

The association between the prevalence of cigarette smoking and complications in patients with type 2 diabetes

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Summary. *Background:* This study including diabetic individuals from Elazığ province of Turkey was undertaken to assess the association between complication risk and the prevalence of cigarette smoking, a growing public health problem and a major cause of morbidity and mortality worldwide. *Methods:* In this descriptive cross-sectional study, a total of 300 patients (150 male, 150 female) attending to our outpatient unit with a diagnosis of Type 2 DM between May 2018 and October 2018 were included. History of cigarette smoking, educational level, presence of complications and demographic characteristics, systolic and diastolic blood pressure, and family history were recorded. Demographic data of interest included age, gender, waist and hip circumference, and the body mass index. Results of biochemistry tests were collected from routine investigations. All statistical analyses were performed using a statistical software pack (SPSS 22.0). Quantitative data were analyzed with the t-test, while categorical data were examined using chi-square test. The results were expressed with 95% confidence intervals at a significance level of $p < 0.05$. *Results:* Of the 300 participants, 77 (25%) were current smokers. Male and elderly patients were more likely to be smokers, who had a lower BMI. A significant and inverse association between cigarette use and BMI was observed ($p < 0.01$). Smokers had significantly higher HbA1c, triglyceride, and LDL ($p < 0.01$, $p < 0.01$, and $p < 0.01$, respectively). Hypertension, level of education, duration of diabetes, and the presence of neuropathy, nephropathy, or retinopathy were not significantly associated with smoking, while coronary artery disease showed a significant association ($p < 0.01$). *Conclusion:* Approximately one fourth (25%) of this diabetic cohort was smokers, who had significantly increased occurrence of coronary artery disease. Also smokers had significant elevations in LDL, triglycerides, and HbA1c as compared to non-smokers.

Keywords: cigarette smoking, diabetes mellitus, Elazığ

Introduction

Risk factors in diabetes are classified as either unmodifiable or modifiable/controllable. Unmodifiable risk factors include the genetic factors, age, and gender, while the latter group includes metabolic disorders such as dyslipidemia, obesity, cigarette smoking, hypertension, poor nutrition, and physical inactivity (1, 2).

Tobacco smoking is globally the leading preventable cause of death and standard cigarettes represent the most common route of tobacco consumption through smoking. In the 20th century, tobacco epidem-

ics was responsible for the death of almost 100 million individuals worldwide. Each year, tobacco smoking kills around 5.4 million individuals, and this figure is expected to exceed 8 million by the year 2030 (3, 4). Based on the estimations of the World Health Organization (WHO), around one billion individuals will be threatened by the adverse health effects of smoking in this century if the global trend for smoking continues at the same rate (3). Cigarette smoking is not only associated with deathly disease, but also with a number of chronic conditions including chronic obstructive pulmonary disease (COPD), peripheral ath-

erosclerosis, and ocular vasodynamic alterations. The adverse effects of cigarette smoking are generally not evident in the short term, and smokers tend to deny the harmful effects of smoking as long as they maintain their health and they ignore such effects (5). In Turkey, where the rate of cigarette smoking is second highest after Greece among all European countries, the prevalence of smoking is increasing in contrast with the developed world, reaching 52% and 17% in males and females over 18 years of age (3).

Type 2 diabetes, obesity, and cigarette smoking represent major preventable causes of morbidity and mortality worldwide. A significant association between smoking, diabetes, dyslipidemia, and obesity exists. For instance, multiple studies reported a link between cigarette smoking and lower body weight as well as a lower body mass index (BMI). Furthermore, similar associations have been observed between cigarette smoking and dyslipidemia, insulin resistance, and diabetes (6-11). In this descriptive, cross-sectional, population-based study we compared the complication rates in a group of diabetic smoker and non-smoker patients followed up and treated at our hospital in the Elazığ province of Turkey.

Materials and Methods

In this descriptive and cross-sectional study, the study sample consisted of a total of 300 patients (150 male, 150 female) followed-up and treated with a diagnosis of Type 2 DM at our outpatient unit. The study was conducted in the Elazığ Province of Turkey in October and November 2018.

Demographic data such as gender, age, cigarette smoking status, educational level, duration of diabetes, and complications were collected via questionnaires. Body mass index (BMI) values were calculated by dividing the body weight in kilograms by the square of the height in meters. Waist circumference was measured in centimeters using a measuring tape. Also, systolic and diastolic blood pressures were measured and recorded.

Routine biochemistry parameters were tested in the central biochemistry laboratory of our hospital. HbA1c, LDL, and triglyceride results were retrieved

from the electronic records of routine biochemistry investigations.

All statistical analyses were performed using SPSS 22.0 software pack. For data assessment, in addition to descriptive statistics [Mean (\bar{X}), Standard deviation (SD)], Student's t test was used for the comparison of quantitative data with normal distribution, while one-way ANOVA was used for the comparisons between the groups. The significance of the difference between two statistically matched samples was tested with Wilcoxon's paired two sample test, while the chi-square test was used for the comparison of quantitative data. The results were expressed with 95% confidence intervals, and a p value of less than 0.05 was considered significant.

The study protocol was approved by the Coordination Center for Scientific Research Projects, Fırat University, Turkey (date and no of approval: 19th July 2018, no: 07). The participation was on a voluntary basis, without any effect on the medical care and any financial obligations, and oral and written consent were obtained from each participant before the study procedures were carried out.

Results

Sociodemographic data

The mean age of the 300 Type 2 DM patients included in the study was 56.3 years (± 12 SD; range: 33-78 y), and of these patients 25% were smokers. The mean age among smokers and non-smokers was 58.6 ± 13 and 55.5 ± 12.2 years ($p=0.06$). Among the 150 males (50%) in the sample, 49 (32.6%) were smokers, while among 150 female participants (50%), 28 (18.6%) were smokers, and this difference was statistically significant ($p=0.006$). Overall, smokers and non-smokers did not differ significantly in terms of education level, incidence of hypertension, and duration of diabetes.

Cigarette smoking and laboratory parameters in patients with diabetes mellitus

Non-smokers had higher BMI as compared to smokers, while LDL-C, triglycerides, HbA1c, fasting blood glucose, and post-prandial glucose levels were

Table 1. Patient Characteristics

Parameter	Smoker	Non-smoker	Total	P value
No	77 (25%)	223 (75%)	300	
Age	58,6±13	55,5±12,2		0,062
Gender				0,006
Male	49 (32,6%)	101 (67,4%)	150 (100%)	
Female	28 (18,6%)	122 (81,4%)	150 (100%)	
Education level				0,9
Educated	62 (25%)	181 (75%)	243 (100%)	
No education	15 (26%)	42 (74%)	5 (100%)	7
Diabetes Duration				0,5
≥10 y	22 (28%)	56 (72%)	78 (100%)	
<10 y	55 (24%)	167 (76%)	222 (100%)	
HT				0,1
Yes	46 (29%)	110 (71%)	156 (100%)	
No	31 (21%)	113 (79%)	144 (100%)	

higher in smokers. The difference between smokers and non-smokers in terms of BMI, HbA1c, LDL-C, triglycerides, fasting blood glucose, and post-prandial blood glucose levels were statistically significant (p value 0.006, 0.01, 0.008, 0.002, 0.03, and 0.01, respectively) (Table 2)

The association between cigarette smoking and complications in patients with diabetes mellitus

Smokers were significantly more likely to have coronary artery disease as compared to non-smokers (p=0.006). On the other hand, cigarette smoking had no significant associations with other complications such as retinopathy, nephropathy, cardiac failure, or renal failure (Table 3)

Table 2. Cigarette smoking and laboratory parameters in patients with diabetes mellitus

Parameter	Smoker	Non-smoker	P value
BMI	25.2 ± 2.8	27.1 ± 2.8	0.006
HbA1c	9.6 ± 1.8	9.0 ± 1.9	0.01
LDL-C	140.3 ± 32.7	121.4 ± 27	0.008
Triglycerides	254.6 ± 82.8	164.1 ± 52	0.002
FBG	200 ± 65	183 ± 54	0.03
PPBG	277 ± 86	252 ± 62	0.01

Discussion and Conclusions

The link between cigarette smoking and type 2 DM has been established in numerous previous studies, and cigarette smoking has been found to trigger endothelial injury via oxidative stress and inflammation. In turn, endothelial injury leads to reduced insulin secretion in pancreas together with insulin resistance in the peripheral tissues. Furthermore, nicotine found in the cigarette smoke may have direct toxic effects on the pancreatic beta cell functions. Also, although cigarette smoking may lead to a tendency for weight loss, it may cause central obesity with associated insulin resistance (12-20).

Our results showed higher BMI among smokers, while elevated LDL-C, triglycerides, HbA1c, fasting blood glucose, and post-prandial blood glucose levels were found in smokers, with significant differences (p value 0.006, 0.01, 0.008, 0.002, 0.03, and 0.01, respectively) between the two groups (Table 2).

There is a well-established link between coronary artery disease and cigarette smoking as well as diabetes. Therefore, smoking is expected to lead to a further

Table 3. The association between cigarette smoking and complications in patients with diabetes mellitus

Parameter	Smoker	Non-smoker	Total	P value
Ischemic cardiac disease				0.006
Yes	51 (48%)	54 (52%)	105 (100%)	
No	26 (13%)	169 (87%)	195 (100%)	
Cardiac failure				0.28
Yes	17 (31%)	37 (69%)	54 (100%)	
No	60 (24%)	186 (76%)	246 (100%)	
Neuropathy				0.4
Yes	51 (24%)	159 (76%)	210 (100%)	
No	26 (28%)	64 (72%)	90 (100%)	
Nephropathy				0.09
Yes	26 (37%)	43 (63%)	69 (100%)	
No	51 (22%)	180 (78%)	231 (100%)	
Retinopathy				0.2
Yes	28 (30%)	65 (70%)	93 (100%)	
No	49 (23%)	158 (77%)	207 (100%)	
Renal Failure				0.1
Yes	5 (41%)	7 (59%)	12 (100%)	
No	72 (25%)	216 (75%)	288 (100%)	

increase in the risk of coronary artery disease among diabetic patients (21-23).

In our study sample consisting of diabetic individuals, the prevalence of cigarette smoking was 25%. In the US, the reported prevalence of cigarette smoking among type 1 diabetics over 20 years of age was 34%, while the corresponding figure in the same age group was 40% for type 2 diabetes mellitus (24). Again, the reported prevalence of cigarette smoking in a diabetic cohort from Atlanta was 27.3% (26). Cigarette smoking has been shown to induce insulin resistance and lead to an increased risk of type 2 diabetes. Also, the increase in HbA1c was found to positively correlate with the intensity of smoking. Similarly, smoking has been linked with dyslipidemia. Wakabayashi (29) showed that cigarette smoking among diabetic patients is not only associated with increased lipid parameters, but also with increased cardiovascular risk (29).

Similar to previous reports, we found an elevated risk of coronary artery disease with smoking in our diabetic patients. These and other findings clearly suggest that reduced rates of cigarette smoking, a major and preventable risk factor for morbidity and mortality in diabetes and coronary artery disease both in Turkey and other countries, may provide significant public health benefits. Therefore, all healthcare professionals and related parties should be showing concerted efforts to reduce smoking rates in the population.

Limitations

Although this was a cross-sectional study that is unable to be representative of the general population and that did not include comparisons between the amount of cigarette consumption and complications, it is clear that health authorities should focus on health campaigns aimed at reducing rates of cigarette smoking.

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