ORIGINAL ARTICLE

IMPAIRED GLUCOSE TOLERANCE TEST AS AN INDICATOR OF DIABETES IN FIRST DEGREE RELATIVES OF DIABETICS

Nadia Bashir, Rukhshan Khurshid*, Arif Malik

Department of Molecular Biology and Biotechnology, University of Lahore,
***Department of Biochemistry Fatima Jinnah Medical College, Lahore, Pakistan**

Background: Diabetes is most often associated with older age, obesity, family history of diabetes, physical inactivity etc. Genetic factors are complex and interact with environmental factors in a poorly understood fashion. Impaired glucose tolerance is also reported as risk factors. **Methods:** This study included 50 first degree relatives of diabetics of both sexes. Subjects were divided into 3 groups on the basis of their age, i.e., age range 14–25 years, 26–35 years, and 36–50 years. Glucose Tolerance Test (GTT) was performed on the attendants of diabetic patients admitted in medical wards of Sir Ganga Ram Hospital, Lahore. Twenty subjects with no history of diabetes were considered as controls. Duration of study was be 8 weeks. **Results:** Glucose Tolerance Test was impaired in first degree relatives of diabetes with age group (14–25) compared to their controls but significant differences (p<0.001) were only seen in fasting and in 90 minutes. Variation in GTT and BMI in age ranged 26–35 years showed significant changes after 30 min of taking 50 gm of glucose. In age group 35–50 years there was significant increase of BMI was observed. Increased level of fasting blood sugar and blood sugar after 30 min and 1 hour of taking glucose was also observed. **Conclusion:** Increased BMI and impaired oral GTT may be an indicator of early detection of diabetes in first degree relatives of both sexes especially in age group 14–25 and 35–50 years. Further work is needed to reach a better conclusion.

Keywords: Glucose tolerance test, First degree relatives, BMI

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INTRODUCTION

Diabetes presents itself as a metabolic syndrome with a spectrum of hyperglycaemia, obesity, insulin resistance, hypertension, complex dyslipidemia, atherosclerosis, and endothelial dysfunction.[1] According to WHO experts it would be a worldwide increase in the number of adult diabetics from 135 million in 1995 to 300 million in 2025. The highest increase in the prevalence of diabetes was estimated to occur in China (68%) and India (59%).[2] Pakistani descent 1,318 people (25–79 year of age) were screened and 60% were diabetic.[3]

Type 2 diabetes mellitus results from insulin resistance.[4] Primary and secondary causes of diabetes include pancreatic disease, hormonal imbalance, Cushing's syndrome, acromegaly, thyrotoxicosis, phaeochromocytoma, glucagonoma. Drug like thiazide diuretics and corticosteroids can induce diabetes.[5]

Type 2 diabetes is most often associated with older age, obesity, family history of diabetes, previous history of gestational diabetes, physical inactivity, and certain ethnicities. About 80% of people with type 2 diabetes are overweight.[6] Genetic factors are complex and interact with environmental factors in a poorly understood fashion.[7] Impaired glucose tolerance is also reported as risk factors.[8] Glucose tolerance test is more pronounced with a family history of diabetes compared to fasting glucose level and glucose challenge test. People with first degree relative may be at more risk of developing diabetes especially in their 40s.

This study was designed to find out presence of diabetes in first degree relatives of diabetics.

MATERIAL AND METHODS

This study included 50 first degree relatives of diabetics of both sexes considered as experimental subjects. Subjects were divided into 3 groups on the basis of their age, i.e., a group with age range 14–25 years, group with age range 26–35 years and group with age range 36–50 years. To perform glucose tolerance test, fasting blood sample was taken and the patient was orally given the 50 gm of glucose solution. Time was noted and further blood samples taken at intervals of 30, 60, 120 and 180 min. Urine specimens for sugar with each blood specimen was also be collected. The subjects included were the attendants of diabetic patients admitted in medical wards of Sir Ganga Ram Hospital, Lahore. Twenty subjects with no history of diabetes were considered as controls. Duration of study was 4–8 weeks. Data regarding age, BMI, family history, profession etc. were entered in a special proforma.

RESULTS

Glucose tolerance test in first degree relatives' male age ranged 14–25 years of diabetics as compared to their controls was tabulated as Table-1. It was observed that the BMI of first degree relatives of male was significantly greater (p<0.001) compared to

controls. Level of fasting sugar and sugar after ½ hour was significantly greater (p<0.001) compared to their controls. On the other hand level of blood glucose after 60, 90 and 120 minutes although was raised in first degree relatives but showed no significant differences.

Glucose tolerance in first degree relatives male age ranged 26–35 years of diabetics compared to their controls was tabulated asTable-2. It was observed that the BMI of first degree relatives of male was significantly greater (p<0.001) compared to control. Fasting blood sugar level was more compared to control and it showed a highly significant difference (p<0.001). Blood sugar after 30 min, 1 hour, 90 min, and 2 hour although was raised in first degree relatives but this showed not significant differences.

Glucose tolerance in first degree relatives male age ranged 36–50 years) of diabetics compared to their controls is shown in Table-3. The BMI of first degree relatives of male was more compared to controls and it showed a highly significant difference (p<0.001). Fasting blood sugar and sugar after 30 min, and 1 hour was significantly higher compared to control (p<0.001). Blood sugar after 1 and 2 hours was significantly higher (p<0.001) compared to control. On the other hand, blood sugar after 90 minutes was increased but it showed no significant differences.

Glucose tolerance in first degree relative females aged 14–25 years of diabetics as compared to their controls was tabulated (Table-4).

The BMI of subjects was more than their controls but this showed no significant differences. Levels of blood sugar including fasting, after 30 min, 1 hour, 90 min, and 2 hours was raised in first degree relatives but this showed not significant differences.

Glucose tolerance in first degree female relatives aged 26–35 years as compared to their controls was tabulated (Table-5).

BMI of first degree relatives of females was non-significantly increased compared to controls. Fasting blood sugar was non-significantly raised in subjects compared to their controls. Blood sugar after 30 min was higher compared to control and it showed highly significant differences (p<0.001). Sugar level after 1 hour, 90 min, and 2 hours showed no significant differences compared to their controls.

Glucose tolerance in first degree relatives female age ranged 36–50 years of diabetics as compared to their controls was tabulated (Table-6).

BMI and level of fasting sugar and level of sugar after half an hour of first degree relatives of male was more compared to control and it showed a highly significant differences (p<0.001). Blood sugar after 1 hour showed significant differences (p<0.05). Sugar level after 90 min and 2 hour was raised but with no significant differences.

Table-1: Glucose tolerance test in first degree relatives' male age ranged 14–25 years of diabetics as compared to their controls (Mean±SD)

Parameters	Subjects (n=8)	Controls (n=10)
Age (year)	19.00±2.24	21.4±4.77
BMI	30.48±5.34*	23.20±1.30
Fasting (mg/dL)	112.40±18.12*	70.0±10.0
30 min. (mg/dL)	143.80±7.36*	100.0±28.28
1 hour (mg/dL)	123.0±15.95	107.0±14.83
90 min. (mg/dL)	109.0±16.73	104.0±29.56
2 hour (mg/dL)	100.80±14.60	89.0±15.97

*p<0.001

Table-2: Glucose tolerance test in first degree relatives' male age ranged 26–35 years of diabetics compared to their controls (Mean±SD)

Parameters	Subjects (n=8)	Controls (n=10)
Age (year)	30.20±2.86	34.40±7.79
BMI	30.44±5.36	26.10±2.60
Fasting (mg/dL)	112.20±28.78*	73.20±8.51
30 min. (mg/dL)	144.20±22.71	116.90±16.15
1 hour (mg/dL)	139.20±19.27	127.70±14.55
90 min. (mg/dL)	122.80±18.78	116.90±16.15
2 hour (mg/dL)	108.20±29.14	101.50±8.83

*p<0.001

Table-3: Glucose tolerance test in first degree relatives' male age ranged 36–50 years of diabetics as compared to their controls. (Mean±SD)

Parameters	Subjects(n=9)	Controls(n=10)
Age (year)	41.80±5.67	34.40±7.79
BMI	34.40±3.65**	26.10±2.60
Fasting (mg/dL)	123.0±3.32**	73.20±8.51
30 min. (mg/dL)	171.0±14.09**	116.90±16.15
1 hour (mg/dL)	151.80±7.89**	127.70±14.55
90 min. (mg/dL)	124.0±8.22	116.90±16.15
2 hour (mg/dL)	13.40±7.06**	101.50±8.83

**P<0.001

Table-4: Glucose tolerance test in first degree relatives' female age ranged 14–25 years of diabetics as compared to their controls. (Mean±SD)

Parameters	Subjects(n=8)	Controls(n=10)
Age (years)	20.25±4.65	22.00±2.12
BMI	27.02±4.98	25.0±1.58
Fasting (mg/dL)	90.75±22.2	79.0±15.97
30 min. (mg/dL)	117.0±28.3	116.40±23.59
1 hour (mg/dL)	131.75±19.18	114.0±4.93
90 min. (mg/dL)	112.53±23.27	106.0±5.48
2 hour (mg/dL)	94.25±21.73	88.0±8.37

Table-5: Glucose tolerance test in first degree relatives' female age ranged 26–35 years of diabetics as compared to controls. (Mean±SD)

Parameters	Subjects(n=8)	Controls (n=10)
Age (year)	29.67±3.88	34.40±7.79
BMI	25.78±6.05	26.10±2.60
Fasting (mg/dL)	102.0±16.78	73.20±8.51
30 min. (mg/dL)	164.33±40.66*	111.20±11.92
1 hour (mg/dL)	126.0±25.94	127.70±14.55
90 min. (mg/dL)	116.67±23.1	116.90±16.15
2 hour (mg/dL)	104.33±22.43	101.50±8.83

*p<0.001

Table-6: Glucose tolerance test in first degree relatives' female age ranged 36–50 years of diabetics as compared to controls. (Mean±SD)

Parameters	Subjects (n=9)	Controls (n=10)
Age (year)	45.11±4.20	34.40±7.79
BMI	40.11±11.62**	26.10±2.60
Fasting (mg/dL)	122.67±31.58**	73.20±8.51
30 min. (mg/dL)	173.44±36.57**	111.20±11.92
1 hour (mg/dL)	173.56±30.56*	127.70±14.55
90 min. (mg/dL)	163.67±75.68	116.90±16.15
2 hour (mg/dL)	151.22±73.93	101.50±8.83

*p<0.05, **p<0.001

DISCUSSION

Diabetes exerts a significant burden worldwide and this is expected to increase. Many diabetic patients face significant challenges accessing diagnosis and treatment which contributes to high mortality and prevalence of complications. First degree relatives of subjects with type 2 diabetes are at risk of developing hyperglycaemia as their glucose tolerance test is alter.[9]

Variation in BMI and glucose tolerance test in male first degree relative, age ranged 14–25 years was compared with their controls. It was observed that the BMI and fasting blood sugar of first degree relatives of males was significantly greater (p<0.001) compared to controls. However a study reported that there is no variation in BMI and fasting blood sugar of First degree relatives of diabetics when compared to their controls.[10]

Present study observed that GTT, was increased in first degree relatives of diabetes with age group (14–25) compared to their controls but significant difference (p<0.001) was seen only in fasting and after 90 min. Our study is in agreement with a study which observed that first degree relatives of people with type 2 diabetics are at higher risk of diabetes due to increased GTT. This risk increased with age and BMI.[11]

Present study was also observed significant increased BMI and impaired . GTT was observed in first degree relatives of diabetics. According to American Diabetic Association[12], first degree relatives of diabetes with impaired GTT and increased BMI may be at increased risk of diabetes. American Diabetic Association recommended that FBS with $\geq$ to 126 mg/dl and plasma glucose after 2 hour with $\geq$to 200 mg/dl may be considered the first degree relatives at higher risk of developing diabetes. Another study reported that increased BMI may be related with increased blood sugar level which in turn may be associated with insulin resistance that in turn increased the risk of diabetes in first degree relatives.[13]

Impaired GTT and increased BMI in female first degree relatives age ranged 14–25 years was increased non-significantly as compared to their controls. Impairment in GTT and increased BMI in age ranged 26–35 years was also determined. It was observed that the in this age group there is a significant change after ½ hour of glucose load. A group of worker screened the first degree relatives of diabetics, and recommended that in age >35 years, the BMI, fasting blood glucose level, and GTT should be recommended to screen for diagnosis of diabetes.[14,15]

It was observed that impaired GTT was more marked in age group 26–35 compared to 14–25. This showed that with increased age, the risk of diabetes is more prevalent. Many studies are in agreement to our study. These studies concluded that insulin resistance is present in individuals who are at high risk of developing diabetics. The studies concluded that the beta cell function is relatively low in some groups and they have at high risk of developing hyperglycaemia.[16,17] Our study is in accord with a study who that the impaired GTT in first degree relatives of diabetes may be due to diminished beta cell function and this reduction effect on insulin.[10]

CONCLUSION

Body mass index and impaired oral glucose tolerance test may be an indicator of early detection of diabetes in first degree relatives of both male and female. Further research is needed on large number of first degree relatives to reach a better conclusion.

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Address for Correspondence:

Nadia Bashir, Department of Molecular Biology & Biotechnology, University of Lahore, Pakistan. **Cell:** +92-322-4996163
Email: nadiabashir31@yahoo.com