Research Article

Diabetes prevalence and awareness in adults in the Balçova district in Turkey

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Background/aim: To determine the prevalence and awareness of diabetes and to evaluate associated factors in a population aged 30 and over in the Balçova district of İzmir, Turkey.

Materials and methods: In this cross-sectional study data from 12,915 people who participated in Balçova's Heart Project were evaluated. Diabetes was defined using fasting blood glucose levels according to ADA criteria.

Results: Diabetes prevalence was 13.0% and 87.7% of the patients were aware of the condition. Diabetes prevalence was 1.32 times higher in males, 1.31 times higher in individuals with primary school or lower level of education, 1.37 times higher in individuals who perceived their economic status as bad, 1.20 times higher in those who had quit smoking, 2.84 times higher in individuals who had chronic disease, 1.78 times higher in overweight or obese individuals, and 1.65 times higher in individuals with high blood pressure. Diabetes awareness was 1.78 times higher in women, 1.94 times higher in individuals with social security, 2.62 times higher in individuals with a chronic disease, and 3.55 times higher in individuals who perceived their economic level as poor.

Conclusion: Diabetes prevention policies and programs that aim for early diagnosis, treatment, and prevention of complications in patients should be developed and implemented for the public.

Key words: Diabetes, prevalence, awareness

1. Introduction

Diabetes is one of the most common noncommunicable diseases globally. The aging of populations and the effects of modernization of lifestyle have led to a dramatic increase in the prevalence of diabetes globally, with very high rates in developing countries (1). The International Diabetes Federation predicted the diabetes prevalence as 8.3% in 2011, while approximately 80% of individuals with diabetes live in low- and middle-income countries and diabetes prevalence is estimated to reach 9.9% in 2030 (2). According to the results of the Turkish Diabetes Epidemiology Study I (TURDEP-I) conducted between 1997 and 1998 on individuals over 20 years of age, diabetes prevalence was 7.2%. The results of the TURDEP-II study, repeated in 2010, indicated that prevalence had reached 13.7% (3,4). The increase in the prevalence of diabetes in last 12 years has become a major public health problem in Turkey. With diverse health challenges, health authorities in Turkey need robust data on the epidemiology and impact of diabetes in order to plan and prioritize their health programs (4).

Healthcare professionals as well as public policy makers are well aware of the public health impact of diabetes. Diabetes is a silent disease. Many sufferers become aware that they have diabetes only when they develop one of its life-threatening complications. Awareness of diabetes can help in early detection of the disease and reduce the incidence of complications (5). Increasing community awareness of diabetes and keeping blood glucose levels under control in the early phases of diabetes is very important in preventing complications, improving the quality of life in individuals, and prolonging lifespan.

A limited number of studies have been carried out to determine the level of awareness of diabetes in Turkey. The determination of the factors affecting the level of awareness is important to guide the planning of interventions, including those aimed at increasing awareness and control of diabetes in the population. This study aims to determine the prevalence and awareness of diabetes and to evaluate associated factors in the population aged 30 and over in the Balçova district of İzmir.

2. Materials and methods

In this cross-sectional study, part of the data collected in 2007–2008 in the baseline survey of the Balçova's Heart Project (BAK) were evaluated. The population of the BAK study comprised 36,187 individuals over 30 years of age living in the Balçova district of İzmir Province. All of these individuals were invited to participate in a survey and in total 12,915 individuals completed the questionnaire and provided a blood sample. The response rate was 35.6% (6).

The dependent variables of the study were the existence of diabetes and diabetes awareness status. Existence of diabetes was defined according to the American Diabetes Association (ADA) diagnostic criteria as fasting blood glucose of 126 mg/dL and over or diabetic drug use by patient statement or previous diabetes diagnosis by a physician (7). Diabetes awareness was defined for the individuals who declared diabetes based on physician diagnosis among the individuals who were diagnosed with diabetes after the measurements and medical history assessment. The proportion of previous diabetes diagnosis by a physician to the total number of the individuals with diabetes gives the diabetes awareness ratio. Impaired fasting glucose (IFG) was defined according to the ADA diagnostic criteria as fasting blood glucose levels of 100 mg/dL to 125 mg/dL (7).

Age, sex, education level, marital status, social security coverage, perceived economic status, smoking habits, accompanying chronic disease (coronary artery disease, cancer, hypertension, and stroke), body mass index (BMI), and blood pressure were the independent variables of the study. The social security system in Turkey provides pension and health insurance to public and private employees and their dependents. In our evaluation of BMI, the classification of World Health Organization was used and BMI of 30.0 kg/m^2 or higher was defined as obesity (8). In evaluation of blood pressure, the classification of the 7th Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) was used. According to this classification, having 120–139 mmHg systolic and 80–89 mmHg diastolic blood pressure was defined as prehypertension, while having 140 mmHg and higher systolic and 90 mmHg and higher diastolic blood pressure was defined as hypertension (9).

The questionnaire was developed by the research team and was applied by trained interviewers at the homes of the participants in face-to-face interviews. Participants were then invited to the nearest Balçova Municipality district office for blood pressure and anthropometric measurements and blood sampling. A venous blood sample was drawn from the arm of each subject by antecubital vein puncture after an overnight 8-h fasting by a trained nurse. Blood samples were taken between 0830 and 1000

hours. Blood samples were transferred to the Dokuz Eylül University Hospital Central Laboratory, which is an accredited laboratory that applies strict standard quality control techniques. Blood samples were centrifuged within a maximum of 4 h after extraction and then immediately analyzed using an Abbott Architect c16000 autoanalyzer (Abbott Diagnostics, Abbott Park, IL, USA).

In data analysis descriptive statistics, chi-square test and logistic regression analysis were used. Logistic regression models were constructed using the backward elimination method to define independent factors associated with diabetes and awareness. Logistic regression models included all the variables that may be significantly associated with diabetes including age, sex, education level, marital status, perceived economic status, social security, smoking habits, accompanying chronic disease, BMI, and blood pressure. For diabetes awareness, age, sex, education level, perceived economic status, social security, smoking habits, and accompanying chronic disease were included. SPSS 15.0 was used in the data analysis.

3. Results

Data from the 12,915 people who participated in Balçova's Heart Project were analyzed and descriptive characteristics of the study group are presented in Table 1. The mean age of the study group was 52.53 ± 12.93 years; 66.6% of the participants were female and 81.0% were married. The proportion of individuals with primary school or lower education level was 55.4% and the proportion of the individuals who perceived their economic level as moderate was 80.7%. The majority of the study group (92.5%) had social security coverage. Approximately 32% of the group were smokers, 34% had a chronic disease history, 40% were obese, and 26% were hypertensive (Table 1). According to the diabetes history and fasting blood glucose results obtained from the participants, 77.9% had normal fasting plasma glucose levels and no history of diabetes. It was also seen that 9.1% of the population had IFG. Diabetes prevalence in the study group was 13.0% (Table 2).

Diabetes prevalence was significantly higher for the 70-and-over age group, males, individuals with primary school or lower education level, widows, individuals who perceived their economic level as bad, individuals with social security coverage, individuals who had quit smoking, individuals who had accompanying chronic diseases, and obese and hypertensive individuals (Table 3). All these statistically significant factors were included in multivariate logistic regression models. All the variables except marital status and social security

Table 1. The Sociodemographic characteristics of the study group, Balçova, İzmir, Turkey.

Sociodemographic characteristics		n	%*
Age	30–39	2305	18.3
	40–49	3253	25.8
	50–59	3287	26.1
	60–69	2284	18.2
	70 and over	1466	11.6
Sex	Female	8392	66.6
	Male	4203	33.4
Marital status	Married	10,156	81.0
	Single	686	5.5
	Widowed	1432	11.3
	Divorced	272	2.2
Education level	Primary school or lower	6959	55.4
	Secondary school	1347	10.8
	High school	2712	21.6
	University	1536	12.2
Perceived economic status	Good	1206	9.6
	Moderate	10,113	80.7
	Bad	1207	9.7
Social security	Present	11,645	92.5
	Not present	950	7.5
Smoking habits	Smoker	4051	32.2
	Quitter	2653	21.1
	Nonsmoker	5881	46.7
Accompanying chronic disease	Present	4276	33.9
	Not present	8319	66.1
BMI (kg/m²)	Slim (<18.50)	66	0.5
	Normal (18.50–24.99)	2640	21.0
	Overweight (25.00–29.99)	4901	39.0
	Obese (≥30.00)	4954	39.5
Blood pressure (mmHg)	Normal (<120/80)	4278	34.0
	Prehypertensive (120–139/80–89)	5094	40.4
	Hypertensive (≥140/90)	3223	25.6

* Column percentages.

Table 2. Distribution of individuals based on blood glucose levels.

Blood glucose level	All participants	
	n	%*
<100 mg/dL (normal)	9804	77.9
100-125 mg/dL (IFG)	1148	9.1
Diabetes	1643	13.0
Total	12,595	100.0

*Column percentages.

Table 3. Diabetes prevalence and awareness by sociodemographic characteristics, smoking habits, BMI, and blood pressure in Balçova, İzmir, Turkey.

Variable (n = 12,595)	n	Diabetes prevalence		P*	Diabetes awareness		P*
		n	%		n	%	
Age							
30–39	2305	37	1.6		29	78.4	
40–49	3253	210	6.5		169	80.5	
50–59	3287	489	14.9	<0.001	428	87.5	0.002
60–69	2284	549	24.0		493	89.8	
70 and over	1466	358	24.4		322	89.9	
Sex							
Female	8392	1041	12.4	0.003	948	91.1	<0.001
Male	4203	602	14.3		493	81.9	
Marital status							
Married	10,156	1225	12.1		1066	87.0	
Single	686	44	6.4	<0.001	38	86.4	0.232
Widowed	1432	343	24.0		307	89.5	
Divorced	272	19	7.0		19	100.0	
Marital status							
Education level							
Primary school or lower	6959	1136	16.3		1018	89.6	
Secondary school	1347	150	11.1	<0.001	127	84.7	0.001
High school	2712	218	8.0		184	84.4	
University	1536	129	8.4		102	79.1	
Perceived economic status							
Good	1206	129	10.7		109	84.5	
Moderate	10,113	1310	13.0	0.001	1137	86.8	0.001
Bad	1207	193	16.0		185	95.9	
Social security							
Present	11,645	1554	13.3	<0.001	1369	88.1	0.044
Not present	950	89	9.4		72	80.9	
Smoking habit							
Smoker	4051	337	8.3		283	84.0	
Quitter	2653	467	17.6	<0.001	409	87.6	0.044
Nonsmoker	5881	838	14.2		748	89.3	
Accompanying chronic disease							
Present	4276	1111	26.0	<0.001	1021	91.9	<0.001
Not present	8319	532	6.4		420	78.9	
BMI (kg/m^2)							
Slim (<18.50)	66	1	1.5		1	100.0	
Normal (18.50–24.99)	2640	155	5.9	<0.001	135	87.1	0.489
Overweight (25.00–29.99)	4901	563	11.5		503	89.3	
Obese (≥30.00)	4954	918	18.5		796	86.7	
Blood pressure (mmHg)							
Normal (<120/80)	4278	241	5.6		213	88.4	
Prehypertension (120–139/80–89)	5094	664	13.0	<0.001	590	88.9	0.369
Hypertension (≥140/90)	3223	738	22.9		638	86.4	

*Chi-square test.

remained significant in the multivariate model. Diabetes prevalence was 1.32 times higher in males, 1.31 times higher in individuals with primary school or lower level of education, 1.37 times higher in individuals who perceived their economic level as bad, 1.20 times higher in those who quit smoking, 2.84 times higher in individuals with an accompanying chronic disease, 1.78 times higher in overweight or obese individuals, and 1.65 times higher in individuals with high blood pressure compared with the reference categories (Table 4).

Approximately 88% of the individuals with diabetes were aware of their condition. Diabetes awareness was significantly higher in the 70-and-over age group, women, individuals with primary school or lower level of education, individuals who perceived their economic level as bad, individuals with social security, nonsmokers, and individuals with accompanying chronic disease (Table 3). After inclusion in multivariate logistic regression analysis, sex, social security, educational status, accompanying chronic disease, and perceived economic status remained significant factors. Multivariate adjusted diabetes awareness was 1.78 times higher in women, 1.94 times higher in individuals with social security, 2.62 times higher in individuals with an accompanying chronic disease, and 3.55 times higher in individuals who perceived their economic level as bad compared with the reference categories (Table 5).

4. Discussion

Diabetes prevalence was 13.0% in this large cross-sectional study that included over 12,000 people over 30 years of age representing a western urban Turkish population. Diabetes prevalence was significantly higher in males, individuals with lower education levels, individuals who perceived their economic level as moderate, individuals who had accompanying chronic diseases, individuals who had quit smoking, and those who were overweight or obese and hypertensive. Prevalence of diabetes varies between developed and developing countries. In Iran in a cross-sectional study conducted on a 20-years-and-over population in an urban area suggested that diabetes prevalence was 14.3% (10). In another cross-sectional study conducted on a 20-years-and-over population in an urban area in southern India, diabetes prevalence was reported as 15.5% (11). In a community-based cross-sectional study conducted on a 20-years-and-over population in 2004 in the United States, it was reported that diabetes prevalence was 12.5% (12).

In the Heart Disease and Risk Factors in Adults (Turkish acronym: TEKHARF) study conducted in 2007–2008 on a national sample in Turkey, it was reported that diabetes prevalence in the 35-years-and-over population was 11.3% (13). In TURDEP I, conducted for the first time in Turkey in 1997–1998 on 20-years-and-over individuals, it was found that diabetes prevalence was 7.2%, and in the TURDEP II study repeated in 2010 diabetes prevalence was reported to be as high as 13.7% (3,4). Diabetes

Table 4. Variables associated with diabetes prevalence in logistic regression model.

Variable (n = 12,595)*		β	SE	P	OR (95% CI)
Sex	Female (reference) Male	0.276	0.067	<0.001	1.32 (1.16–1.50)
Education level	University (reference) Primary school or lower	0.274	0.066	<0.001	1.13 (1.16–1.50)
Perceived economic status	Good (reference) Moderate	0.320	0.132	0.016	1.37 (1.06–1.78)
Smoking habit	Nonsmoker (reference) Quitter	0.187	0.85	0.027	1.20 (1.02-1.42)
Accompanying chronic disease	Not present (reference) Present	1.045	0.66	<0.001	2.84 (2.50–3.24)
BMI	Slim or normal (reference) Overweight or obese	0.575	0.95	<0.001	1.78 (1.48–2.15)
Blood pressure	Normal (reference) Hypertensive	0.500	0.092	<0.001	1.65 (1.38–1.97)

*Variables included in the logistic regression analysis: age, sex, education level, marital status, perceived economic status, social security, smoking habit, accompanying chronic disease, BMI, and blood pressure. Hosmer and Lemeshow test: 0.960. Nagelkerke R square: 0.178.

Table 5. Variables associated with diabetes awareness in logistic regression model.

Variable (n = 12,595)*		ß	SE	P	OR (95% CI)
Sex	Male (reference)				
	Female	0.580	0.158	<0.001	1.78 (1.31–2.43)
Perceived economic status	Good (reference)				
	Moderate	1.268	0.447	0.005	3.55 (1.48–8.53)
Social security	Not present (reference)				
	Present	0.668	0.299	0.026	1.94 (1.08–3.50)
Accompanying chronic disease	Not present (reference)				
	Present	0.960	0.157	<0.001	2.62 (1.91–3.55)

*Variables taken into the logistic regression analysis: age, sex, education level, perceived economic status, social security, smoking habit, and accompanying chronic disease. Hosmer and Lemeshow test: 0.950. Nagelkerke R square: 0.187.

prevalence in individuals living in the Balçova district is consistent with the results of the recent studies conducted in developed and developing countries.

According to the TEKHARF and TURDEP II studies, there is not a difference between males and females in terms of diabetes prevalence (4,13). However, our study indicates that diabetes prevalence is significantly higher in males. In a cross-sectional study conducted on individuals in Adana, Turkey, of 20–79 years old in 2003, diabetes prevalence was 11.6% and diabetes prevalence was reported as being significantly higher in males (14). Similarly, in another cross-sectional study conducted on individuals 30 years old and over in Sivas, Turkey, in 2005, it was reported that diabetes prevalence increases with age and diabetes prevalence is significantly higher in males (15). These two studies are consistent with the findings of our study.

Prevalence of obesity was quite high in the current study and diabetes prevalence was significantly higher in obese and hypertensive individuals. This finding is consistent with various studies in the literature. In the two studies mentioned above conducted in Adana in 2003 and in Sivas in 2005, it was concluded that obesity and hypertension are risk factors for diabetes (14,15).

In order to control obesity and related diseases by improving the diet and physical activity of the population in Turkey, the Ministry of Health prepared the "Obesity Management and Control Program" for the period between 2009 and 2013 (16). Similarly, a "Diabetes Prevention and Control Program" that aimed to prevent diabetes in Turkey from 2011 to 2014 was prepared by the Ministry of Health (17). In both programs, primary prevention interventions targeting obesity and physical inactivity among populations and individuals with high risk were defined to achieve the goal. As with previous studies conducted in Turkey, the findings of this study indicate that these strategies must immediately be used to prevent diabetes and obesity.

This study reports that diabetes prevalence is significantly higher in individuals with primary school or lower level of education. This situation, as with other chronic diseases, can be explained as a low level of education negatively affecting the adoption of a healthy lifestyle. In a study conducted in the Nilüfer district of Bursa, Turkey, in 2006 by Aksu et al., it was reported that diabetes prevalence was higher in individuals with lower levels of education (1). In this study, diabetes prevalence was found significantly higher in individuals who perceived their economic status as moderate when compared to the individuals with a well perceived economic level. This situation may arise from the fact that approximately 81% of the participants declared their perceived economic levels as moderate. The proportion of those quitting smoking was 21.0% in this study. While this rate was 11.4% in the age group of 30–39 years, it was 29.5% in those 70 and over. Diabetes prevalence being significantly higher in quitters and individuals with an accompanying chronic disease may be related to the confounding effect of age and quitting due to diabetes diagnosis.

In this study, awareness is defined as the ratio of known diabetics to the total diabetics and was found to be 87.7%. This quite high awareness rate can be explained by the study group representing an urban population with good access to primary and secondary health care facilities in the Balçova district. Usually the awareness rate is low in developing countries that have fragmented health care systems. In a study from India diabetes awareness was 36.0% and there was no statistically significant difference between age and sex groups (18).

In Turkey, studies aimed at determining diabetes awareness are quite limited. In the TURDEP II study awareness was defined as the ratio of known diabetics

to total diabetics, as it is in this study, and the awareness level was calculated as 54.5% (4). The ease of access to health services in the Balçova district may account for the differences in awareness between this study and the TURDEP II study. There is a university hospital in addition to numerous easily accessible primary health care institutions in Balçova. The finding that diabetes awareness is significantly higher in females can be explained by the fact that women use health services more than men (19). The higher awareness in individuals with social security coverage may arise from the fact that these individuals have easier access to health services. Additionally, the higher awareness in individuals with an accompanying disease may arise from their more frequent use of health services due to the deterioration in their health (19).

Conducting this study on a relatively large study group and using standard criteria in measurement methods are the strengths of the study. Low level of participation, lack of a second measurement to confirm diabetes diagnosis, and inability to perform the glucose tolerance test on individuals with impaired fasting blood glucose are the important limitations of this study. Obtaining these particular measurements might slightly increase the figure for diabetes prevalence; however, it may lower the measured level of awareness.

In conclusion, diabetes prevalence is reported as 13.0% in the present study and 9 out of 10 diabetics are aware of their diabetes status. Diabetes prevalence is significantly higher in males, individuals with low education levels, and overweight or obese and hypertensive individuals. All efforts possible to detect individuals with diabetes risk must be made in primary health institutions to prevent and delay diabetes. Policies to persuade individuals with diabetes risk and the whole society to adopt preventive measures should be implemented and initiatives integrated with primary health services should be planned for society in general and especially for the high-risk group.

Acknowledgment

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