjects with IGT were older and had higher BMI compared with NGT ($p < 0.001$).

A BMI of 25 kg/m^2 or more was seen in a total of 3453 (30.8 %). There was an increasing prevalence of obesity with increasing degree of glucose intolerance (diabetes > IGT > NGT, 46.8 %, 36.4 %, 26.2 % respectively, trend $\chi^2 = 303.4$, $p < 0.0001$). Higher WHR (≥ 0.9 in men and ≥ 0.85 in women) was seen in a total of 5637 (50.3 %) patients; the prevalences were 46.7 %, 51.9 % and 65.2 % in NGT, IGT and diabetes respectively (Trend $\chi^2 = 157.2$, $p < 0.0001$). Higher WHR was more common than general obesity (50.3 % vs 30.8 %, $\chi^2 = 881$, $p < 0.0001$).

Univariate logistic regression analysis using diabetes as the dependent variable in which age and gender were force entered and each independent variable was tested separately (Table 6). The variables BMI, WHR, income, a positive family history of diabetes and subjects with office jobs showed a significant association with diabetes. A similar analysis with IGT as the dependent variable showed that only BMI and a positive family history of diabetes had significant associations.

Table 7 shows the association of independent variables with diabetes and IGT, in multiple logistic regression analyses. Age, BMI, WHR, monthly income, a family history of diabetes, retired and unemployed category of occupation and a sedentary lifestyle showed significant associations with diabetes. Age, BMI and family history of diabetes showed associations with IGT. Interaction of physical activity with age and monthly income were not significant in either analyses (data not shown).

The age and gender adjusted prevalences of diabetes and IGT in each of the six cities studied is shown in Table 8. Hyderabad, in southern India, showed the highest rates of diabetes and IGT. ($p < 0.001$ compared with all cities other than Chennai, for both). In Chennai (formerly Madras), Bangalore and Hyderabad, in southern India and in Mumbai, the prevalences of IGT were higher than the prevalences of diabetes.

Table 6. Univariate logistic regression analysis: adjusted for age and gender

Dependent variable	Diabetes		IGT	
	Odds ratio	*p* value	Odds ratio	*p* value
BMI (kg/m^2)	1.15 (1.13–1.17)	< 0.0001	1.07 (1.05–1.09)	< 0.001
WHR	1.31 (1.25–1.38)	< 0.0001	1.04 (1.00–1.09)	0.075
Monthly income (rupees)	1.43 (1.30–1.57)	< 0.0001	1.01 (0.91–1.12)	0.842
Family history of diabetes	3.55 (3.08–4.08)	< 0.0001	1.26 (1.07–1.49)	0.005
Occupation				
Skilled	1.05 (0.77–1. 41)	0.767	1.02 (0.79–1.30)	0.894
Office job	1.53 (1.20–1.96)	0.001	1.09 (0.87–1.35)	0.458
Housewives	1.28 (0.93–1.76)	0.126	1.04 (0.80–1.35)	0.793
Unemployed	1.04 (0.78–1.39)	0.795	1.00 (0.76–1.31)	0.999
Physical activity				
Moderate	1.12 (0.93–1.34)	0.228	1.15 (0.97–1.36)	0.103
Light	1.13 (0.90–1.42)	0.287	1.02 (0.82–1.27)	0.839
Sedentary	1.10 (0.89–1.36)	0.353	1.00 (0.82–1.22)	0.992

Occupation: category 1 (unskilled) was the reference; physical activity: quartile 4 (heavy) was the reference. Values in parentheses are 95 % confidence intervals

Discussion

Reports from different parts of India have suggested a rising trend in the prevalence of diabetes [5–13]. Serial epidemiological studies conducted in the southern Indian city of Chennai showed a steady increase in the prevalence of diabetes in the urban population [5–8]. However, it was not clear whether this applied to other cities as there were no such reports from other parts of India. This national study has shown that the prevalence is uniformly high in all urban regions of this vast country. In addition, the prevalence of IGT is also high, indicating the potential for a further increase in the number of diabetic patients. An interesting observation made in the study was that in Hyderabad, a southern Indian city, the prevalence of IGT and diabetes was very high. Although the distribution characteristics of the populations from all the cities appeared to be comparable, minor differences in socio-economic factors might have been present. This possibility is being analysed separately. Gender differences were absent in the prevalence of diabetes and IGT. The major risk factors associated with diabetes were similar to the observations in various earlier reports [5–13].

Socio-economic, behavioural, nutritional and public health issues have led to increases in Type II diabetes, obesity and cardiovascular disease (CVD) in several nations [1, 15]. Due to the common pathogenic mechanisms underlying diabetes and CVD, a concomitant increase is often seen in the prevalence of both the diseases [1].

Asian Indians have an ethnic susceptibility to Type II diabetes [16, 17] and a high familial aggregation of the disease [18, 19]. In ethnic groups such as the Naruans with high prevalence of Type II diabetes, a plateau seems to have been reached [20]. But Asian Indians seem to be currently experiencing an increasing trend as shown in the native Indians in this study and in the migrant Indians in Singapore [21]. In Singapore it was found that the greatest increase in diabetes occurred in the Indian ethnic group (8.9–12.7 %) between 1984 and 1992 [21]. Investigators have predicted that India will have the greatest increase in diabetes and will have the largest number of diabetic patients in the world on the basis of current data from different parts of the world [2]. The estimated prevalence of diabetes in this study seems to corroborate these projections.

All previous studies have shown a lower prevalence of IGT than diabetes. In this study, the prevalence of IGT was either similar or higher than that of diabetes in the Indian cities. The ratio between diabetes and IGT is considered to be an index of the epidemic state in the population [22]. The high preva-

Table 7. Multiple logistic regression analysis

Dependent variable	Diabetes		IGT	
	Odds ratio	*p* value	Odds ratio	*p* value
Age (years)	1.78 (1.70–1.87)	< 0.0001	1.20 (1.15–1.25)	< 0.0001
Gender	0.99 (0.75–1.31)	0.940	1.08 (0.86–1.36)	0.481
BMI (kg/m^2)	1.13 (1.11–1.15)	< 0.0001	1.07 (1.05–1.09)	< 0.0001
WHR	1.22 (1.15–1.28)	< 0.0001	1.00 (0.95–1.05)	0.974
Monthly income (rupees)	1.16 (1.05–1.30)	0.005	0.95 (0.86–1.06)	0.377
Family history of diabetes	3.09 (2.66–3.56)	< 0.0001	1.19 (1.01–1.41)	0.044
Occupation				
Skilled	0.88 (0.64–1.19)	0.401	1.01 (0.78–1.29)	0.962
Office jobs	1.07 (0.83–1.40)	0.588	1.03 (0.83–1.29)	0.781
Housewives	0.70 (0.45–1.07)	0.102	1.05 (0.74–1.49)	0.778
Unemployed	0.61 (0.41–0.92)	0.019	1.09 (0.76–1.55)	0.644
Physical activity				
Moderate	1.26 (1.03–1.53)	0.24	1.14 (0.96–1.36)	0.141
Light	1.65 (1.14–2.40)	0.008	0.99 (0.72–1.37)	0.969
Sedentary	1.75 (1.22–2.51)	0.002	1.00 (0.74–1.35)	0.983

Occupation: category 1 (unskilled) was the reference; Physical activity: quartile 4 (heavy) was the reference. Values in parentheses are 95 % confidence intervals

Table 8. Age- and gender-standardised prevalence % of diabetes and IGT in six Indian cities, with 95 % confidence interval in parentheses

	Chennai	Bangalore	Hyderabad	Calcutta	Mumbai	New Delhi
n	1668	1359	1427	2378	2084	2300
M:F	708:960	638:721	685:742	1163:1215	987:1097	1107:1193
Diabetes %	13.5 (11.8–15.2)	12.4[b] (10.5–14.3)	16.6 (14.6–18.6)	11.7[a,b] (10.4–13.0)	9.3[a,b,c] (7.7–10.1)	11.6[a,b] (10.3–12.9)
IGT%	16.8[b,f] (14.6–19.0)	14.9[b,f] (12.8–16.9)	29 .8[f] (26.9–32.8)	10.0[a,b,d] (8.7–11.4)	10.8[a,b,d] (9.3–12.2)	8.6[a,b,d,e,f] (7.4–9.7)

$p < 0.001$
[a] vs Chennai, [b] vs Hyderabad, [c] vs New Delhi, [d] vs Bangalore, [e] vs Calcutta, [f] vs Mumbai

lence of IGT suggested that along with the conversion of IGT to diabetes there was a possible replenishment of the IGT pool by conversion of "normal susceptibles" to IGT [23]. This could be a possible predictor of future increase in diabetes in this population. A higher rate of IGT than diabetes in the younger age group (< 40 years) is not only a warning sign of the impending risk of conversion to diabetes with ageing but also indicates a high risk of glucose intolerance in the population even among the young.

The earlier reports from Chennai had shown a male preponderance in the prevalence of diabetes which in subsequent years had shifted slightly towards a female excess [5–7]. In our study, we found that both genders had similar prevalence of diabetes. Investigators predicted that there would be a decrease in the male excess in India and a worldwide reduction in the female-to-male excess by the year 2025 [2]. On the basis of these changes in the prevalence of diabetes in Chennai, it had been projected that

14.6% of the adult population would have Type II diabetes by the year 2000 [16]. Our finding of a prevalence of 13.5% in 2000 has, to some extent, confirmed this prediction.

A consistent association of BMI and upper body adiposity with diabetes has been shown in the Indian population although the latter has a lean body mass index compared with several western populations [6–12]. Probably, the healthy range of BMI for an Indian would be much lower than 25 kg/m^2. A minimal rise in the BMI would act adversely in a subject with a genetic susceptibility to diabetes [24].

The susceptibility of the urban Indians to central adiposity was highlighted in this study. There was a larger proportion of subjects having higher WHR (50.3%) compared with the population with increased BMI (30.8%). Studies in India had shown that central obesity was more strongly associated with glucose intolerance than generalised obesity [6, 7, 25]. Lean Asian Indians had WHR values similar to the Mexican Americans with higher rates of BMI [26]. Prevalence of diabetes in age adjusted ranges of WHR did not differ significantly between the two groups [26]. This could indicate that Asian Indians have a predisposition to deposit abdominal fat which could be one of the risk factors contributing to the high prevalence of diabetes. Studies in the UK and in the USA have shown that Asian Indians were insulin-resistant despite having BMI that were non-obese, an observation which could probably be related to a high percentage of visceral fat [27, 28]. The higher prevalence of diabetes in Asian Indians than in the white population might be partly related to the above feature.

One of the major observations of this study had been the low amount of physical activity in the urban population of India. Increasing urbanisation tends to lead to lower physical activity worldwide [29]. The impact of urbanisation and its influence on life-style has been shown in an earlier study [8].

A younger age at onset of diabetes had been noted in Asian Indians in several studies [6, 7]. In our study, onset of diabetes occurred before the age of 50 years in 54.1% of cases, implying that these subjects developed diabetes in the most productive years of their life and had a greater chance of developing the chronic complications of diabetes.

This national survey has shown that the prevalence of diabetes and IGT are high in the urban Indian population. The higher prevalence of IGT is probably an indicator of a further rise in prevalence of diabetes in the years to come.

Acknowledgements. We are thankful to Novo Nordisk Education Foundation for their financial support. We thank the staff of ORG-MARG Research and Diabetes Research Centre who conducted the enumeration and screening tests. We are grateful to Dr. S.P. Chandrasekharan, Lifescan, Johnson and Johnson Company, India for the generous supply of the One-Touch glucometer and test strips for the survey. We thank the laboratories in Bangalore, Hyderabad, Mumbai, Calcutta and New Delhi for having conducted the quality control tests. Secretarial assistance of Ms. Uma is acknowledged.

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