

Prevalence and Risk Factors of Diabetes Mellitus among Adults residing in Field Practice Area of a Teaching Hospital in Punjab

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Abstract :

Introduction : 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. **Objectives** : 1. To determine the prevalence of Diabetes Mellitus among the adult population > 20 years of age. 2. To assess the risk factors of Diabetes Mellitus. **Method** : This was a population-based cross-sectional study carried out in the Rural and Urban field practice area of tertiary care medical teaching institute in Patiala, Punjab. Simple random sampling technique was used for the selection of 950 adults 20 years of age and above. Main outcome measures were the assessment of the prevalence of Diabetes Mellitus and correlates of Diabetes Mellitus. A Pre-designed 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 10.0% (7.4% in Rural & 12.6% in Urban Area) with known DM being 6.9% of study population and undiagnosed DM being 3.1% subjects. Significant association was seen between prevalence of DM and age, Obesity and Hypertension. **Conclusions** : It was observed that the prevalence of DM is higher in urban area as compared to Rural Area. Adults with age >40 years, Obesity and Hypertension are more likely to develop Diabetes Mellitus. Control of DM mandates lifestyle modification and control of risk factors.

Keywords : Diabetes Mellitus, Fasting glucose level, Obesity, Hypertension.

Introduction :

Diabetes Mellitus (DM) is a global epidemic in this millennium. Colagiuri et al^[1] 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 WHO^[2], 80% of Diabetes deaths occur in low and middle income countries.

Danaei et al^[3] 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 al^[4] 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 lifestyle 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 diabetic subjects in the year 2013 which is more than 7.1% of India's adult population. An estimate shows that nearly 1 million Indians die due to Diabetes Mellitus every year. Gale J et al^[5] 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 Rural as well as 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 and Rural field practice area of this tertiary care medical teaching institute in Patiala, Punjab.

Objectives :

1. To determine the prevalence of Diabetes Mellitus among the adult population > 20 years of age.
2. To assess the risk factors of Diabetes Mellitus.

Method :

Study design

Population based cross sectional study was carried out in the Urban and Rural field practice area of a tertiary care medical teaching institute in Patiala, Punjab from August 2013 to March 2014 among 950 adults 20 years of age and above.

Sampling design

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 950 in order to make it more representative and to compensate for the design effect.

A complete list of all individuals more than 20 years of age in field practice area was obtained with their addresses. 475 subjects were selected from urban area and 475 subjects were selected from rural area by simple random sampling using random number tables.

Study instrument

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.

Ethical clearance

Ethical committee approval was obtained prior to start of study from institutional ethical committee and an informed consent was obtained from all the study subjects.

Data collection

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 Gms. of oral glucose and post-prandial blood sample was collected in fluoride vial after 2 hrs. The blood samples were transported to Rural / 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 centers 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 for diagnosis of Diabetes Mellitus.

1. Symptoms of Diabetes plus casual plasma glucose concentration ≥ 200 mg/dl (11.1 mmol/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 (7.0 mmol/l). Fasting is defined as no calorie intake for at least 8 hours.

OR

3. 2-h post load glucose \geq 200 mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by W.H.O., using a glucose load containing an equivalent of 75 gm. anhydrous glucose dissolved in water.

Method of data analysis:

Collected data was thoroughly checked and a database was created in MS Excel spreadsheets and analysis was carried out. Data was presented as percentage. Prevalence ratio (PR), Chi-square value and 95% confidence interval was calculated for each categorical risk factor.

Results:

The study population included 487 (51.3%) study subjects in 20-39 years of age group and 463 (48.7%) of study subjects in \geq 40 years of age group. 425 (44.7%) were males and 525 (55.3%) were females. As regards marital status, majority i.e. 758 (79.8%) of study subjects were married. By religion, 548 (57.7%) were Sikh. 58.8% study subjects were unemployed (including housewives) and 30.9% were professionals or skilled. Regarding the education status, 276 (29.1%) were matric pass while only 88 (9.3%) were illiterate. Regarding SES, 310 (32.6%) of the study subjects were belonging to class IV and only 49 (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	Rural (N=475) n(%)	Urban (N=475) n(%)	Total (N=950) n(%)	Statistical analysis
Age distribution	20-39 years	260 (54.7)	227 (47.8)	487 (51.3)	$\chi^2=4.6$
	\geq 40 years	215 (45.3)	248 (52.2)	463 (48.7)	$p<0.05$
Sex distribution	Male	223 (47.0)	202 (42.5)	425 (44.7)	$\chi^2=1.9$
	Female	252 (53.0)	273 (57.5)	525 (55.3)	$p>0.05$
Marital Status	Unmarried	74 (15.6)	56 (11.8)	130 (13.7)	$\chi^2=3.0$
	Married	370 (77.9)	388 (81.7)	758 (79.8)	$p>0.05$
	Separated / Widowed	31 (6.5)	31 (6.5)	61 (6.5)	
Religion	Hindu	156 (32.8)	237 (49.9)	393 (41.4)	$\chi^2=29$
	Sikh	313 (65.9)	235 (49.5)	548 (57.7)	$p<0.001$
	Muslim	06 (1.3)	03 (0.6)	09 (0.9)	
Occupation	Professional/ Skilled	159 (33.5)	135 (28.4)	294 (30.9)	$\chi^2=5.4$
	Semi- Skilled/ Unskilled	54 (11.4)	43 (9.1)	97 (10.2)	$p>0.05$
	Unemployed	262 (55.2)	297 (62.5)	559 (58.8)	
Education	Illiterate	71 (14.9)	17 (3.6)	88 (9.3)	$\chi^2=50.8$
	Primary	77 (16.2)	84 (17.7)	161 (16.9)	$p<0.001$
	Middle	83 (17.5)	84 (17.7)	167 (17.6)	
	Matric	143 (30.1)	133 (28)	276 (29.1)	
	Higher Secondary	61 (12.8)	79 (16.6)	140 (14.7)	
	Graduate	34 (7.2)	56 (11.8)	90 (9.5)	
	Postgraduate & Above	06 (1.3)	22 (4.6)	28 (2.9)	
Socio- Economic Status (Modified BG Prasad Classification)	Class I	18 (3.8)	31 (6.5)	49 (5.2)	$\chi^2=39.2$
	Class II	59 (12.4)	114 (24)	173 (18.2)	$p<0.001$
	Class III	137 (28.8)	134 (28.2)	271 (28.5)	
	Class IV	162 (34.1)	148 (31.2)	310 (32.6)	
	Class V	99 (20.8)	48 (10.1)	147 (15.5)	

In the present study it was observed that out of total 950 study subjects, 95 (10.0%) study subjects were found to be Diabetic. Among these 95 diabetic cases, 66 (6.9%) were known/ old cases of Diabetes Mellitus and 29 (3.1%) were newly diagnosed Diabetes Mellitus cases (Table 2).

Table 2 : Prevalence of Diabetes Mellitus among study subjects

Status	Rural	Urban	Total n (%)
Diabetics			
Old cases	23	43	66(6.9)
New cases	12	17	29(3.1)
Total Diabetics	35	60	95(10.0)
Non- Diabetics	440	415	855 (90.0)
Total subjects	475	475	950 (100)

The prevalence of Diabetes Mellitus was higher (81.1%) in persons aged ≥ 40 years than in persons aged between 20 and 39 years (18.9%). Diabetes was seen to be more prevalent among females (54.7%), middle/ high SES (61.1%), having sedentary occupation (77.9%), vegetarians (82.1%), non-alcoholic (86.3%), nonsmokers (97.9%), having no family history of diabetes mellitus (69.5%), obesity (83.2%), with higher waist-hip ratio (65.3%). Diabetes was associated with 72.6% of hypertensive participants. Prevalence of Diabetes was significantly associated with age, Obesity and Hypertension. Overall, 95 (10.0%) study subjects had fasting venous blood glucose level ≥ 126 mg/dl. Proportion of persons with fasting venous blood glucose level ≥ 126 mg/dl was higher in urban (12.6%) than in rural (7.4%) area. (Table 3)

Table 3 : Prevalence of DM and association between DM and each risk factor (P.R. and C.I.) among study subjects.

S. No.	Risk Factors	Category	Total	Diabetes (N =95) N (%)	Prevalence Ratio	Confidence Interval	Chi Sq/ p-value
1.	Age	21-40	487	18(18.9)	0.22	3.072-8.877	44.414 / p<0.05
		> 40	463	77(81.1)			
2.	Sex	Male	425	43(45.3)	1.01	0.669-1.568	0.012 / p>0.05
		Female	525	52 (54.7)			
3.	SES	Low	457	37 (38.9)	0.66	0.981-2.335	3.546/ p>0.05
		Middle/high	493	58 (61.1)			
4.	Diet	Veg	766	78 (82.1)	1.1	0.525-1.582	0.109 / p>0.05
		Non veg / mixed	184	17 (17.9)			
5.	Smoking	Current user	09	02 (2.1)	2.27	0.533-12.724	1.508 / p>0.05
		Non user/ex user	941	93 (97.9)			
6.	Alcohol	Current user	92	12 (12.6)	1.46	0.830-2.922	1.931 / p>0.05
		Non user/ex user	858	83 (87.4)			
7.	Family history	No	761	66 (69.5)	1.7	1.194-3.052	7.486/ p<0.05
		Yes	189	29 (30.5)			
8.	Obesity	Non obese	329	16 (16.8)	0.38	1.437-4.162	11.470/ p<0.05
		Obese	621	79 (83.2)			
9.	WHR (Waist Hip Ratio)	Normal	431	33 (34.7)	0.61	0.557-1.321	0.488/ p>0.05
		>Normal	489	62 (65.3)			
10.	WC (Waist Circumference)	Normal	492	37 (38.9)	0.59	0.915-2.148	2.428/ p>0.05
		>Normal	458	58 (61.1)			
11.	Physical Activity	Sedentary	708	74 (77.9)	1.21	0.739-2.042	0.631/ p>0.05
		Moderate/ Heavy	242	21 (22.1)			
12.	Blood pressure	Normotensive	631	26 (27.4)	1.89	3.790-9.692	68.340/ p<0.05
		Hypertensive	319	69 (72.6)			

Discussion :

Our study reflects the correlates of Diabetes Mellitus among 950 adults 20 years of age and above in Urban and Rural field practice area of this tertiary care medical teaching institute in Patiala, Punjab.

The present study revealed that the total prevalence of Diabetes Mellitus was 10.0% (12.6% in urban field practice area and 7.4% in rural field practice area). 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 (13.7% in urban area and 7.8% in rural area), 8.4% in Maharashtra (10.9% in urban area and 6.5% in rural area) and 13.6% in Chandigarh (14.2% in urban area and 8.3% in rural area). National Urban Diabetes Survey ^[7] reported the prevalence of Diabetes Mellitus in urban population as 12.1%.

Out of 95 diabetic subjects, 77(81.1%) diabetics were in the age group of ≥ 40 years and only 18 (18.9%) diabetics were in the age group of 20 – 39 years. Mohan et al ^[8] 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 females than males. Krentz et al ^[9] reported that the prevalence was higher in females.

In the present study, according to modified BG Prasad classification of socio-economic status, higher prevalence (61.1%) of Diabetes Mellitus was reported from middle/ high class as compared to low class (38.9%). This is supported by study of Bhatti et al ^[10] 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 (82.1%) as compared to those having mixed diet (17.9%). In contrast to this, Liu S et al ^[11] found that high intake of green leafy or dark yellow vegetables were associated with reduced risk of Diabetes Mellitus.

The present study found that 02 (2.1%) diabetic subjects were smokers and 93 (97.9%) diabetic subjects were ex-users/ non-users. In contrast to this, Solberg L et al ^[12] in his study had linked smoking with increasing insulin resistance which later on induces full blown Diabetes Mellitus.

12 (12.6%) diabetic subjects were current users of alcohol and 83 (87.3%) diabetic subjects were ex-users/non-users of alcohol. In contrast to this, Kao et al ^[13] found that high alcohol intake increases Diabetes Mellitus risk (OR=1.5, 95% C.I.=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 95 diabetics, 66 (69.5%) diabetic subjects were having no family history of Diabetes and 29 (30.5%) were having family history of Diabetes. In contrast to this, Scott AR et al ^[14] 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 95 diabetic subjects, 79 (83.2%) diabetics were having raised BMI i.e. ≥ 25 kg/m² and 16 (16.8%) diabetics were having with BMI in normal range i.e. 18.5-24.9 kg/m². The Chennai urban population study ^[15] 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 95 diabetic subjects, 58 (61.1%) diabetics were having waist circumference more than normal (>102 cms in males and >88 cms in females) and 37 (38.9%) diabetics were having normal waist circumference. Similarly, 62 (65.3%) diabetics were having waist-hip ratio more than normal (>1.0 in males and >0.85 in females) and 33 (34.7%) 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 95 diabetic subjects, 74 (77.9%) diabetics were having sedentary lifestyle and only 21 (22.1%) diabetics were having moderate physical activity. Xu f et al^[16] 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%CI= 0.28, 0.50) to develop Diabetes Mellitus.

The present study found a positive association between high BP and Diabetes Mellitus ($p<0.001$). Out of 95 diabetic subjects, 69 (72.6%) diabetics were hypertensives and 26 (27.4%) diabetics were normotensives. Similar results were found in a study done by Mengesha YA^[17], 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 both urban and rural area. Bias was taken care of by random sampling. Further, the Oral Glucose Tolerance Test was included in our methods.

It can be concluded that prevalence of DM is higher in urban area as compared to rural area. Although age is a non-modifiable risk factor, Diabetes Mellitus can be prevented by adopting healthy lifestyle, regular exercise and maintaining normal body weight.

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