



CODEN [USA]: IAJPBB

ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

<http://doi.org/10.5281/zenodo.3831301>

Available online at: <http://www.iajps.com>

Research Article

RATE OF OCCURRENCE OF IMPAIRED FASTING GLUCOSE IN 1ST DEGREE RELATIVES OF THE PATIENTS SUFFERING FROM TYPE-2 DIABETES MELLITUS AND ITS CORRELATION WITH BMI

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Article Received: March 2020

Accepted: April 2020

Published: May 2020

Abstract:

Objectives: The aim of this study is to find out the rate of occurrence of impaired fasting glucose in the 1st degree relatives of the patients suffering from Type-2 Diabetes Mellitus and its correlation with BMI (Body Mass Index).

Methodology: This transverse research work was carried out at DHQ Hospitals, Sialkot from August 2019 to February 2020. People with ≥ 35 years of age, 1st degree relatives of the patients suffering from Type-2 diabetes mellitus, got recruitment in this research work and we checked their levels of fasting blood sugar 2 times a week apart. We divided the participants of this research work into three groups. Group-1 comprised the persons with normal fasting blood glucose (FBS: $<100.0\text{mg/dl}$), Group-2 contained the patients with impaired fasting glucose ($100.0-125.0\text{ mg/dl}$), thought to be with high risk and Group-3 contained the patients who turned out to be present with frank diabetes (FBS: $\geq 126.0\text{mg/dl}$). The patients with known diabetes mellitus and having pregnancy were not included in this research work. We used the Chi square method for the comparison of the proportions of levels of impaired fasting glucose versus body mass index. P value of <0.0010 considered as significant.

Results: A sum of 100 patients were the participants of this study with average age of 44.27 years. 60.0% patients were present with normal fasting blood sugar, 31.0% patients appeared with impaired fasting blood sugar and 9% patients were present with frank diabetes ($P < 0.0010$). There was a significant correlation between impaired fasting glucose and body mass index. There was increase in the rate of occurrence of impaired fasting glucose with the increase in body mass index.

Conclusion: 1st degree relatives of persons suffering from Type-2 diabetes mellitus showed high rate of occurrence of impaired fasting glucose and most important risk factor was obesity.

KEYWORDS: Fasting Glucose, Impaired, Body Mass Index, Type-2 Diabetes Mellitus, Pregnancy.

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Please cite this article in press Saad Ur Rehman et al, *Rate Of Occurrence Of Impaired Fasting Glucose In 1st Degree Relatives Of The Patients Suffering From Type-2 Diabetes Mellitus And Its Correlation With BMI.*, Indo Am. J. P. Sci, 2020; 07(05).

INTRODUCTION:

Diabetes Mellitus is a disease of metabolism which is characterized by hyperglycemia causing from abnormalities in secretion of insulin or insulin action or both [1]. Type-2 diabetes mellitus is an issue of health in whole world and its incidence is increasing in both developed as well as developing regions of the world [2]. Now, Pakistan is in top ten countries for absolute rise in the prevalence of diabetes. The prevalence rate of diabetes in our country is very high. Overall prevalence of diabetes is 26.30%, of which 19.20% are present with known diabetes and 7.10% are newly detected patients of diabetes. The rate of prevalence of impaired fasting glucose is about 14.40% [3]. There is estimation that in the year of 2019, over 19 million adults in our country were present with diabetes, putting all these patients at risk of life-threatening problems [4].

There are very few researches in the whole world which evaluated the incidence of insulin resistance in 1st degree relatives of the patients suffering from Type-2 diabetes mellitus, who are present with enhanced risk to develop the Type-2 diabetes mellitus is near future. The persons present with impaired levels of fasting glucose levels have a 20.0% to 30.0% chance for the development of diabetes over the next 5 to 10 years [5]. Risk factors for developing the Type-2 diabetes mellitus include the history of diabetes mellitus in the family, enhanced body mass index, enhanced circumference of waist, ethnicity, previously diagnosed impaired fasting glucose, history of Gestational Diabetes Mellitus, Hypertension, HDL-C level <0.9mmol/L(35.0 mg/dl) and/or level of triglycerides >2.820mmol/L (250.0mg/dl) and high incidence of cigarette smoking in the countries of South Asia [6-8]. There is a strong relationship between the history of diabetes mellitus in the family and high BMI with the Type-2 diabetes mellitus [9]. Persons present with the impaired glucose tolerance can decrease the risk of diabetes mellitus by changing their life styles as well as decreasing their body weight [10]. So, levels of impaired blood glucose in the persons with the strong history of diabetes in family, especially in 1st degree relatives, should be identified and there should be modification in their lifestyles and it will reduce the burden of diabetes mellitus as well as its complications. Main rationale of this research work was to examine the rate of incidence of impaired fasting glucose in 1st degree relatives of patients suffering from Type-2 diabetes mellitus and its correlation with BMI.

MATERIAL AND METHODS:

This was an observational research work. In this research work, the evaluation of the fasting plasma glucose in 100 persons from parentage suffering

from Type-2 diabetes mellitus coming to DHQ Hospitals, Sialkot from August 2019 to February 2020, got recruitment. In this research work, 1st degree relatives particularly siblings and children of patients suffering from Type-2 diabetes mellitus were included. The age of the patients were 30 years or more. A cut-off age of 35 years at diagnosis for Type-2 diabetes mellitus was commonly utilized to separate Type-1&Type-2 diabetes mellitus in different research works [11]. The participants of this research work were from both genders. We excluded the patients present with confirmed diagnosis of diabetes mellitus, present with symptoms suggestive for diabetes mellitus like polyuria, loss of weight and polydipsia, females with pregnancy because placental hormones induce the insulin resistance. We also excluded the participants suffering from diseases of liver and kidneys [6]. All the persons present with endocrinopathies that rise the blood sugar like thyrotoxicosis and Cushing's syndrome [7, 8]. We collected the following information on an organized Performa as age of the person, gender, profession, lifestyle, history of Type-2 diabetes mellitus in family, hypertension and obesity. We measured the weight of the participants in kilograms in light clothing and without shoes. As measured the height of the participants in centimeters in standing position without shoes. We calculated BMI from the formula $BMI = \frac{Weight}{height^2}$. The normal range of BMI is from 18.50 to 24.90 Kg/m². Overweight BMI is ≥ 25.0 Kg/m², pre-obese BMI is between 25.0-29.99 Kg/m² and obese if BMI is ≥ 30.0 Kg/m².

ADA considers a level of fasting blood glucose of 100.0 mg/dl or higher to be diagnostic of the impaired glucose tolerance. Fasting blood glucose between 100.0 to 125.0mg/dl is known as impaired Fasting blood glucose and Fasting blood glucose of 126.0 mg/dl or higher is considered as frank diabetes mellitus. We presented the numerical data in averages and standard deviations. We used the X² test for the analysis of the nominal variables. P value of 0.050 was the significant value for analysis. SPSS V.20 was in use for the statistical analysis of the collected information.

RESULTS:

There were 100 patients recruited in this current research work. We separated the participants into 3 different groups on the basis of the levels of fasting blood glucose.

Group-1 included 60 patients with fasting blood sugar level of <100.0mg/dl on different occasions. Group-2 included 31 patients with fasting blood sugar between 100.0 to 125.0 mg/dl on 2 different occasions.

Group-3 contained the patients who were present with fasting blood sugar ≥ 126.0 mg/dl on 2 separate occasions.

There were 29 male and 31 female patients in the Group-1 with an average age of 43.50 years. In the Group-2, there were 21 male and 10 female

patients with an average age of 45.90 years. In the Group-3, there were 7 male and 2 female patients with an average age of 43.40 years. We calculated the P value as 0.4520, which is not statistically significant (Table-1).

Table-I: Baseline Characteristics of Three Groups

Characteristics		Group-1 (n=60)	Group-2 (n=31)	Group-3 (n=9)	P-Value
Age	Mean	43.5	45.9	43.4	0.452
	SD	8.34	9.7	6.36	
Gender	Male	29	21	7	
	Female	31	10	2	
Family History	Obesity	17 (28.33%)	12 (38.7%)	7 (77.7%)	
	Smoking	21 (35%)	15 (48.3%)	7 (77.7%)	
Sedentary Life Style		21 (35%)	11 (35.4%)	3 (33.3%)	
BMI	Mean	24.76	27.53	29.05	0.001
	SD	3.44	4.98	4.24	

There was a positive history of obesity in 28.330% patients of Group-1, 38.7% patients of Group-2 and 77.770% patients of Group-3 correspondingly. There was presence of a sedentary lifestyle in 35.0% patients of Group-1, 35.480% patients of Group-2 and 33.330% patients of Group-3. There was presence of a positive history of cigarette smoking in 35.0% patients of Group-1, 48.380% patients of Group-2 and 77.770% patients of Group-3. As elaborated in Table-1, history of obesity was higher in the patients of Group-2 in comparison with the patients of Group-1.

In the same manner, the positive history of smoking was also higher in the patients of Group-2 as compared to the patients of Group-1. About the sedentary lifestyle, the Group-2 patients displayed a slightly higher frequency as compared to the patients of Group-1. These all are the important risk factors in the determination of the enhanced chances of the development of diabetes mellitus in near future. Average BMI in the patients of Group-1, Group-2 and Group-3 were 24.760 ± 3.440 , 27.530 ± 4.980 and 29.050 ± 4.240 respectively with a P-value of 0.0010, which is significant statistically (Table-1). There was significant association between the level of impaired fasting glucose and body mass index. There was increase in the risk of acquiring impaired glucose level or diabetes with the increase in the body mass index.

Table-II: Association of Impaired Fasting Blood Sugar with BMI

	Normal FBS		Impaired FBS		Diabetes Mellitus		Total	
	Count	Row N%	Count	Row N%	Count	Row N%	Count	Row N%
BMI normal	34	77.30%	9	20.50%	1	23%	44	100.00%
Overweight	23	60.50%	13	34.20%	2	53%	38	100.00%
Obese	3	16.70%	9	50.50%	6	33.30%	18	100.00%
Total	60	60.00%	31	31.00%	9	9.00%	100	100.00%

P-value of <0.001 with Chi sq=24.42.

DISCUSSION:

In this current research work, we observed the high rate of occurrence of impaired fasting glucose in 1st degree relatives of the patients suffering from Type-2 diabetes mellitus [9,10]. Out of 100 patients with family history of Type-2 diabetes mellitus; impaired fasting blood sugar was present in 31.0% patients and frank diabetes in 9.0% patients (Table-1). One research work performed by Bock G

noticed that persons with impaired levels of fasting blood sugar have a 20.0% to 30.0% chance for the development of the diabetes over the next 5 to 10 years [11,12]. Similarly, Shaikh MA carried out a research which showed that patients with strong history of Type-2 diabetes mellitus in family are at high risk for the development of the impaired fasting blood sugar leading to many other complications [13]. One other research work

conducted by Kumar A displayed that there was presence of insulin resistance with high incidence in the 1st degree relatives of the patients of Type-2 [14]. This incidence increases with the increase of the development of disease in the relatives of the patients of Type-2 diabetes mellitus [15]. Rodríguez-Moran stated that the presence of positive family history of diabetes mellitus in 1st degree relatives has association with the level of impaired fasting glucose, even in non-obese patients [16].

This research work stated that history of smoking, obesity and sedentary lifestyle has a strong influence on the patients developing impaired fasting blood sugar in future (Table-1). Increased BMI, gain of body weight, dyslipidemia, Hypertension and increase fasting plasma glucose are the main indicators of development to Type-2 diabetes mellitus [17,18,19]. With the increase in the fat of body, there is always increase in the diabetes incidence. There was much high incidence of impaired fasting blood sugar and diabetes in the patients who were obese. So, there is a strong risk for the development of the diabetes mellitus in the obese patients of the 1st degree relatives of the patients suffering from Type-2 diabetes mellitus [20]. This current research work also stated a strong correlation between higher body mass index and increased fasting blood sugar (Table-2). In this current research work, there were increased values of BMI in the diabetic group as compared to the other groups. So, there was association between diabetes mellitus and increased body mass index [21,22]. Park YW stated related risk factors with Type-2 diabetes mellitus that include the history of diabetes mellitus in family and increased body mass index. Banerjee S also stated that there was significant association between high body mass index and history of diabetes mellitus in family [23,24]. The proper management of obesity can reduce the progression of Type-2 diabetes mellitus. Research works have showed that lifestyle intervention and counselling should be treatment options for the improvement of glycemic control and reduce the prospect of development of Type-2 diabetes mellitus.

CONCLUSION:

Results of this research work concluded that there was very high rate of occurrence of impaired fasting glucose in 1st degree relatives of the patients suffering from Type-2 diabetes mellitus; therefore, timely screening and early intervention like modification in the life style of such persons can be helpful in the prevention of the incidence of diabetes mellitus in near future. It is also helpful in the reduction of the national diabetic burden. A strong correlation between the impaired fasting glucose and high BMI suggested that the

most important priority is the maintenance of healthyweight and prevention from obesity. There should be counselling of all the 1st degree relatives of the patients suffering from Type-2 diabetes mellitus who are obese, regardless of the value of level of blood glucose, about the modifications in the lifestyle.

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