

Prevalence and Risk Factors of Diabetes Mellitus among Adults residing in Field-Practice area of B. J. Medical College, civil hospital, Ahmedabad

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Abstract

Background & Aims: The worldwide prevalence of Diabetes Mellitus (DM) has risen dramatically in the developing countries over the past two decades. Diabetes Mellitus is emerging as a major health-care challenge for India. So the aim of this study is to determine the prevalence of Diabetes Mellitus among the adult population > 30 years of age and to assess the risk factors of Diabetes Mellitus. **Materials and Method:** This was a population-based cross-sectional study carried out in the urban field practice area of tertiary care medical teaching institute in Ahmedabad, Gujarat. Simple random sampling technique was used for the selection of 1900 adults, 30 years of age and above. Main outcome measures were the assessment of the prevalence of Diabetes Mellitus and correlates of Diabetes Mellitus. A Predesigned and pretested questionnaire was used to elicit the information on family and individual socio-demographic variables. Height, weight, waist circumference, hip circumference, blood pressure were measured and venous blood was also collected to measure fasting and postprandial blood glucose. **Results:** Overall the prevalence of DM was 20.0% with known DM being 6.2% of study population and undiagnosed DM being 13.8% subjects. Significant association was seen between prevalence of DM and age, Obesity and Hypertension. **Conclusion:** It was observed that every 5TH study subject is having Diabetes Mellitus. Adults with age >40 years, Obesity and Hypertension, belonging to middle/ high class are more likely to develop Diabetes Mellitus. Also family history of Diabetes & sedentary lifestyle were seen as risk factors. **Keywords:** Diabetes Mellitus, Fasting glucose level, Obesity, Hypertension.

Introduction

Diabetes Mellitus (DM) is a global epidemic in this millennium. Colagiuri et al¹ reported that the highest increase in Diabetes Mellitus prevalence is amongst low and middle-income countries, predominantly within the 40-59 years age group, although a tendency is seen for onset at a younger age. According to WHO², 80% of Diabetes deaths occur in low and middle income countries. Danaei et al³ reported that globally, as of 2013, an estimated 347 million people had Diabetes Mellitus. Diabetes Mellitus occurs throughout the world, but is more common (especially Type 2) in the more developed countries. According to Wild S et al⁴ the greatest increase in prevalence is, however, expected to occur in Asia and Africa, where most patients will probably be found by 2030. The increase in incidence in developing countries follows the trend of urbanization and 1 diabetic subjects in the year 2013 which is more than

7.1% of India's adult population. An estimate shows ifestyle changes, perhaps most importantly a "Western-style" diet.

Diabetes Mellitus is emerging as a major health-care challenge for India. According to the International Diabetes Federation (IDF) estimates, India had 62 million that nearly 1 million Indians die due to Diabetes Mellitus every year. Gale J et al⁵ reported that the average age of onset is 42.5 years. The early identification of at-risk individuals and appropriate intervention to increase physical activity & changes in dietary habits could to a great extent help in preventing/ delay the onset of Diabetes Mellitus and thus reduce the burden due to its associated complications in India. There is also a need to improve knowledge and awareness about Diabetes Mellitus in Urban areas through various IEC activities.

The present study was undertaken to determine the prevalence and the risk factors of Type-2 Diabetes Mellitus among the adult population residing in the urban field practice area of B. J. Medical College, Civil Hospital, Ahmedabad.

Materials and Method

Population based cross sectional study was carried out in the urban field practice area of B. J. Medical College, Civil Hospital, Ahmedabad from August 2019 to March 2020 among 1900 adults, 30 years of age and above. The prevalence of Diabetes Mellitus among adults in India varies from 9.0% to 16.9%. Thus considering a prevalence of Diabetes Mellitus as 11.0%, a sample size of 809 was calculated. This sample size was increased to 1900 in order to make it more representative and to compensate for the design effect. A complete list of all individuals more than 30 years of age in field practice area was obtained with their addresses. Subjects were selected from urban area by simple random sampling using random number tables. The data collection tool used for the study was an interview schedule that was developed at the institute with the assistance of faculty members. This questionnaire was tested for appropriateness by conducting a pilot study and modifications were made. Questionnaire included information regarding age, sex, education, occupation, diet, smoking, alcoholism and family history of the disease. All the participants were explained about the nature and purpose of the study and were ensured strict confidentiality. Written informed consent was taken from each of them before the total procedure. No non-response was reported. Anthropometric measurements of every study subject were taken i.e. weight, height, waist circumference & hip circumference. Blood pressure reading of all the subjects was also recorded. The participants were then requested to remain fasting (for at least 8 hrs) on next morning for venous blood sample collection. After collection of fasting blood in fluoride vial they were given 75 gm of oral glucose and post-prandial blood sample was collected in fluoride vial after 2 hrs. The blood samples were transported to Urban health centre lab for blood glucose estimation (glucose-oxidase-peroxidase method). If a known case of Diabetes Mellitus on treatment came to be selected it was subjected to only fasting blood sugar estimation to see if blood glucose levels were controlled. Repeat testing was done on a different day for those study subjects whose FBS levels were in diabetic range and pre-diabetic range. Newly diagnosed cases of Diabetes Mellitus were referred to respective health centres and started on treatment. For pre-diabetes, suggestions were given regarding physical activity, weight reduction, control of blood pressure and repeat FBS levels once a year.

Criteria:

1. Symptoms of Diabetes plus casual plasma glucose concentration ≥ 200 mg/dl (11.1mmol/l). Casual is defined as any time of day without regard to time since last meal. The classic symptoms of Diabetes include polyuria, polydipsia and unexplained weight loss. OR 2. FPG ≥ 126 mg/dl (7 mmol/l). Fasting is defined as no calorie intake for at least 8 hours. OR 3. 2-h post load glucose ≥ 200 mg/dl (11.1mmol/l) during an OGTT. The test should be performed as described by W.H.O, using a glucose load containing an equivalent of 75 gms anhydrous glucose dissolved in water. Collected data was thoroughly checked and a database was created in MS Excel spreadsheets and analysis was carried out.

Results

The study population included 974 (51.3%) study subjects in 20-39 years of age group and 936 (48.7%) of study subjects in ≥ 40 years of age group. 850 (44.7%) were males and 1050 (55.3%) were females. As regards marital status, majority i.e. 1516 (79.8%) of study subjects were married. By religion, 1096 (57.7%) were Hindu. 58.8% study subjects were unemployed (including housewives) and 30.9% were professionals or skilled. Regarding the education status, 552 (29.1%) were matric pass while only 176 (9.3%) were illiterate. Regarding SES, 620 (32.6%) of the study subjects were belonging to class IV and only 98 (5.2%) belonged to class I (modified BG Prasad classification of socioeconomic status) (Table 1).

Table 1: Distribution of study subjects according to socio-demographic profile

Characteristics	Category	Frequency (Percentage %)
Age	31-40 years	974(51.3)
	>40 years	926(48.7)
Sex	Male	850(44.7)
	Female	1050(55.3)
Marital status	Unmarried	260(13.7)
	Married	1526(79.8)
	Separated/ widowed	122(6.5)
Religion	Hindu	786(41.4)
	Sikh	1096(57.7)
	Muslim	18(0.9)
Occupation	Professional	588(30.9)
	Semi-professional	194(10.2)
	Unemployed	1118(58.8)
Education	Illiterate	176(9.3)
	Primary	32(16.9)
	Middle	334(17.6)
	Matric	552(29.1)
	Higher secondary	270(14.7)
	Graduate	180(9.5)
	Post-graduate and above	54(2.9)
Socio-economic class	Class I	98(5.2)
	Class II	346(18.2)
	Class III	542(28.5)
	Class IV	620(32.6)
	Class V	294(15.5)

In the present study it was observed that out of total 1900 study subjects, 190 (20.0%) study subjects were found to be Diabetic. Among these 190 diabetic cases, 58 (6.2%) were known/ old cases of Diabetes Mellitus and 132 (13.8%) were newly diagnosed Diabetes Mellitus cases (Table 2).

Table 2: Prevalence of Diabetes Mellitus among study subjects

Status	Frequency	Percentage (%)
Diabetics		
Old cases	58	6.2
New cases	132	13.8
Total diabetics	190	20.0
Non-diabetics	1710	80.0
Total subjects	1900	100

Table 3 :Association between DM and risk factor among study subjects.

Risk – factor	Category	Total	Diabetics (N=190) N (%)	Non Diabetics(N = 1710) N (%)	Chi square	p value
Age	31-40	974	36(3.69)	938(96.3)	88.24	p = 0
	>40	926	154(17.7)	772(82.3)		
Sex	Male	850	86(10.11)	764(89.9)	0.024	p = 0.8
	Female	1050	104(9.9)	946(90.1)		
Socio-economic status	Low	914	74(8.1)	840(91.9)	7.09	p = 0.007
	Middle/high	986	116(11.8)	870(88.2)		
Diet	Veg.	1532	166(10.8)	1366(89.2)	6.13	p = 0.01
	Non veg	368	24(6.5)	344(93.6)		
Smoking	Current user	18	04(22.22)	14(77.8)	3.016	p = 0.08
	Non user	1882	186(10)	1696(90)		
Alcohol	Current user	184	24(13.04)	160(86.96)	2.09	p = 0.14
	Non user	1716	166(9.67)	1550(90.33)		
Family history	No	1522	132(8.7)	1390(91.3)	17.09	p = 0.00003
	Yes	364	58(16)	306(84)		
Obesity	Non-obese	658	32(4.86)	626(95.14)	29.51	p = 0.04
	Obese	1242	158(12.7)	1084(87.3)		
WHR (waist hip ratio)	Normal	862	66(7.65)	796(92.35)	12.48	p = 0.0004
	>Normal	978	124(12.7)	854(87.3)		
WC (waist circumference)	Normal	984	74(7.52)	910(92.5)	13.94	p = 0.0001
	>Normal	916	116(12.7)	800(87.3)		
Physical activity	Sedentary	1614	148(9.17)	1466(90.83)	0.109	p = 0.74
	Moderate/ Heavy	484	42(8.7)	442(91.3)		
Blood pressure	Normotensive	1262	52(4.12)	1210(95.9)	144.35	p = 0
	Hypertensive	638	138(21.6)	500(78.4)		

The prevalence of Diabetes Mellitus was higher (17.7%) in persons aged > 40 years than in persons aged between 20 and 39 years (3.7%). Diabetes was seen to be more prevalent among males, middle/ high SES (11.8%), having sedentary occupation (9.17%), vegetarians (10.8%), alcohol users (13.04%), smokers (22.22%), having family history of diabetes mellitus (16%), obesity (12.7%), with higher waist–hip ratio (12.7%). Diabetes was associated with 21.6% of hypertensive participants. Prevalence of Diabetes was significantly associated with age, socio-economic status, diet, family history of diabetes, Obesity, waist hip ratio, waist circumference, and Hypertension. Overall, 190 (20.0%) study subjects had fasting venous blood glucose level > 126 mg/dl.

Discussion

Our study reflects the correlates of Diabetes Mellitus among 1900 adults 30 years of age and above in Urban Field practice area of a B. J. Medical college, Civil Hospital, Ahmedabad.

The present study revealed that the total prevalence of Diabetes Mellitus was 20.0%. Similar results were obtained by ICMR-INDIAB study (phase I),⁶ a population based study conducted in three states i.e.

Maharashtra, Tamilnadu, Jharkhand and one union territory- Chandigarh. The prevalence of Diabetes Mellitus was 10.4% in Tamilnadu, 8.4% in Maharashtra and 13.6% in Chandigarh. National Urban Diabetes Survey⁷ reported the prevalence of Diabetes Mellitus in urban population as 12.1%.

Out of 190 diabetic subjects, 154 (81.1%) diabetics were in the age group of >40 years and only 36 (18.9%) diabetics were in the age group of 30 to 49 years. Mohan et al⁸ reported that prevalence of Diabetes Mellitus increased with increase in age until 70 years. The present study revealed that the prevalence of Diabetes Mellitus was more in males than females. Krentz et al⁹ reported that the prevalence was higher in females. In the present study, according to modified BG Prasad classification of socio-economic status, higher prevalence of Diabetes Mellitus was reported from middle/ high class as compared to low class. This is supported by study of Bhatti et al¹⁰ which reported that the prevalence of Diabetes Mellitus among higher, middle and lower SES group was 21.49%, 66.7% and 12.25% respectively. The present study revealed that the prevalence of Diabetes Mellitus was high among vegetarians (10.8%) as compared to those having mixed diet. In contrast to this, Liu S et al¹¹ found that high intake of green leafy or dark yellow vegetables were associated with reduced risk of Diabetes Mellitus. In our study, there was higher prevalence of diabetes among smokers compare to non-smokers. This difference was not statistically significant. In similar to this, Solberg L et al¹² in his study had linked smoking with increasing insulin resistance which later on induces full blown Diabetes Mellitus. 24 (13.04%) diabetic subjects were current users of alcohol and 166 (9.67%) diabetic subjects were ex-users/non-users of alcohol. Same as, Kao et al¹³ found that high alcohol intake increases Diabetes Mellitus risk (OR=1.5, 95% CI =1.02, 2.2) among men who drank >21 drinks / week when compared with men who drank ≤1 drink / week. The present study revealed that out of total 190 diabetics, 132 (8.7%) diabetic subjects were having no family history of Diabetes and 58 (16 %) were having family history of Diabetes. This difference was statistically significant. Similar result reported by Scott AR et al¹⁴ found that the greatest risk of Diabetes Mellitus was observed in those with a biparental history of Type 2 Diabetes Mellitus (HR=5.14, 95% C.I. 3.74, 7.07) and those whose parents have been diagnosed with Diabetes Mellitus at a younger age (<50 YRS; HR=4.69, 95% C.I. 3.35, 6.58).

The present study showed significant association ($p < 0.05$) between Obesity and Diabetes Mellitus in populations with BMI more than normal i.e. ≥ 25 kg/m². Out of 190 diabetic subjects, 158 (12.7%) diabetics were having raised BMI i.e. ≥ 25 kg/m² and 32 (4.86%) diabetics were having with BMI in normal range i.e. 18.5-24.9 kg/m². The Chennai urban population study¹⁵ reported that prevalence of Diabetes Mellitus in subjects with abdominal Obesity was high (27.8%) as compared to those without abdominal Obesity (9.0%). Out of 190 diabetic subjects, 116 (12.7%) diabetics were having waist circumference more than normal (>102 cm in males and >88 cm in females) and 74 (7.52%) diabetics were having normal waist circumference. Similarly, 134 (12.7%) diabetics were having waist-hip ratio more than normal (>1.0 in males and >0.85 in females) and 66 (7.65%) diabetics were having normal waist-hip ratio. Bhatti JS et al [10] had observed that the North Indian diabetic patients had pronounced abdominal adiposity as evident by their significant higher waist circumferences (37.01±4.3 in patients vs. 35.2±4.3 in controls; $p = 0.000$) and higher waist-hip ratio (0.97±0.07 in patients vs. 0.94±0.08 in controls; $p = 0.000$). Physical inactivity is an independent factor in triggering the epidemic of Diabetes Mellitus. Out of 190 diabetic subjects, 148 (9.17%) diabetics were having sedentary lifestyle and only 42 (8.7%) diabetics were having moderate physical activity. Xu f et al¹⁶ in his study found that compared to those participants with insufficient physical activity and who were hypertensive those with sufficient physical activity and who were normotensives were at lower risk (OR=0.37, 95% C.I.= 0.28, 0.50) to develop Diabetes Mellitus. The present study found a positive association between high BP and Diabetes Mellitus ($p < 0.001$). Similar results were found in a study done by Mengesha YA¹⁷, which concluded that most of Diabetes Mellitus patients (61.2%) suffer from co- existing hypertension and related cardiovascular risk factors.

The strength of the study was that it was a population based cross-sectional study to find the prevalence of T2DM among adults in urban area. Bias was taken care of by random sampling. Further, the Oral Glucose Tolerance Test was included in our methods.

Conclusion

The present study showed that every 5TH study subject is having Diabetes Mellitus. Majorly, Male subjects, subjects having age >40 years & subjects belonging to middle/ high class had Diabetes Mellitus. It can be concluded that there is significant association between Obesity and Diabetes Mellitus in populations with BMI more than normal, moreover, they were having high waist circumference & increased waist-hip ratio. Also they were having family history of Diabetes & sedentary lifestyle.

References

1. Colagiuri S, Borch-Johnsen K, Glumer C. There really is an epidemic of Type 2 Diabetes. *Diabetologia*. 2005; 48(8): 1459- 1463.
2. World Health Organisation. Geneva: Factfile; 2014. Available from: <http://www.who.int/features/factfiles/diabetes/en>, dated 14/03/2020.
3. Danaei G, Finucane MM, Lu Y, Singh GM, Coman MJ, Paciorek CJ et al. National, regional and global trends in fasting plasma glucose and Diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country years and 2.7 million participants. *Lancet*. 2011; 378 (9785):31-40.
4. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of Diabetes: Estimates for the year 2000 and projections for 2030. *Diabetes Care*. 2004; 27: 1047-53.
5. Gale J. India's Diabetes Epidemic Cuts Down Millions Who Escape Poverty. Bloomberg; 2010 (Retrieved 8 June 2012). Available from: <http://www.bloomberg.com/news/2010-11-07/India's-deadly-Diabetes-scourge-cuts-down-millions-rising-to-middle-class.html>, dated 14/03/2020.
6. Anjana MR, Pradeepa R, Deepa M, Datta M, Sudha V, Unnikrishnan R et al. ICMR-INDIAB collaborative study group. Prevalence of Diabetes and pre diabetes (impaired fasting glucose and / or impaired glucose tolerance) in urban and rural India: Phase 1 results of the Indian Council of Medical Research- INDIA DIABetes (ICMR-INDIAB) study. *Diabetologia*. 2011; 50:125- 011-2291.
7. Ramachandran A, Snehlata C, Kapur A, Vijay V, Mohan V, Das AK, Rao VP, Yajnik SC, Kumar PMK, Nair DJ. Diabetes epidemiology study group in India (DESI). High prevalence of Diabetes and impaired glucose tolerance in India- National Urban Diabetes Survey (NUDS). *Diabetologia*. 2001; 44:1094-1101.
8. Mohan V, Shantirani CS, Deepa R. Glucose intolerance (Diabetes and IGT) in a selected South Indian population with special reference to family history, obesity and lifestyle factors- the Chennai Urban Population Study. *J Assoc Physicians India*. 2003; 51:771-7.
9. Krentz AJ, Bailey JC. Type 2 Diabetes in practice. In practice series. 2001; 4.
10. Bhatti JS, Bhatti GK, Joshi A, Rai S, Mastana SS, Ralhan SK et al. Identification of risk factors for the high prevalence of T2DM & its complications in Punjabi population. North Indian Diabetes Study: A case control study. *International Journal of Diabetes in Developed Country*. 2007; 27(4):108-115.
11. Liu S, Serdula M, Janket SJ et al. A prospective study of Fruits and Vegetables intake and the risk of T2DM in women. *Diabetes Care*. 2004; 27:2993-6.
12. Solberg L, Desai J, O'Connor P, and Bishop D, Devlin H. Diabetic patient who smoke: Are they different? *Ann fam Med*. 2004; 2:26-32.
13. Kao L, Puddey BI, Boland LL, Watson LR, Brancati LF. Alcohol consumption and the risk of T2DM. *American Journal of Epidemiology*. 2001; Vol 158 (8):748.
14. Scott R A. The link between family history and risk of Type 2 Diabetes is not explained by anthropometric, lifestyle or genetic risk factors: the EPIC-InterAct study. *Diabetologia*. 2013; 56:60-69.
15. Mohan V, Shantirani CS, Deepa R. Glucose intolerance (Diabetes and IGT) in a selected South Indian population with special reference to family history, obesity and lifestyle factors- the Chennai Urban Population Study. *J Assoc Physicians India*. 2003; 51:771-7.

16. Xu F, Ware RS, Tse LA, Wang Y, Hong Y, Chan EY et al. Joint associations of physical activity and hypertension with the development of Type 2 Diabetes among urban men and women of mainland China. *PLOS One*. 2014; 9(2): e88719.
17. Mengesha YA. Hypertension and related risk factors in Type 2 Diabetes Mellitus (DM) patients in Gaborone City Council (GCC) clinics, Gaborone, Botswana. *African Health Sciences*. 2007; 7(4).