

Original Research Article

Assessment of plasma blood sugar level in first degree relatives of known type 2 diabetes patients: a descriptive study from Maharashtra, India

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ABSTRACT

Background: There is steady increase in the prevalence of diabetes mellitus from 0.73% to current 2.4% in rural and 4.0% to 11.6% in urban areas. Familial clustering of diabetes may support a genetic predisposition to diabetes. With increase in the prevalence of diabetes there is increase in number of first degree relative as well, thus an increased risk of developing diabetes, will also increase. To study the plasma glucose levels in First-degree relatives of family member of type 2 diabetic patients was the objective of the present study.

Methods: It is a descriptive observational study with 1020 individuals serially coming to our outpatient Department for Pre-employment Medical Health Check Up Annual Health Check Up were selected. These individuals have been enrolled for the study and their family history of diabetes was noted, their sugar levels and their lipid levels were estimated and their body mass index was calculated. The data thus collected and analyzed with excel.

Results: 184 (18%) individuals were FDRs, were as 836 (82%) individuals were Non-FDRs. There were 754 (74%) males [131(17%) FDR and 623(83%) Non-FDR], were as 213 (26%) females [53(20%) FDR and 213(80%) Non-FDR], 61(6%) individuals were having Diabetic Mother, 91(9%) individuals had Diabetic Father and 32(3%) were those in whom both the Parents were Diabetic. It was found that maternal history has strong association for getting abnormal BSL levels as compared to a diabetic father as the RR of 9.82 (95% 4.84 to 19.95) in individuals with mother being diabetic, and RR of 1.54(95% 0.68 to 3.87) of father being diabetic.

Conclusions: Family history of diabetes, maternal history of diabetes and history of both the parents having diabetes are risk factors for diabetes in FDRs.

Keywords: First degree relatives, Plasm blood sugar, Type 2 diabetes

INTRODUCTION

In the recent past, the incidence of non-communicable diseases like Diabetes Mellitus, Hypertension, Ischemic Heart Disease and Cancer is on an increasing trend than the communicable diseases. Lifestyle habits play an important role in placing them on the top. Diabetes is an

“Ice-berg disease”. Current estimate of diabetic patients is around 150 million. This number is predicted to be doubled by 2025.¹ Urbanization, unfavourable modifications in lifestyle, stress, and dietary habits play an important role in development of diabetes. In India, the prevalence of diabetes in adults is found to be 2.4% in rural and 4.0 - 11.6% in urban area.¹

The World Health Organization (WHO) has recently acknowledged that India has maximum number of diabetic patients than does any given country (around 37.77 million diabetics in India in 2004; 21.4 million in urban areas and 16.36 million in rural areas).² This number is projected to be increased to 57 million by the year 2025. India is thus the “Diabetic Capital of the world”.³

Since 1938 there has been a steady increase in the prevalence of diabetes mellitus from 0.73% to current 2.4% in rural and 4.0% to 11.6% in urban areas.¹ Diabetes in all form is one of the most important chronic diseases of the developed and developing world.⁴ Diabetes is the single, most important metabolic disease recognized worldwide as one of the leading cause of death and disability.⁵ Family members of people with diabetes are at higher risk of developing diabetes. The inheritance pattern is, however, unclear. Though a series of candidate genes have been investigated, none has been identified that contribute significantly to the development of the disease.

Presence of a parental history is associated with impairments in insulin sensitivity and/or insulin secretion and may therefore modify the effect of obesity on glucose homeostasis. If the association between obesity and hyperglycemia is different in individuals with a parental history of diabetes, this may affect decisions about weight reduction and screening for diabetes. Although both obesity and parental history of diabetes have been studied extensively, information on the effect of combinations of these risk factors on hyperglycemia is limited. Most studies were too small to provide precise estimates of diabetes.⁶

Hence, it was decided to study the plasma glucose levels of first-degree relatives of known diabetic individuals for early detection of abnormal plasma glucose levels, and to prevent further impairment and formation of diabetes and influence of parental history on getting diabetes and find prevalence of diabetes in them.

Aim was to study the plasma glucose levels in First-degree relatives of family member of type 2 diabetic patients and to study the correlation between anthropometry measurements and plasma glucose levels were the main objectives of the present study.

METHODS

The study was an observational study, conducted in Deenanath Mangeshkar multispecialty hospital, Pune over a period of 18months. (from 1st September 2007 to 28th February 2009).

Inclusion criteria

Patients aged 18 and above coming to outpatient department for pre employment medical health check-up

or annual health check-up. Study group consisted of asymptomatic 1st degree relatives of known diabetic patients (Father, mother, brother, sisters) control group of asymptomatic non 1st degree and non-2nd degree relatives of non-diabetic individuals.

Exclusion criteria

Known cases of DM, persons having systemic illness like thyroid, dyslipidemia persons, persons on steroid therapy 2nd degree relatives of known diabetic persons.

In this observational study total 1020 of individuals were included. The details of the history as demographic, personal, family history, regarding of symptoms suggestive of diabetes and any significant past history. The patients were examined and vitals noted. Their BMI were calculated. Their fasting, lipid profile and post prandial, sugars were estimated blood sugar was done by GODPOD method and lipid estimation was done by RXDAYTONA and Triglyceride by GPDPA method.

Criteria for the diagnosis of diabetes were followed as per ADA 2007 guidelines.

The data was processed using the statistical stools like Microsoft office excel 2003, “SPAS10” EPI inf and ODDs calculation. Test of significance used was chi square test.

If the ‘p’ value is less than 0.05 (<0.05), it is considered as statistically significant and if the p value is greater than 0.05 (>0.05) it is considered as not significant.

RESULTS

Out of 1020 subjects involved in our study, majority i.e. 462 (45%) were from 18-29 years age group followed by 217 (21%) from 30-39 years age group and 136 (13%) from 40-49 years age group. Out of 1020 subjects involved in our study, majority i.e. 74% were males and 26% were females (Table 1).

Table 1: Distribution according to age and gender (n=1020).

		Frequency	Percent
Age group in years	18-29	462	45
	30-39	217	21
	40-49	136	13
	50-59	70	7
	60-69	101	10
	≥70	34	4
Gender	Male	754	74
	Female	266	26

Out of 76 subjects with BSL fasting more than 126 mg/dl, in 36 subjects there was no family history of diabetes, in 18 i.e. 24% cases both parents were diabetic,

in 16 (21%) cases mother was found to be diabetic. There is statistically significant association was found between BSL fasting and family history ($p < 0.001$) (Table 2).

Out of 28 subjects with BSL postprandial more than 200 mg/dl, in 21 subjects there was no family history of

diabetes and in 5 cases i.e. 17%, mother was found to be diabetic. There is statistically significant association was found between BSL PP and family history ($p < 0.001$) (Table 3).

Table 2: Distribution according to BSL fasting and family history.

Family history	BSL (FF)						Total
	<100		100 - 125		≥126		
	Frequency	Percent	Frequency	Percent	Frequency	Percent	
Mother	26	4	19	7	16	21	61
Father	61	9	24	9	6	8	91
Both the Parents	10	2	4	1	18	24	32
No family History	575	85	225	83	36	47	836
Total	672	100	272	100	76	100	1020

The chi-square statistic is 157.13. The p-value is < 0.00001 . The result is significant at $p < 0.05$.

Table 3: Distribution according to BSL postprandial and family history.

Family history	BSL (PP)						Total
	<140		140 - 199		≥200		
	Frequency	Percent	Frequency	Percent	Frequency	Percent	
Mother	14	4	1	2	5	17	20
Father	17	5	1	2	1	4	19
Both the Parents	7	3	3	6	1	4	11
No family History	291	88	46	90	21	75	358
Total	329	100	51	100	28	100	408

The chi-square statistic is 14.78. The p-value is 0.022. The result is significant at $p < 0.05$

Table 4: Distribution according to BSL fasting and age group.

BSL (FF)	20-40		41-60		>60		Total
	Frequency	Percent	Frequency	Percent	Frequency	Percent	
>100	530	74	97	50	45	40	672
100-125	150	21	70	36	52	46	272
≥126	34	5	26	14	16	14	76
Total	714	100	193	100	113	100	1020

The chi-square statistic is 80.60. The p-value is < 0.00001 . The result is significant at $p < 0.05$

Table 5: Distribution according to BSL fasting and gender.

BSL (FF)	Female		Male		Total
	Frequency	Percent	Frequency	Percent	
<100	182	68	490	65	672
100 - 125	70	26	202	27	272
≥126	14	6	63	8	76
Total	266	100	754	100	1020

The chi-square statistic is 2.86. The p-value is 0.23. The result is not significant at $p < 0.05$.

BSL between 100-125 was seen in 21% subjects from 20-40 years age, 36% from 41-60 years, 46% from above 60 years age. This difference in the proportion of cases with different age group was found to be statistically

significant ($p < 0.05$) (Table 4). BSL between 100-125 was seen in 26% females as compared to 27% males. BSL above 126 was observed in 6% females as compared to 8% males. This difference in the proportion of cases with

respect to gender was found to be statistically significant (p<0.05) (Table 5).

Table 6: Distribution according to correlation between BSL fasting and BMI.

BMI	BSL (FF)						Total
	<100		100 - 125		≥126		
	Frequency	Percent	Frequency	Percent	Frequency	Percent	
<18.5	39	6	7	3	0	0	46
18.5 - 22.9	235	35	60	22	17	22	312
23 - 24.9	133	20	49	18	13	17	195
≥25	265	39	156	57	46	61	467
Total	672	100	272	100	76	100	1020

The chi-square statistic is 37.27. The p-value is <0.00001. The result is significant at p <0.05

Table 7: Distribution according to correlation between BSL fasting and BMI.

BMI	BSL (PP)						Total
	<140		140 - 199		≥200		
	Frequency	Percent	Frequency	Percent	Frequency	Percent	
<18.5	5	2	0	0	0	0	5
18.5 - 22.9	71	21	5	10	1	4	77
23 - 24.9	67	20	8	16	4	14	79
≥25	186	57	38	74	23	82	247
Total	329	100	51	100	28	100	408

The chi-square statistic is 11.7. The p-value is 0.019. The result is significant at p <0.05.

BSL fasting above 126 was found in 61% cases with BMI >25, 57% cases with BSL between 100-125 and 39% cases with BSL below 100 mg/dl. This difference in the proportion of cases with respect to BMI was found to be statistically significant (p<0.05) (Table 6).

BSL PP above 200 was found in 82% cases with BMI >25, 74% cases with BSL between 140-199 and 57% cases with BSL below 140 mg/dl. This difference in the proportion of cases with respect to BMI was found to be statistically significant (p<0.05) (Table 7).

DISCUSSION

Age and gender

L Mykkanen et al, observed 36.2% males and 63.7% females in their study with commonly involved age group as 65-74 years.⁷ Deo SS et al, observed 45.8% males and 54.1% females in their study with commonly involved age group as 40-60 years.⁸ Amini M et al, observed 25.9% males and 74.1% females in their study with commonly involved age group as 30-60 years.⁹

Distribution of family history

In this population 184 (18%) individuals were First Degree Relative of Diabetic Patients (FDR). Out of these 131 (79%) were males and 53 (29%) were females. In

FDR group 61 (34%) individuals were having Diabetic Mother, 91 (49%) individuals were having Diabetic Father History and in 32 (17%) individuals both parents were Diabetic.

Rob M. Van Dam et al, reported family history in 15.3% father and 17.9% mother as first-degree relatives. M. V. Jali et al, reported family history of diabetes in 216 (42.10%) mother and 210 (40.93%) father as first-degree relatives and 87 (16.96%) cases in both parents.^{5,6} PR Kokiwar et al, found in 46.93% first degree relatives. Ticiana Costa Rodrigues et al, found in 30% first degree relatives.^{3,10}

Study findings are consistent with the findings of above-mentioned authors.

Prevalence of abnormal sugar levels

It was found that 272 (26.66%) individuals were having Impaired Fasting sugar levels (19.8% males and 6.8% females) while 76 (7.4%) individuals were having Fasting Hyperglycemia (i.e.6.1% males and 1.3% females), whereas 51 (12.5%) individuals were having Impaired Glucose Tolerance (3.5% males and 1.4% females). 28 (6.8%) individuals were found to have postprandial hyperglycemia i.e. BSL >200 (1.8% males and 0.88% females). In our study 104 (10.19%) individuals were newly detected Diabetic.

Sudha S. Deo et al, reported IFG in 4.9% males and 3.6% females, IGT in 1.9% males and 1.8% females, diabetes in 9.2% males and 9.9% females.⁸

Simmi Dube et al, reported IFG in 4.61% males and 1.41% females. Fasting hyperglycaemia in 6.82% males and 0.70% females.⁴

Prevalence of abnormal BMI

In the studied population 195 (19.1%) individuals were overweight and 467 (45.8%) individuals were obese. Similar finding was found by MV Jali et al, 171 (33.33%) individuals were having normal BMI i.e. <25 and 342 (66.67%) were having BMI >25.⁵ Statistically 27.47% individuals were having BMI >25 whereas 9.7% individuals were having BMI <25 this finding was observed by PR Kokiwar et al.³

Family history of diabetes

Out of 76 subjects with BSL fasting more than 126 mg/dl, in 36 subjects there was no family history of diabetes, in 18 i.e. 24% cases both parents were diabetic, in 16 (21%) cases mother was found to be diabetic. There is statistically significant association was found between BSL fasting and family history ($p < 0.001$). Out of 28 subjects with BSL postprandial more than 200 mg/dl, in 21 subjects there was no family history of diabetes and in 5 cases i.e. 17%, mother was found to be diabetic. There is statistically significant association was found between BSL PP and family history ($p < 0.001$). L Mykkanen et al, Rob M. Van Dam et al, Arvind Kumar et al, MV Jali et al, had similar findings i.e. a strong association between family history of diabetes and plasma glucose levels.^{5-7,11}

Maternal history has strong association for getting abnormal BSL levels as compared to a diabetic father as the RR of 9.82 (95% 4.84 to 19.95) in individuals with mother being diabetic, and RR of 1.54 (95% 0.68 to 3.87) of father being diabetic. But the major risk of FDRs getting diabetes in their future life is highest if both the parents are diabetic RR 28.75 (95% 12.37 to 66.80).

Similar finding was observed by Jorgen V. Bjornholt et al, were he had found RR of 6.89 for both the parents were diabetic and RR of 2.65 and 1.79 for diabetic mother and father respectively.¹²

CONCLUSION

There is strong association between family history of diabetes and abnormal plasma glucose levels. Maternal history of diabetes plays as an important risk factor for developing diabetes than a history of diabetic father. When both the parents of an individual have diabetes, the individual is at a greater risk of getting diabetes than those of maternal history. There is also strong correlation between total body adiposity and high plasma glucose levels. As the age of individuals increases there are

higher chances of the individual to have abnormal plasma glucose levels. The plasma glucose level does not vary with the gender of an individual.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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