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Related factors to disparity of diabetes care in Iran

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Summary

Background: We determined, in Iranian patients with diabetes mellitus, the prevalence of inadequate glycemic control and its predictors.

Material/Methods: The data from a national population-based survey that included a random sample of 89 404 Iranian individuals in 2005 were analyzed. In that sample, 2923 diabetic subjects (age range, 25–64 years) were identified. We linked the results of their fasting plasma glucose levels with demographic and behavioral variables to determine predictors of poor glycemic control.

Results: About 57% of the subjects had a fasting plasma glucose level of ≥130 mg/dL. That percentage was comparable in male and female subjects and in literate and illiterate subjects. However, inhabitants in rural areas controlled their fasting plasma glucose level about 11% better than did subjects who lived in an urban area. We also found that control of the fasting plasma glucose level was much better in relatively younger diabetic patients. Diabetic subjects with a family history of type 2 diabetes mellitus exhibited a higher uncontrolled fasting plasma glucose level than those without positive family history of diabetes.

Conclusions: The percentage of uncontrolled type 2 diabetes found in our study suggests that the Iranian healthcare system should devote more attention to that disorder, particularly in elderly individuals, who are more vulnerable to the complications of diabetes and control their disorder less well than do younger diabetic patients. The recent integration of diabetic care in primary healthcare systems in Iranian rural areas was found to have a promising effect on community health.

key words: type 2 diabetes • glycemic control • Iran

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Background

The number of people with type 2 diabetes mellitus is expected to increase worldwide from 175 million in 2000 to 353 million in 2030 [1]. The largest increase in that disorder is expected to occur in developing countries, in which 305 million individuals are likely to have type 2 diabetes mellitus by 2030 [2]. Data from the first survey of risk factors of noncommunicable diseases in Iran revealed type 2 diabetes mellitus in an estimated 7.7% of adults aged 25 to 64 years in 2005 [3]. Diabetes and its complications (limb amputation, blindness, kidney failure) create huge sociocultural problems and result in an unacceptable economic burden [4[. Evidence shows that socioeconomic status is associated with the quality of diabetes care [5,6]. Because little is known about type 2 diabetes in Iran, which is a rapidly developing country in the Middle East, we conducted a population-based survey to assess the prevalence of that disorder and to explore the existing modifiable risk factors for uncontrolled type 2 diabetes in an Iranian population.

Material and Methods

We analyzed data, which had been collected according to the World Health Organization recommended stepwise approach [7], on the surveillance of noncommunicable disease risk factors. Those data were compiled by staff from the Iranian Ministry of Health who estimated the prevalence of risk factors for non-communicable diseases in Iran. The study subjects were recruited in a 1-stage cluster random sampling in both rural and urban areas in Iran. After providing informed consent, the subjects completed a standardized questionnaire via a face-to-face interview, underwent a physical examination that included serologic testing and the determination of the fasting plasma glucose level, and provided demographic information and a medical history.

Database

The main database consisted of 89 404 records from a random sample of the general Iranian population (age range, 15–64 years) in 2005. The details of the study methodology were published by the Ministry of Health and Medical Education of Iran in 2005 [8]. After having checked the consistency of the data (Figure 1), we defined the following exclusion criteria: a reported fasting plasma glucose level lower than 50 mg/dL or higher than 500 mg/dL and age younger than 25 years.

Statistical methods

This study consisted of diabetic individuals. Subjects with a fasting plasma glucose level of ≥130 mg/dL were considered to have uncontrolled diabetes mellitus [9]. We compared the percentage of subjects with uncontrolled type 2 diabetes mellitus according to residence (rural vs urban areas). We also examined the effects of several main social determinants such as age, sex, educational level, and marital status. To eliminate the potential confounding effects of obesity and a family history of diabetes, we entered those variables in a logistic regression model. All statistical analyses were performed with STATA version 8 (StataCorp – 4905 Lakeway Drive, College Station, Texas 77845 USA).

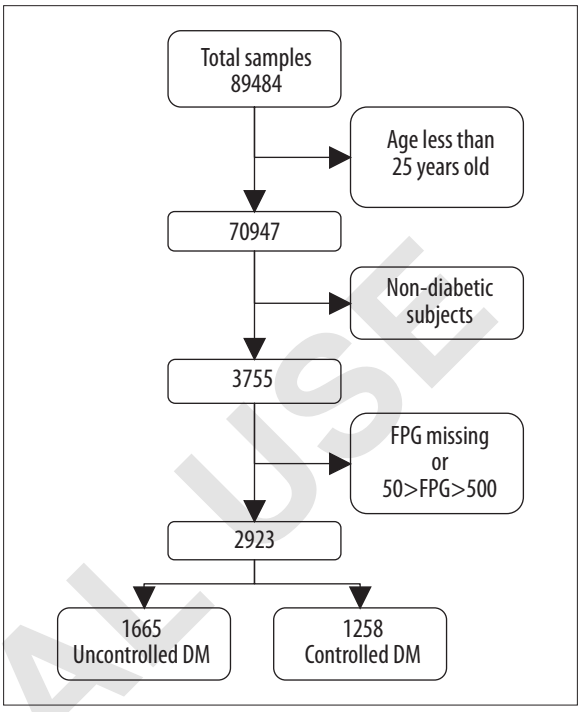

Figure 1. Sample selection strategy and size.

Results

Type 2 diabetes mellitus was reported in about 2923 individuals (5.6%; 95% CI: 5.4%-5.8%). Most of the study subjects were female (62.7%) (Table 1) and were on average 52±8.9 years old. More than 80% of those with type 2 diabetes mellitus were older than 45 years. Approximately 87% were married, and more than 70% lived in an urban area. The literacy rate was about 55% in the study subjects. Almost 45.7% of those individuals had at least 1 family member with confirmed type 2 diabetes mellitus. Based on body mass index, only 23.8% had a weight within the reference range, and more than 33% were obese (Table 1).

Overall, 1665 (56.9%; 95% CI: 55.1–58.8%) subjects had a fasting plasma glucose level of ≥130 mg/dL. About 59% of the men and 56% of the women had uncontrolled type 2 diabetes mellitus, but that difference was not statistically significant (P=0.106). We found a positive association between age group and the risk of inadequate control: Only 23% of the subjects aged 25 to 34 years had uncontrolled type 2 diabetes mellitus, but about 60.3% of those older than 55 years had that disorder (P<0.001) (Table 2). Only 49% of the subjects who were living in an urban area adequately controlled their disease, but that percentage improved to 51% in subjects who lived in a rural area (P<0.001). The percentage of uncontrolled type 2 diabetes mellitus did not statistically significantly differ between illiterate and literate patients (56.3% vs 57.6%; P=0.503). Subjects with no type 2 diabetes mellitus in first-degree family members better controlled their diabetes (P<0.001). In general, the percentage of uncontrolled type 2 diabetes mellitus increased as did the degree of obesity, but that correlation was not statistically significant (Table 2).

The adjusted effect of different predictors on uncontrolled type 2 diabetes mellitus is illustrated in Table 2. However,

Table 1. The charectristics of selected samples, who had history of diabetes mellitous.

Variables	Diabetic cases (n=2,923)
Gender	
Male	1092 (37.4)
Female	1829 (62.6)
Age group (year)	
25–34	133 (4.5)
35–44	424 (14.5)
45–54	972 (33.3)
55–64	1394 (47.7)
Marital statues	
Married	2571 (88.0)
Single	80 (2.7)
Other	271 (9.3)
Living Area	
Urban	2182 (74.6)
Rural	741 (25.4)
Educational Level	
Illiterate	1312 (44.9)
Literate	1607 (55.1)
Diabetes in Family	
Yes	1332 (45.7)
No	1581 (54.3)
Obesity – BMI (kg/m^2)	
Healthy Weight	695 (23.8)
Over-weight	1243 (42.6)
Obesity I	723 (24.8)
Obesity II	201 (6.9)
Obesity III	56 (1.9)

All Data in () expressed as Percentage. BMI – Body Mass index.

when compared with the base age group (25–34 years old), the group of older subjects demonstrated a 3-fold to 5-fold greater prevalence of uncontrolled diabetes mellitus ($P<0.001$). Living in a rural area was associated with an improved diabetes control rate of about 28% ($P<0.001$). Having no first-degree family member with type 2 diabetes decreased the percentage of uncontrolled diabetes by 36%. Variables such as sex, marital status, educational level, and obesity had no statistically significant effect on the prevalence of uncontrolled diabetes in both univariate and multivariate models (Table 2).

Discussion

Although in general in Iran, the socioeconomic level in rural areas is lower than that in urban areas, we found better control of type 2 diabetes in patients who lived in a rural area. We found that more than half of the subjects studied, regardless of sex, had no adequate glycemic control. Uncontrolled diabetes was more frequent in the elderly, who were prone to more adverse complications. In addition, a family history of type 2 diabetes mellitus did not improve the quality of glycemic control. Factors such as marital status, literacy level, and low-to-moderate obesity had no statistically significant association with uncontrolled diabetes mellitus.

Uncontrolled diabetes, which is currently a topic of considerable debate, often leads to biochemical imbalances that can cause acute life-threatening events. Most adverse outcomes associated with diabetes result from macrovascular [10] or microvascular [11] complications. The burden of diabetes-related hospitalizations will increase as a result of inadequate early medical care and the lack of diabetes prevention programs [12,13].

Our results showed that the quality of diabetes control was inadequate in more than half of the subjects studied. Even in developed countries, about 50% of individuals with type 2 diabetes are not diagnosed as having that disorder [14]. In Iran, there may be a lack of programs for the early diagnosis and management of type 2 diabetes mellitus, especially in urban areas. It has been estimated that at least 1.2 million people in Iran have type 2 diabetes mellitus [15,16], and without prompt attention to that problem, the burden of complications caused by that disorder will increase in the near future.

We found that the prevalence of uncontrolled type 2 diabetes mellitus was more frequent in families with a history of diabetes; a finding that, after other factors had been considered, remained statistically significant in our study. We concluded that in Iran, there was less family support of glycemic control in families with diabetic individuals. Some studies have confirmed the importance of family support and have shown that successful glycemic control is positively associated with the degree of family cohesion and negatively associated with the level of family conflict in adults with type 2 diabetes [17,18]. Trief and colleagues reported a strong association between good glycemic control and a good marriage [19].

In Iran, the correlation between family support and glycemic control underscores the importance of familial relationships in the management of diabetes, and further investigation of that topic is highly recommended.

One interesting finding of this study was that subjects with type 2 diabetes who lived in a rural area in Iran had better glycemic control than did those who lived in an urban area. The most possible explanation for that finding is the level of the Iranian healthcare system activity in rural areas. Primary healthcare services in Iran are provided and supported primarily by the government. Healthcare workers in rural healthcare houses actively survey rural people and record their most communicable and noncommunicable diseases, such as type 2 diabetes mellitus. Those workers are trained to follow their patients in designated areas, and they are available to assist rural patients.

In a population-based study in Tehran in 2001, Azizi and colleagues showed that obesity is more frequent in patients with diabetes or impaired glucose tolerance [15]. We also found that diabetic subjects with only grade III obesity were at risk for uncontrolled diabetes mellitus. In addition, we found that the prevalence of uncontrolled type 2 diabetes did not vary according to sex. Studies in other countries have also indicated that there is no sex-related difference in the quality of care, including diagnosis, treatment, hospitalization, and rehabilitation, for patients with diabetes [20].

Table 2. The frequency of uncontrolled diabetes mellitus by gender, age, marital statues, living place, literacy, family history of DM.

	Controlled DM (n=1419)	Un-Controlled DM (n=1504)	Crude OR [CI 95%]	Adjusted OR [CI 95%]
Gender				
Male**	449 (41.12)	643 (58.88)	1	1
Female	808 (44.18)	1021 (55.82)	1.13 [0.97–1.32]	1.06 [0.90–1.27]
Age group				
25–34**	102 (76.69)	31 (23.31)	1	1
35–44	211 (49.76)	213 (50.24)	3.32 [2.13–5.18]*	3.21 [2.04–5.06]*
45–54	391 (40.23)	581 (59.77)	4.89 [3.21–7.46]*	4.98 [3.22–7.69]*
55–64	554 (39.74)	840 (60.26)	4.99 [3.29–7.56]*	5.29 [3.42–8.18]*
Marital statues				
Married**	1098 (42.71)	1473 (57.29)	1	1
Single	40 (50.00)	40 (50.00)	0.75 [0.48–1.16]	0.94 [0.59–1.51]
Other	119 (43.91)	152 (56.09)	0.95 [0.74–1.23]	0.88 [0.67–1.15]
Living Area				
Rural**	381 (51.42)	360 (48.58)	1	1
Urban	877 (40.19)	1305 (59.81)	1.57 [1.33–1.86]*	1.39 [1.16–1.67]*
Educational Level				
Illiterate**	573 (43.67)	739 (56.33)	1	1
Literate	682 (42.44)	925 (57.56)	1.05 [.91–1.22]	1.11 [0.93–1.32]
DM in Family				
No**	758 (47.94)	823 (52.06)	1	1
Yes	493 (37.01)	839 (62.99)	1.57 [1.35–1.82]*	1.55 [1.33–1.81]*
Obesity (%)				
Healthy Weight**	307 (44.17)	388 (55.83)	1	1
Over-weight	532 (42.80)	711 (57.20)	1.06 [0.88–1.28]	1.02 [0.84–1.24]
Obesity I	314 (43.43)	409 (56.57)	1.03 [0.84–1.27]	0.98 [0.79–1.23]
Obesity II	84 (41.79)	117 (58.21)	1.10 [0.80–1.51]	1.09 [0.78–1.52]
Obesity III	17 (30.36)	39 (69.64)	1.82 [1.01–3.27]*	1.74 [0.95–3.18]

* P value<0.0001; ** Control Group. All Data in () expressed as Percentage while those in [] indicates the 95% confidence interval for OR. OR – Odds Ratio; CI – Confidence Interval; DM – Diabetes Mellitus; Uncontrolled DM is defined as FPG >130 with positive history of DM.

Limitations

We acknowledge the following limitations of our study. We used a fasting plasma glucose level of > 130 mg/dL to indicate uncontrolled diabetes mellitus. That threshold is based on a recent report from the American Diabetes Association, which mentioned the reference range of preprandial capillary plasma glucose is between 60 and 130 mg/dL [21]. Also, we performed a sensitivity analysis for various thresholds ranging from 126 to 140 mg/dL. Although the percentage of uncontrolled diabetes mellitus changed, we found no statistically significant changes in the association of various predictors for the percentage of uncontrolled diabetes mellitus. Many studies have reported that using the fasting plasma glucose level as a screening test to detect or monitor type 2 diabetes has similar but underestimated findings on uncontrolled diabetes, in compare to oral glucose tolerance tests and glycosylated hemoglobin level [22–24]. Therefore, we believe that we underestimated the prevalence of uncontrolled type 2 diabetes mellitus in Iran because we used the fasting plasma glucose level and not the glycosylated hemoglobin level in our study. Furthermore, there was no specific approach used to detect gestational diabetes. However, because the percentage of gestational diabetes has been shown to be very low in a very large cohort study (n=2574) in Spain [25], that factor could not have greatly affected our findings.

Conclusions

In Iran as in many other countries, the prevalence a controlled fasting plasma glucose level in patients with type 2 diabetes mellitus is low. We suggest that the healthcare system should pay more attention to elderly diabetic patients (particularly those in urban areas). We found that subjects who had a family history of type 2 diabetes mellitus and those who were severely obese were more likely to exhibit an uncontrolled controlled fasting plasma glucose level, and we suggest that those individuals require appropriate care. It is encouraging that the integration of care provided by the public healthcare system for people with type 2 diabetes mellitus in rural areas in Iran has been successful.

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