

## Original Article

### A Study of Screening for Diabetes Mellitus Type II in Population aged more than 40 years in Central Indian City

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#### ABSTRACT:

##### Background

Type 2 diabetes mellitus is one of the most common chronic metabolic disorders characterized by hyperglycemia. The International Diabetes Federation (IDF) estimates the global prevalence of type 2 diabetes at 6.6% (285 million cases) in 2010 and expects to reach to 7.8 % (438 million cases) by 2030<sup>1</sup>. This rapid increase in the global prevalence is attributed to population growth, aging, urbanization and increasing prevalence of obesity and physical inactivity. This study was carried out to screen those > 40 years of age in the population of Rewa Madhya Pradesh for Type 2 diabetes mellitus. **Material and Methods:** 4000 individuals were screened. These were those who were either admitted or attending the OPD of SGMH Rewa between August 2013 and October 2014. Patients who were known Diabetics, Type 1 Diabetics, MODY and Gestational Diabetes Mellitus were excluded. Consent was taken from all individuals. Samples were collected from those fulfilling the inclusion criteria and 2 hr post prandial blood sugar values were estimated. **Results:** 516 cases were diagnosed as diabetics while 640 had impaired glucose tolerance. Out of those 516 diabetics a slight majority of 53.1% were males. 56.98% of those were from the 41-50 years age group. The majority of the population screened belonged to urban areas i.e. 2116 people. 61.63% patients who were diagnosed as diabetics were literate. 184 people out of the 516 diagnosed as diabetics had BMI between 25-29.9 kg/m<sup>2</sup> and those having BMI between 18.5-24.9 kg/m<sup>2</sup> had impaired glucose tolerance. **Conclusion:** Our study revealed that there is positive co relation between incidence of Diabetes and age, gender, BMI >25 kg/m<sup>2</sup> and an inverse co relation with literacy rate. There was a surprising revelation of impaired glucose tolerance in people with normal BMI leading us to question whether how effective is BMI in Indian population as a marker for Impaired glucose tolerance and if there are any other indices which need to be explored for our population.

**Key words:** Diabetes mellitus, hyperglycemia.

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#### BACKGROUND

Type 2 diabetes mellitus is one of the most common chronic metabolic disorders characterized by hyperglycemia. It occurs due to defects in insulin secretion, insulin action or both and accounts for at least 90% of all cases of diabetes.<sup>2</sup> It is highly prevalent in the elderly and associated with various co-morbidities, such as obesity, hypertension, hyperlipidemia, and cardiovascular disease, which ultimately lead to a condition called 'Metabolic Syndrome'<sup>3</sup>. Diabetes Mellitus is multifactorial disease main risk factors include modifiable variables like Body Mass Index (BMI), physical inactivity, diet, infections and non-modifiable variables like age, family history of Diabetes Mellitus.<sup>4</sup> Diabetes mellitus (DM) ranks twelfth in all-cause mortality worldwide<sup>5</sup>. One percent of Disability Adjusted

Life Years (DALY) is contributed by Diabetes Mellitus.<sup>6</sup> The prevalence of type 2 diabetes is increasing at alarming rates both in the developing and the newly industrialized countries of the world. On an average, two persons develop diabetes and one person dies from diabetes-related causes in the world every ten seconds<sup>7</sup>. This rapid increase in the global prevalence is attributed to population growth, aging, urbanization and increasing prevalence of obesity and physical inactivity.<sup>8</sup> In addition to frank and symptomatic diabetes, there are two different prediabetic conditions which are known as impaired fasting glucose (IFG) and impaired glucose tolerance (IGT). These are overlapping and essentially asymptomatic conditions characterized by impaired glycemia and are important known risk factors for type 2 diabetes.<sup>9,10</sup>

**MATERIALS AND METHODS**

This was an Observational Study conducted at Shyam Shah Medical College and Associated S.G.M.H Rewa from August 2013 to October 2014. This study was carried out on 4000 patients admitted in Medicine wards and fulfilling the inclusion criteria.

**Inclusion Criteria**

- 1) Fasting blood Glucose  $\geq 126$ mg/dl (7.0 mmol/L)
- 2) 2 hrs after 75gm glucose  $\geq 200$ mg/dl (11.1 mmol/L)
- 3) Random Blood Sugar  $\geq 200$ mg/dl (11.1 mmol/L)
- 4) People  $>40$ yr age from rural and urban population of Rewa.
- 5) Patients with signs and symptoms of Diabetes Mellitus.

**Exclusion Criteria**

- 1) Patients with known Diabetes Mellitus
- 2) DM type 1
- 3) MODY
- 4) Gestational diabetes mellitus

with informed consent from all patients, complete history and examination done according to a proforma. Samples were collected and examined for blood sugar 2 hr post prandial. Those with endangered values were followed and counselled and advised for further management.

**STATISTICAL ANALYSIS**

Data was collected and analysed via the Chi-Square test to assess the categorical data presented as numbers and percentages. P value of 0.05 or less was considered statistically significant.

**RESULTS:**

**Blood sugar level in total number of cases**

S. No.	BLOOD SUGAR	No.	%
1	<139	2844	71.1
2	140-199	640	16
3	>200	516	12.9

This table shows that, out of 4000 cases 516 (12.9%) cases were diagnosed as diabetic, 640 (16%) cases had impaired glucose tolerance.

**Distribution of cases according to sex**

BLOOD SUGAR (mg/dl)	MALE		FEMALE	
	No.	%	No.	%
<139 (n=2844)	1632	57.38	1212	42.62
140-199 (n= 640)	323	50.46	317	49.54
>200 (n= 516)	274	53.10	242	46.90
TOTAL	2229		1771	

**P value is 0.0027676**

Out of 516 diagnosed diabetic cases 274 (53.10%) were male and 242(46.90%) were female. While 323 (14.49%) males out of 2229 and 317 (17.89%) females out of 1771 were from IGT category. This suggests that prevalence of diabetes was more in males while that of IGT was more in females.

**Distribution of cases according to age groups**

BLOOD SUGAR (mg/dl)	41-50 years		51-60 years		Age >61 years	
	No.	%	No.	%	No.	%
<139 (n= 2844)	1467	51.58	712	25.04	665	23.38
140-199 (n=640)	335	52.34	155	24.22	150	23.44
>200 (n=516)	294	56.98	109	21.12	113	21.89
TOTAL	2096		976		928	

**P value is 0.02304**

Out of 516 newly diagnosed diabetic cases 294(56.98%) were from 41-50 year age group and 109(21.12%) cases belonged to age class of 51-60 years. And 113(21.89%) cases belonged to >60 years. Similarly highest number of cases 335 (52.34%) of impaired glucose tolerance were from age group of 41-50 and least were from age group of >60years.

**Distribution of cases according to residence**

BLOOD SUGAR (mg/dl)	URBAN		RURAL	
	No.	%	No.	%
<139	1455	68.76	1389	73.72
140-199	362	17.10	278	14.76
>200	299	14.14	217	11.52
TOTAL	2116	100	1884	100

**P value is 0.002273**

In present study of 4000 cases 2116 cases belonged to urban area and 1884 cases belonged to rural area. Among the 516 diagnosed diabetic cases 299 (14.14%) belonged to urban area and 217(11.52%) cases belonged to rural area.

Similarly in IGT group 362 (17.10%) cases were from urban area and 278 (14.76%) cases were from rural area. This shows that prevalence of diabetes and IGT was more in urban than in rural area.

**Distribution of Cases According to Educational Status**

1	EDUCATIONAL STATUS	<139 Mg/dl		140-200 Mg/dl		>200 Mg/dl	
		No.	%	No.	%	No.	%
1	Illiterate	1304	45.85	286	44.68	198	38.37
2	Literate	1540	54.15	354	55.32	318	61.63
a)	Primary School	480	16.87	81	12.65	67	12.98
b)	Secondary	311	10.95	91	14.23	78	15.12
c)	Graduate	676	23.76	166	25.94	166	32.18
d)	Postgrad.	73	02.57	16	02.50	7	01.35

**P value is 0.001949 statistically significant**

Out of 516 diabetes patients 198(38.37%) patients were illiterate and 318(61.63%) patients were literate, out of which 67(12.98%) were educated up to primary school, 78(15.12%) up to secondary school, 166(32.18%) were graduates and 7(1.35%) postgraduates. Out of 640 cases from IGT group 286 (44.68%) were illiterate and 354(55.32%) were literate.

**Distribution of Cases According to Past History of Hypertension**

BLOOD SUGAR Mg/dl	PAST H/O HTN		W/O H/O HTN	
	No.	%	No.	%
<139 (n=2844)	949	33.36%	1895	66.64%
140-199 (n= 640)	222	34.68%	418	65.32%
>200 (n=516)	206	39.93%	310	60.07%

**P value is 0.01549 statistically significant**

Above table shows that, out of total study population 1377 cases had history of hypertension out of which 206 (39.93%) cases found to be diabetic and 222 (34.68%) cases had impaired glucose tolerance.

**Distribution of Cases According to Past History Of CAD**

BLOOD SUGAR Mg/dl	PAST H/O CAD		W/O H/O CAD	
	No.	%	No.	%
<139 (n=2844)	75	57.70	2769	71.55
140-199 (n=640)	24	18.46	616	15.92
>200 (n=516)	31	23.84	485	12.53
TOTAL	130	100	3870	100

Out of 130 cases with past history of CAD, 31(23.84%) cases were diagnosed with diabetes. Similarly 24 (18.46%) cases were diagnosed with impaired glucose tolerance.

**Distribution of Cases According to Past History of HTN and CAD**

BLOOD SUGAR Mg/dl	PAST H/O HTN+CAD		W/H PAST H/O HTN+CAD	
	No.	%	No.	%
<139 (n= 2844)	74	56.48	2770	71.60
140-199 (n= 640)	36	27.48	604	15.60
>200 (n= 516)	21	16.04	495	12.80
TOTAL	131	100	3869	100

**P value is 0.000295 statistically significant**

Out of 131 cases with past history of HTN and CAD 21 (16.03%) cases were found to be diabetic and 36 (27.48%) cases were from impaired glucose tolerance group.

**Distribution of Cases According to Addiction of Tobacco**

BLOOD SUGAR Mg/dl	ADDICTION OF TOBACCO		NO ADDICTION OF TOBACCO	
	No.	%	No.	%
<139 (n=2844)	1875	65.92	969	34.08
140-199 (n=640)	425	66.40	215	33.60
>200 (n=516)	308	59.68	208	40.32

**P value is 0.018501469 statistically significant**

Above table shows that, 308(59.68%) cases out of 516 diabetic cases were addicted to tobacco and 425 (66.40%) cases out of 640 were having impaired glucose tolerance. This suggested that prevalence of diabetes and IGT was more in tobacco addicts than non addicts. This suggested that prevalence of diabetes and IGT was more in tobacco addicts than non addicts.

## DISCUSSION

The following inferences were drawn from the study of 4000 cases:

In present study out of 4000 cases 516 (12.9%) cases were diagnosed as diabetic, 640 (16%) cases were having impaired glucose tolerance. Ramachandran et al<sup>11</sup> in his population based study, conducted in six large cities from different regions of India, which was done on 11,216 subjects aged over 20 years from all socio-economic strata, showed that the age standardized prevalence of type 2 diabetes was 12.1%.

In this study out of 516 diagnosed diabetic cases 286(55.42%) were male and 230(44.53%) were female. Among 640 cases of impaired glucose tolerance 306 (47.81%) were male and 334 (52.19%) were females. This showed higher prevalence of diabetes among males and impaired glucose tolerance among females. Studies carried out by Patel M et al<sup>12</sup> reported that prevalence of DM was 62% in males and 38% in females and that of Thakkar B et al<sup>13</sup> reported prevalence of DM was 58% in males and 42% females.

In present study out of 516 newly diagnosed diabetic cases 294 (56.98%) were from 41-50 year age group and 109(21.12%) cases belonged to age group of 51-60 years. And 113(21.89%) cases belonged to >60years. Similarly highest number of cases 335 (52.34%) of impaired glucose tolerance were from age group of 41-50 and least were from age group of >60years. In this study mean age for diabetes was 53 years which was comparable with Patel M et al<sup>12</sup>, who carried out study on 622 newly diagnosed type 2 diabetic patients & reported the mean age of  $47.7 \pm 10.9$  years.

In present study of 4000 cases 2116 cases belonged to urban area and 1884 cases belonged to rural area. Among the 516 diagnosed diabetic cases 299 (14.14%) belonged to urban area and 217(11.52%) cases belonged to rural area. Similarly in IGT group 362 (17.10%) cases were from urban area and 278 (14.76%) cases were from rural area. This shows that prevalence of diabetes and IGT was more in urban than in rural area. These findings correlated well with Ramachandran et al.<sup>14</sup> who reported that age-standardized prevalence of diabetes and impaired glucose tolerance (IGT) in urban India in 2000 was 12.1% and 14.0%, respectively.

In present study highest number of cases 184 (35.66%) had BMI between 25-29.9kg/m<sup>2</sup> and least 9(1.74%) had <18.5kg/m<sup>2</sup>, among 516 diagnosed diabetics. In impaired glucose tolerance group highest cases had BMI between 18.5-24.9kg/m<sup>2</sup>. In present study, average BMI for diagnosed diabetics was 29kg/m<sup>2</sup>, which was comparable to study by Metriveli et al<sup>15</sup> who observed average BMI was  $30 \pm 5.34$  kg/m<sup>2</sup> in 648 newly diagnosed diabetics.

In present study out of 516 diabetes patients 198(38.37%) patients were illiterate and 318(61.63%) patients were literate, out of which 67(12.98%) were educated up to primary school, 78(15.12%) up to secondary school, 166(32.18%) were graduates and 7(1.35%) postgraduates. Hence 343(66.47%) and 458 (71.56%) cases from diabetic and IGT group had education below graduation respectively. Similar to our study, studies done by Valdes

S et al<sup>16</sup>, Maty SC et al<sup>17</sup> found that low education is significant predictor of type 2 diabetes mellitus.

In present study of 516 newly detected diabetic patients, 206(39.93%) patients were hypertensive. These observations correlate with study of Pradeepa et al<sup>18</sup> who conducted CURES study in 338 newly diagnosed diabetics; prevalence of hypertension was 40% in newly detected diabetics. Harjallah et al<sup>19</sup> reported prevalence of hypertension to be 22% among newly detected diabetic patients.

In present study out of 130 cases with past history of CAD, 31(23.84%) cases were diagnosed with diabetes. And out of 63 cases with past history of CVA 9 (14.28%) cases were found to be diabetic. Multiple Risk Factor Intervention Trial (MRFIT)<sup>20</sup> and the United Kingdom Prospective Diabetes Study (UKPDS)<sup>21</sup> have clearly established the underlying link between cardiometabolic risk factors and the increased risk of cardiovascular events in patients with diabetes.

Out of 516 diabetic cases 230 (44.57%) patients were reported with positive family history of DM. 129 cases showed both parental history of DM and 101 cases with single parental history. Abdollahi et al<sup>22</sup> who observed 152 newly detected diabetic patients and reported family history in 63 patients (41.4%). Ranganayakul et al<sup>23</sup> reported that positive family history was present in 1/3 of newly detected diabetics.

In our study 308(59.68%) cases out of 516 were addicted to tobacco. Out of which 144 (45.56%) were tobacco chewer, 76 (24.67%) were smoker and 88 (27.84%) were both addicted to smoking and chewing tobacco. This shows that prevalence of diabetes is more in tobacco addicts than in non-addicts. These findings are similar to studies done by Patja et al.<sup>24</sup>, Willi et al.<sup>25</sup> stating that tobacco and smoking are independent and modifiable risk factors for diabetes. Passive smoking is associated with an increased risk of diabetes Hayashino et al.<sup>26</sup>

## CONCLUSION

- In present study 2229 (55.73%) were males and 1771 (44.27%) were females.
- 274 (53.10%) males found to be diabetic whereas 323 (50.46%) had IGT.
- 242 (46.90%) females found to be diabetic whereas 317 (49.54%) had IGT.
- In present study prevalence of diabetes was 12.9% and that of IGT was 16%.
- In 4000 study cases 2096 (52.4%) cases were from age group of 41-50 years, 976(24.4%) cases were from age group of 51-60 years while 928(23.2%) cases were more than 61 years of age.
- In present study, out of 516 diabetic cases, 294 (56.98%) were from age group of 41-50 years, 109 (21.12%) were from 51-60 years and 113 were from >61years, indicating T<sub>2</sub>DM was more prevalent among 41-50 years age group.
- Among IGT group also highest number of cases (52.34%) were from 41-50 years age group.
- In present study, 2116 (52.90%) cases belonged to the urban area and 1884 (47.10%) belonged to rural area.

- 57.94% diabetic cases detected from urban area and 42.06% cases from rural area.
- Similarly 362 cases from urban area and 278 cases from rural area had impaired glucose tolerance.
- In present study, 1788 cases were illiterate, 628 cases had education up to primary school, 480 cases completed their secondary schooling, 1008 cases were graduate and 96 completed their post graduation.
- 198 cases from the group of illiterate were found to be diabetic while out of 318 diabetic cases from literate group 145 cases were educated up to secondary school and 173 cases were educated up to post graduation.
- Similarly 286 cases from illiterate group had IGT and 172 cases were educated up to secondary school 182 cases were educated up to post graduation.
- Hence 343(66.47%) diabetics, 458 (71.56%) cases among IGT group were with low education.
- Out of 4000 study cases, 784(19.6%) cases had BMI <18.5kg/m<sup>2</sup>, 2256(56.4%) had 18.6-24.9 kg/m<sup>2</sup>, 720(18%) cases had 25-29.9 kg/m<sup>2</sup>, 240(6%) cases had BMI >30 kg/m<sup>2</sup>.
- Out of 516 diabetic cases highest number(184) had BMI 25-29.9 kg/m<sup>2</sup>, and least number of cases (9) had BMI of <18.5 kg/m<sup>2</sup>.
- 257 cases had BMI 18.6-24.9 kg/m<sup>2</sup> out of 640 cases with IGT, and 215 cases had BMI 25-29.9 kg/m<sup>2</sup>.
- 1377 cases from total study population had history of hypertension, out of which 206 cases were diabetic and 222 cases had impaired glucose tolerance.
- 130 cases out of total study population had past history of coronary vascular disease, out of which 31 cases were found to be diabetic.
- 63 cases out of total study population had history of cerebrovascular accidents out of which 9 cases were found to be diabetic and 19 cases had IGT.
- Out of 516 diabetic cases 230 (44.57%) patients were reported with positive family history of DM. 129 (25.00%) cases had both parental history of DM and 101 (19.57%) cases with single parental history. From IGT group in 152 (23.75%) cases both parental history was present and in 128 (20.00%) cases single parental history was present.
- Out of 1410 cases with positive family history of hypertension, 205 (14.54%) were diagnosed to have diabetes and 236 (16.73%) were diagnosed to have impaired glucose tolerance.
- Out of 1467 cases with positive family history of hypertension and diabetes, 204 (13.91%) were diagnosed to have diabetes and 259 (17.66%) were diagnosed to have impaired glucose tolerance.
- 308(59.68%) cases out of 516 diabetic cases were addicted to tobacco. And 425 (66.40%) cases out of 640 were having impaired glucose tolerance. This suggested that prevalence of diabetes and IGT was more in tobacco addicts than non addicts.

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