

Evaluating the Prevalence of Type 2 Diabetes, Impaired Fasting Glucose, and Impaired Glucose Tolerance in the First-degree Family Members of the Diabetic Patients

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Abstract

Introduction: Type 2 diabetes is a genetic disorder, but the gene or genes involved in the development of this diabetes have not been well identified so far. In most studies, diabetes has been reported as one of the most common causes of mortality and disability in communities. The probability of diabetes in the first-degree family members of the diabetic person is 30%, which many of them are asymptomatic and unaware of their diabetes. **Methodology:** In this research, the first-degree family members of type 2 diabetic people were examined, and screening was performed to find impaired glucose tolerance (IGT) and impaired fasting glucose (IFG) diabetes. In this research, 174 families (1556 people aged over 30 years) were examined, which 1232 of them were alive. Fasting blood sugar (FBS) test and oral glucose tolerance test (OGTT) were also used in this regard. **Results:** The results of this research revealed that 1232 people were alive and 324 died, which 343 (27.9%) of the alive people and 82 of dead people (25.3%) were diabetic. Moreover, 179 (14.5%) had IFG and 89 (7.2%) had IGT. The percentage of offspring and sibling involvement in this sample was 32.9% and 22.1%, respectively. The highest number of diabetic people was seen in the age group of 41–49 years. In this research, it was revealed that the risk of diabetes would be higher in children, if both parents are involved. The percentage of diabetes was higher in females than that in males (32.4% vs. 22.2%). Investigating the diabetes involvement among the first-degree family members also indicated that the highest percentage of diabetes belonged to sisters-brothers (siblings) (41.95%) and the lowest percentage belonged to father-son (10.9%). **Conclusion:** The incidence of diabetes in most communities is 8–10%. In the case of the development of type 2 diabetes in one of the family members, the incidence of diabetes in other family members increases by 30%. Thus, screening should be performed in all family members of type 2 diabetic person continuously so that the disease to be immediately diagnosed and treated to prevent major complications of diabetes.

Key words: Familial diabetes, impaired fasting glucose, impaired glucose tolerance, prevalence, type 2 diabetes

INTRODUCTION

Diabetes mellitus is one of the most common causes of metabolic disorders and the fifth leading cause of death in western communities. The pathogenicity of this complication is very high in terms of medical costs and disability. It is one of the main human health issues.^[1] Studies conducted in Iran on the prevalence of diabetes before the 1970s were very limited. Primary epidemiological studies on diabetes in Iran were conducted in 1976 and 1978 by the Institute of Nutrition Sciences and Food Industry of Iran. This research showed an

increase in diabetes among employees compared to workers and the high prevalence of diabetes in the marginal areas of the desert. The prevalence of diabetes in adults was reported 2–10%.^[1] In studies conducted on people aged over 30 years old, it was revealed that diabetes prevalence was about 7.6%

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in females and 7.1% in males, and impaired glucose tolerance (IGT) was 6.4% in females and 8.9% in males and half of diabetic patients were unaware of their disease.^[2] These researchers reported that the prevalence of diabetes is 7.3% and the prevalence of IGT is 7.2% in subjects aged over 30 years and living in villages of Tehran province.^[2]

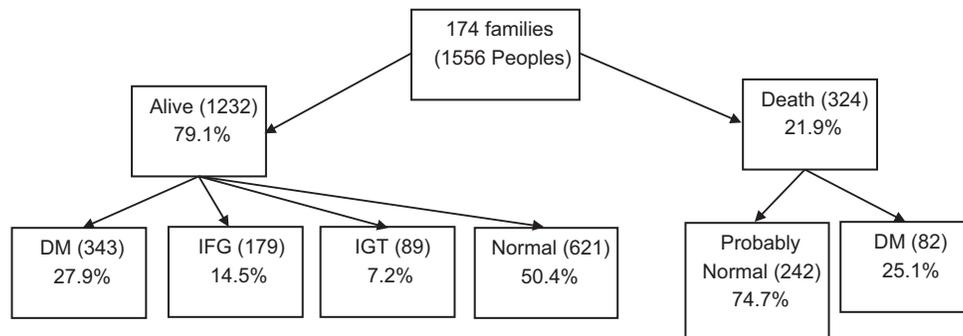
In another study conducted by the Gland Research Center of Tehran University of Medical Sciences on 28,000 residents aged over 30 years, the prevalence of diabetes mellitus and IGT was reported 7.2% and 8.2%, respectively.^[3] In another study conducted in 1977 on diabetic people aged over 30 years, the prevalence of diabetes and IGT in disable and underactive subjects were reported 9% and 6%, respectively, and in subjects with severe physical activity, they were reported 2% and 3%, respectively.^[4] The pedigree of type 2 diabetes will provide valuable informations. Thus, by conducting this research, early diagnosis of diabetes in other members will be possible. The results of this research and their dissemination at the community level could increase the awareness of individuals and even with a change in the lifestyle of the subjects, intervening actions can be taken to improve the life of diabetic people and delay the development of diabetes in these people.

METHODOLOGY

In this research, 250 diabetic patients aged over 30 years were randomly invited to participate. Out of them, 174 families (1556 people) participated. Fasting blood sugar (FBS) and oral glucose tolerance test (OGTT) tests were requested for all the first-degree family members who did not have diabetes history. Thus, diabetic, impaired fasting glucose (IFG), and IGT subjects were identified. Those who had died had two conditions. Either they were diagnosed as diabetic people or they were not diagnosed and died.

RESULTS

In the screening of 1556 subjects aged over 30 years, the following information was obtained [Algorithm 1].



Algorithm 1: Screening of 174 families (1556 people)

The information of 174 diabetic families based on the age group is shown in Table 1

Most of the type 2 diabetic people were in the age group of 41–50 years (32.65%) and the lowest of them was in age group >71 years [Table 1]. The incidence of diabetes in offspring and sibling of diabetic people was 32.9% and 22.1%, respectively. In this research, the mother of 103 families had type 2 diabetes, which 27.9% of their children were affected by diabetes. The father of only 59 families was diabetic, which 29.23% of their children were diabetic. Of six families, both parents were diabetic, which 43.75% of their children were diabetic. In 95 families, parents were not diabetic, but 38.62% of their children were diabetic [Table 2].

In the study, the relationship was found between diabetes involvement of the first-degree family members and children diabetes, which the highest rate belonged to siblings and the lowest rate belonged to father-sons.

DISCUSSION

In this research, random sampling method was used. The main objective of this research was evaluating the prevalence of diabetes, IFG, and IGT in the first-degree family members of type 2 diabetic patients. In most studies, the prevalence of type 2 diabetes in Iran is 5–6% based on the WHO criteria.^[5] In one study conducted to evaluate the level of lipid and glucose in Tehran, it was reported to be 11.4%.^[2] Screening of the first-degree family members of diabetic people by OGTT, more diabetic people would be identified. Thus, the prevalence of type 2 diabetes in Iran will be higher than this figure. This suggests that more effort should be made to find the causes of type 2 diabetes in Iran than other communities and more effective steps should be taken to prevent and treat it. Out of the 174 families studied (1556 people), 324 people died and 82 people (25.3%) had previously diagnosed as diabetic people, and in the case of 242 people, no accurate information was available on their diabetic or non-diabetic status, so they were placed in the “probably non-diabetic” group and 1232 of them (27.9%) were alive and had diabetes.

Table 1: Calcification of diabetic patients by age groups

Age groups (years)	30–40	41–50	51–60	61–70	<71
Total (Number)	299	381	240	152	67
Diabetic patients (Number)	42	112	85	66	38
DM to total (%)	14.04	29.39	35.41	43.42	56.71

Table 2: Prevalence of diabetic patients in offspring

Number of families	DM in offspring number (%)	Normal Offspring number (%)	Total number
DM in mothers (103 families)	118 (27.9)	305 (72.1)	423
DM in fathers (59 families)	69 (29.23)	167 (70.77)	236
DM in mothers and fathers (6 families)	21 (43.75)	27 (56.25)	48
Normal mothers and fathers (95 families)	163 (38.62)	259 (61.38)	422

In this research, 179 subjects (14.5%) were placed in IFG group and 89 subjects (7.2%) were placed in IGT group. In some studies, the prevalence of IGT has been reported to be higher than that of diabetes.^[3,6] However, in this research, the prevalence of IGT was less than that of diabetes, since in subjects, whose FBS was in the range of diabetes or IFG, OGTT was not performed. If the test was performed on these subjects, the prevalence of IGT would have been reported higher and a bias would have been formed between the prevalence of IFG and IGT. The prevalence of diabetes has been reported more than IGT in some studies, for example, in a study conducted on 1977 diabetic patients aged over 30 years, it was found that the prevalence of diabetes and IGT was 9% and 6%, respectively.^[7] In another study was conducted on subjects aged over 30 years, it was found that the prevalence of diabetes was 7.6% in females and 7.1% in males and IGT was 6.4% in females and 8.9% in males.^[2] The prevalence of diabetes was more than IGT in females.

In total, 49.6% of the subjects suffered one type of glucose metabolism disorder such as diabetes or IFG or IGT. People with IFG and IGT are at risk for diabetes, and these people should be controlled under diet and treated in some cases.^[8] Thus, by screening diabetes in the community, diabetes can be diagnosed before its development and it can be delayed and its chronic complications can be prevented. In this research, 50.4% of the subjects were completely “normal,” but they should be reexamined in future. In this research, the highest incidence of diabetes was seen in subjects aged 41–50 years (32.62%). Type 2 diabetes occurs mainly at this age. However, in previous studies, this increase of prevalence was seen in the age group of 51–56 years.^[9,10] The lowest age of diabetes belongs to people aged 71 years, which it is due to an increase in mortality in this age group. Thus, it could be stated that the reduced prevalence of diabetes in people aged over 60 years old in Iran is due to increased mortality in this age group.

Another reason might be related to average life expectancy in Iran, which is lower than other countries.^[2] In this

research, the percentage of diabetic people increased with increasing age [Table 1]. For example, in the age group of 30–30 years, 14.44% of the subjects were diabetic, but in the group older than 71, 56.71% were diabetic. Given these results, it can be concluded that, if life expectancy of people allows, the probability of diabetes in the first-degree family members of the type 2 diabetic people would increase significantly. Based on the conducted study, the percentage of offspring and siblings was 32.9% and 32.1%, respectively, which these figures were 33% and 33%, respectively, in other studies.^[11,12] MODY is a major genetic achievement in diabetes and it includes 2–5% of diabetes, but it includes about 10–15% of diabetes in France.^[13] Many studies have reported that the prevalence of diabetes is slightly higher than that in males. In the research conducted by Curley, the ratio of females-to-males was 1.4%. However, the ratio of females-to-normal males was equal in that population.^[9] In the research conducted by Ramchandran, no significant change was observed in males and females diabetic people (301 vs. 307) ($P < 0.62$).^[10] The prevalence of diabetes in females and males in this research was reported 32.4% and 22.2%, respectively ($P < 0.05$).

However, the report of other studies suggests that the prevalence of diabetes in females is slightly higher than that of males and there is no significant difference between them,^[11,14] but this difference was significant in our study. Another issue studied in this research was diabetes involvement of the first-degree family members. The highest percentage was related to siblings (41.95%) and the lowest was related to the father-son (10.9%). In investigating the family trees, it was observed that both parents were diabetic in six families and 75.74% of children were diabetic in average [Table 2]. If both parents are diabetic in a family, the risk of diabetes in their children would be higher in comparison to the conditions in which father or mother of the family is diabetic, and this result has been observed in many studies.^[5,8,9] In addition, in 59

families, only fathers were diabetic and 29.32% of their children were affected by diabetes.

In most studies, it was seen that the transmission of the disease is more when mother is diabetic compared to conditions in which father is involved. In the research conducted by Shao on 2310 diabetic patients, the incidence of diabetes was higher when the mother was infected.^[9] However, in the research conducted by Hussain, this increase was not observed.^[15]

In his research, Weires found that the frequency of the incidence of diabetes when the mother is involved 2.5 times more than that when the father is involved.^[16] In another study conducted on pregnant diabetic people, it was found that 3% of mothers had diabetes, while 8.8% of the fathers had diabetes.^[17] In this research, in 103 families in which the mothers had diabetes, 27.9% of children were diabetic. Moreover, in 95 families, none of the fathers and mothers was diabetic, but 38.62% of the children were diabetic. With regard to the lack of diabetes in parents (95 families) and the development of diabetes in children (38.62%), the genetic issue complicates the diabetes.

However, it was found that in 82 families of this group, one of the parents died, and the lack of diabetes was not certain in these people. Therefore, died people might be diabetic and they might transmit their genes involved in diabetes to their children. In this research, it was found that in the case of father or mother involvement in diabetes, no significant difference is seen in their children involvement (29.23% vs. 27.9%). While some other studies suggest that the mother involvement increases risk of diabetes in children,^[15,18] no such finding was observed in this research.

In 15 families, 100% of children were diabetic, which the father was diabetic in three families and mother was diabetic in one family. In addition, none of the parents was diabetic in 11 families, while parents of 10 families out of 11 families died and it was not clear that they were diabetic or non-diabetic. However, lack of diabetes in parents, which 100% of their children were diabetic, complicates the importance and role of genetic. Given what was said above and the results obtained, it can be concluded that people at the age of 40–60 years are probably more prone to type 2 diabetes and the likelihood of developing diabetes decreases after this age range. Thus, the population aged 40–60 years is at risk of diabetes in Iran and the screening program is required for people at this age group. Moreover, an increase in the prevalence of diabetes in Iran compared to that in other countries is a warning sign, making it necessary to identify the diabetic people.

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COMPLIANCE WITH ETHICAL STANDARDS

Ethical approval

The study protocol was approved by the Ethics Committee of Tabriz University of Medical Sciences, Tabriz, Iran. The current study was performed according to the Institutional Committee for the Protection of Human Subjects, which was adopted by the 18th World Medical Assembly, Helsinki, Finland, and its later amendments.

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