



## Type 2 Diabetes Mellitus Screening: The Sample of Sivas

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### Research Article

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#### ABSTRACT

The aim of the study is to screen for Type 2 Diabetes Mellitus (DM), to determine the risk of DM and to evaluate the factors affecting it. It is a descriptive study. The population of the research consisted of people over the age of 18 living in Sivas who were not diagnosed with diabetes. The sample of the research consisted of individuals over the age of 18 who did not have diabetes and participated in the event, which was organized as part of the 14 November 2022 "World Diabetes Day" event, which continued between 08.00-17.00. In order to reach the universe, a stand was set up in the city center in the square where the people are concentrated. Capillary blood glucose measurement, a questionnaire including height, weight, demographic characteristics and Finnish Diabetes Risk Questionnaire (FINDRISK) were applied to the patients. FINDRISK consists of 8 questions. It determines an individual's risk of developing diabetes in the next ten years. Results are shown as frequencies, mean±standard deviation. Pearson correlation analysis, Student-T test and One way ANOVA test were applied. P<0.05 was considered significant at the 95% confidence interval. 78.2% (n=560) of 716 participants were male and 21.8% (n=156) were female. 74.2%(n=531) of them were married. 39.5% (n=283) of them were primary school graduates. 30.2%(n=216) of them were working in any job. 30.9% (n=221) were smokers. 42.5% (n=304) had a chronic disease other than DM. Age groups; 25.8%(n=185) were under 45 years old, 17.7%(n=127) were 45-54 years old, 28.9%(n=207) were 55-64 years old, 27.5% (n=197) of them were over 64 years old. The mean body mass index (BMI) of 684 people who accepted the height-weight measurement was 27.5±4.5. Capillary blood glucose mean of the participants was 130.9±57.0 (min:51-max:494). The mean FINDRISK score was 11.1 ± 5.68 (min:0-max:26). Participants' FINDRISK scores; 20.9% (143) were found to be high and 6.7% (46) were found to be very high. A weakly significant positive correlation was found between FINDRISK score and capillary blood glucose levels (p<0.001; r=0.244). A significant difference was found between the diabetes risk status of the participants and their marital status, education status, employment status, and presence of chronic disease (respectively; p<0.001; 0.004; 0.001; <0.001). The rate of diabetes was higher in married people than in single people, those who did not work than those who worked, and those who had additional chronic diseases than those without. FINDRISK scores were found to be higher than different studies in the literature in the study conducted with population screening. Early identification of groups at high risk of diabetes will reduce the disease and burden of diabetes. At this stage, it will be advantageous to use easy-to-apply and inexpensive scanning methods such as FINDRISK.

**Keywords:** Diabetes mellitus, screening, FINDRISK, diabetes risk, score

## Tip 2 Diyabetes Mellitus Taraması: Sivas Örneği

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#### Öz

Çalışmanın amacı Tip 2 Diyabetes Mellitus (DM) taraması yapmak, DM riskini belirlemek ve etkileyen faktörleri değerlendirmektir. Bu çalışma tanımlayıcı bir çalışmadır. Araştırmanın evreni, Sivas'ta yaşayan 18 yaş üstü, diyabet tanısı konmamış kişilerden oluşturulmuştur. Araştırmanın örneklemini 14 Kasım 2022 "Dünya Diyabet Günü" etkinliği kapsamında düzenlenen ve 08.00-17.00 saatleri arasında devam eden etkinliğe katılan 18 yaş üstü, diyabet hastası olmayan bireyler oluşturmaktadır. Evrene ulaşmak için şehir merkezinde insanların yoğunlaştığı meydana bir stant kuruldu. Hastalara kılcal kan şekeri ölçümü, boy, kilo, demografik özelliklerin yer aldığı anket ve Finlandiya Diyabet Risk Anketi (FINDRISK) uygulandı. FINDRISK 8 sorudan oluşmaktadır. Bir kişinin önümüzdeki on yıl içinde diyabet geliştirme riskini belirlemektedir. Sonuçlar sıklık, ortalama±standart sapma olarak gösterilmiştir. Pearson korelasyon analizi, Student-T testi ve One way ANOVA testi uygulandı. P<0.05, %95 güven aralığında anlamlı kabul edildi. 716 katılımcının %78,2'si (n=560) erkek, %21,8'i (n=156) kadındı. Bunların %74,2'si (n=531) evlidir. Bunların %39,5'i (n=283) ilkokul mezunuydu. %30,2'si (n=216) herhangi bir işte çalışıyordu. %30,9'u (n=221) sigara içiyordu. %42,5'inin (n=304) DM dışında kronik bir hastalığı vardı. Yaş grupları; %25,8'i (n=185) 45 yaş altı, %17,7'si (n=127) 45-54 yaş arası, %28,9'u (n=207) 55-64 yaş arası, %27,5'i (n=197) bunlardan 64 yaşın üzerindeydi. Boy-kilo ölçümünü kabul eden 684 kişinin ortalama vücut kitle indeksi (BMI) 27,5±4,5 olarak belirlendi. Katılımcıların kapiller kan şekeri ortalaması 130,9±57,0 (min:51-maks:494) idi. Ortalama FINDRISK skoru 11,1±5,68 (min:0-maks:26) idi. Katılımcıların FINDRISK puanları; %20,9'u (143) yüksek, %6,7'si (46) çok yüksek olarak bulunmuştur. FINDRISK skoru ile kapiller kan şekeri düzeyleri arasında pozitif yönde zayıf düzeyde anlamlı bir korelasyon bulundu (p<0,001; r=0,244). Katılımcıların diyabet risk durumları ile medeni durumları, eğitim durumları, çalışma durumları ve kronik hastalık varlığı arasında anlamlı farklılık bulunmuştur (sırasıyla; p<0,001; 0,004; 0,001; <0,001). Evlilerde diyabet görülme oranı bekarlara göre, çalışmayanlarda çalışanlara göre, ek kronik hastalığı olanlarda çalışmayanlara göre daha yüksekti.


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Toplum taramasıyla yapılan çalışmada FINDRISK puanlarının literatürdeki farklı çalışmalara göre daha yüksek olduğu görüldü. Diyabet riski yüksek olan grupların erken belirlenmesi diyabet hastalığını ve yükünü azaltacaktır. Bu aşamada FINDRISK gibi uygulaması kolay ve ucuz tarama yöntemlerinin kullanılması avantajlı olacaktır.


**Anahtar sözcükler:** Diyabetes Mellitus, tarama, FINDRISK, diyabet riski, puan


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## Introduction

Diabetes is a serious chronic disease that occurs as a result of insufficient insulin production or inability to use the produced insulin in the body, resulting in a long-term metabolic disorder. Diabetes affects an estimated 537 million adults aged 20 to 79 worldwide. By 2030, 643 million people worldwide will have diabetes, and by 2045 this number will rise to 783 million <sup>1</sup>. The main reasons for this are the increase in obesity and physical inactivity due to population growth, aging and lifestyle changes brought about by urbanization <sup>2</sup>. The International Diabetes Federation (IDF-2021) reports that 10.5% of the adult population (20-79 years old) has diabetes, and almost half of them are not aware that they live with this condition <sup>3</sup>.

According to the TURDEP-II study data, 42% of the adult population in our country is diabetic or prediabetic <sup>4</sup>. Similar to world data, awareness of diabetes is low in our country. It is known that the majority of diabetics are not aware of the disease, and this issue emerges as an important problem <sup>5</sup>. In our country, this rate was expressed as 32%. Due to the low awareness of diabetes, individuals who have not yet been diagnosed with diabetes but have a high risk of diabetes should be identified. In this process, "risk screening" is of great importance in determining diabetes risk factors and catching diabetes at an early stage. Although the benefits and financial burden of community-based diabetes screening are discussed, it is emphasized that screening activities are important for raising public awareness <sup>2</sup>.

One of the risk questionnaires (eg FINDRISK, ADA risk questionnaire) developed to identify individuals at high risk for diabetes and prediabetes easily and cost-effectively can be used <sup>4</sup>. Our aim in this study is to screen for Type 2 Diabetes Mellitus (DM) in the population and to determine the risk of developing DM within 10 years and to evaluate the factors affecting this situation.

## Material Method

### Study type

This study is a descriptive cross-sectional study.

### Design:

The population of the research consisted of 390,318 people living in the center of Sivas. When the population is calculated in the 95% confidence interval according to the known sample calculation, the number of people to be reached was calculated as 384 people. In order to reach the universe in the research, a stand was set up in the city center in the square where the people are concentrated. The sample of the research consisted of individuals over the age of 18 who did not have diabetes and participated in the event, which was organized as part of the 14 November 2022 "World Diabetes Day" event, which continued between 08.00-17.00.

### Data collection tool:

The sociodemographic questionnaire form prepared by the researchers was filled in by face-to-face interview method after giving general information about diabetes to the participants. The age, gender, marital status, education level, occupation, smoking habits and exercise status of the individuals were recorded in this questionnaire. The Finnish Type 2 Diabetes Risk Assessment Questionnaire (FINDRISK) was used. FINDRISK; It consists of eight questions. It was developed by the Finnish Diabetes Association in 2003 as part of the Finnish Type 2 Diabetes Prevention Programme. FINDRISK can be easily used for this purpose in daily practice <sup>6</sup>. It has been translated into Turkish by the Turkish Society of Endocrinology and Metabolism (TEMED) and is recommended for diabetes screening in our country <sup>5</sup>. This test determines a person's risk of developing diabetes in the next ten years, thus identifying people with high risk levels. FINDRISK is a simple, easy and straightforward test. The weight of each question in the test is different. In FINDRISK, age, body mass index, waist circumference (evaluated differently in women and men), exercise status, frequency of consumption of vegetables and fruits, history of antihypertensive treatment,

history of hyperglycemia, and family history of diabetes are evaluated. The maximum possible score is 26. A score of 15 and above increases the risk. It is recommended that these individuals be screened for diabetes with advanced laboratory methods <sup>7</sup>.

After the questions were answered by the participants, the height, weight, waist circumference and blood glucose measurements of the individuals who accepted were made. Random capillary blood glucose measurement was performed during screening. Capillary whole blood sample was taken at any time of the day, without questioning the hunger status, with the same brand and model glucometer with international quality certificate. Plasma glucose was calculated from capillary blood according to the formula "Plasma glucose (mg/dl) = 0.102 + [19.295 x capillary blood glucose (mg/dl)/18]". In the scans, the cut-off value was accepted as 140 mg/dl. Those who got 12 points and above according to the FINDRISK score and those with random blood glucose  $\geq$ 140 mg/dl regardless of the risk score were referred to a health institution for further examinations.

#### Statistical methods used:

The collected data were analyzed using SPSS (Statistical Package for Social Sciences) for Windows Version 25 package program. Normality analysis of numerical data was analyzed with the Shapiro-Wilk test. Descriptive statistical analyses of the data were first performed. Frequencies for categorical data and measures of central distribution (Mean  $\pm$  Standard Deviation) for numerical data were calculated. Independent Samples test whether the means of normally distributed numerical data differ significantly between two independent groups; One way ANOVA test was used to analyze whether there was a significant difference between more than two independent groups. Post-hoc analysis of homogeneous variances was analyzed by Bonferroni test. Pearson correlation analysis was applied. Chi-square test was used to compare categorical data.  $P < 0.05$  was considered significant at 95% confidence interval.

#### Permissions:

Ethics committee approval for the study was obtained from Sivas Cumhuriyet University Clinical Research Ethics Committee (Approval date/number: 2022-06/05).

## Results

### Demographic data characteristics of the participants

78.2% (n=560) of 716 people participating in the study were male and 21.8% (n=156) were female. 74.2% (n=531) were married, 25.8 % (n=185) were single. Education levels 4.3 % (n=31) were illiterate, 39.5 % (n=283) primary school, 11.0 % (n=79) secondary school, 26.4 % (n=189) high school, 18.7% (n=134) was a university graduate. business situations; 30.2% (n=216) were working, 38.8% (n=278) were retired, 28.5% (n=204) were unemployed, and 2.5% (n=18) were students. 30.9% (n=221) were smokers. 42.5% (n=304) had a chronic disease other than DM. Age groups; 25.8 % (n=185) were under 45 years old, 17.7% (n=127) were 45-54 years old, 28.9% (n=207) were 55-64 years old, 27.5% (n=197) of them were over 64 years old. Body mass index (BMI) values of 684 people who accepted the height-weight measurement; 1.8% (n=12) were underweight, 29.1% (n=199) were normal, 40.8% (n=279) were overweight, 22.8% (n=156) were mildly obese, 5.0% (n=34) were moderately obese 0.6% (n=4) were morbidly obese. The mean BMI of the participants was  $27.5 \pm 4.5$ . The mean BMI of men was  $27.3 \pm 4.5$ , while that of women was  $27.9 \pm 5.5$  ( $p = 0.147$ ).

The calculated plasma glucose mean of the participants was  $139.5 \pm 60.8$  (min:54-max:494). 12.1% (n=83) were 200 mg/dl and above. 87.9% (n=601) were 200 mg/dl and below. Mean capillary blood glucose was  $130.9 \pm 57.0$  (min:51-max:494). Medication use for high blood pressure in 69.7% of the participants (n=477). Diabetes was diagnosed in any family member in 44.2% (n=302). FINDRISK questionnaire data of the participants are shown in Table 1.

Table 1. Participants' FINDRISK survey data		
	n	%
Age		
<45 years	167	24.4
45-54 years	126	18.4
55-64	200	29.2
>64	191	27.9
BMI		
<25 kg/m <sup>2</sup>	214	31.3
25-30 kg/m <sup>2</sup>	276	40.4
>30 kg/m <sup>2</sup>	194	28.4
Waist circumference measurement		
Female<80 cm / Male<94 cm	151	22.1
Female 80-88 cm / Male 94-102 cm	156	22.8
Female >88 cm / Male >102 cm	377	55.1
How often do you consume vegetables and fruits?		
Every day	444	64.9
Not everyday	240	35.1
Do you mostly exercise at least 30 minutes a day?		
Yes	496	72.5
No	187	27.5
Have you ever used medication for high blood pressure or have you ever had high blood pressure?		
Yes	477	69.7
No	207	30.3
Have you been told by the doctor that your blood sugar is high or borderline?		
Yes	488	71.3
No	196	28.7
Has any of your family members been diagnosed with diabetes?		
No	382	55.8
Yes, uncle, aunt, uncle, cousin or niece (Secondary nearby)	71	10.4
Yes, biological father, mother, sibling or child (First degree relative)	231	33.8

The mean FINDRISK score of the participants was  $11.1 \pm 5.68$  (min:0-max:26). Participants' FINDRISK scores; 23% (157) were low, 32% (219) mild, 17.4% (119) moderate, 20.9% (143) high, and 6.7% (46) very high.

A weakly significant positive correlation was found between FINDRISK score and capillary blood glucose levels ( $p < 0.001$ ;  $r = 0.244$ ). FINDRISK average score; married, non-diabetic chronic disease, calculated Plasma glucose  $\geq 200$  mg/dl was significantly higher. Comparison of FINDRISK results with various factors is shown in Table 2.

<b>Table 2. Comparison of FINDRISK results with various factors</b>		
	FINDRISK score mean	p
Total	11.1±5.6	-
<b>Gender</b>		
Female	12.3±6.3	0.070
Male	11.3±5.2	
<b>Educational Status</b>		
illiterate	11.1±6.6	<b>0.003*</b>
Primary school	11.7±5.5	
Middle school	10.6±5.1	
High school	11.6±6.1	
University	9.5±5.1	
<b>Marital status</b>		
Married	11.8±5.4	<b>&lt;0.001</b>
Single	9.0±5.9	
<b>Smoking</b>		
Yes	9.9±5.6	<b>&lt;0.001</b>
No	11.6±5.6	
<b>Non-Diabetes Chronic Disease</b>		
Present	13.8±5.5	<b>&lt;0.001</b>
Absent	9.1±4.8	
<b>Calculated PG</b>		
≥200 mg/dl	15.0±4.9	<b>&lt;0.001</b>
<200 mg/dl	11.0±5.4	
PG, plasma glucose; DM, diabetes mellitus *One way ANOVA test, Bonferoni Post Hoc analysis; Significant difference was found between university and primary school, university and high school.		

A significant difference was found between the diabetes risk status of the participants and their marital status, education status, employment status, and presence of chronic disease (respectively;  $p < 0.001$ ; 0.004; 0.001;  $< 0.001$ ). High and very high risk rate was more common in married (31.6%) than single (16.1%). 16% of those with university or higher education were in the high and very high risk group. This rate is lower than other education categories. The diabetes risk of unemployed (31%) was significantly higher than that of working (19.7%). Those with additional chronic diseases other than diabetes (46.3%) had a higher and very high risk compared to those without (14.1%) (Table 3).

**Table 3. Sociodemographic characteristics of the participants by diabetes risk status**

Sociodemographic characteristics	Low and mild risk		Moderate risk		High and very high risk		p
	n	%	n	%	n	%	
<b>Gender</b>							
Female	72	49.7	24	16.6	49	33.8	0,170
Male	304	56.4	95	17.6	140	26	
<b>Marital status</b>							
Married	257	50.4	92	18	161	31.6	<0.001
Single	119	68.4	27	15.5	28	16.1	
<b>Educational status</b>							
Primary education	205	54.2	97	17.7	106	28	0,004
High school	90	51.4	23	13.1	62	35.4	
University and above	81	61.8	29	22.1	21	16	
<b>Working status</b>							
Worker	115	56.7	48	23.6	40	19.7	0.001
Inoperative	261	54.3	30	15.4	149	31	
<b>Smoking</b>							
Yes	127	60.2	35	16.6	49	23.2	0,152
No	249	52.6	84	17.8	140	29.6	
<b>Non-Diabetes Chronic Disease</b>							
Present	101	35.2	53	18.5	133	46.3	<0.001
Absent	275	69.3	66	16.6	56	14.1	

## Discussion

DM is a chronic disease with an increasing incidence. It has become one of the most important public health problems with the increase in life expectancy and obesity in the world and in our country<sup>8</sup>. However, unfortunately, awareness of diabetes is low in our society. We carried out a diabetes screening in Sivas to raise awareness within the scope of World Diabetes Day. The findings were discussed by comparing them with the data in the literature.

Although there are different methods to identify people at high risk of diabetes, there is no established practice in routine practice yet. In this study, participants' diabetes risk levels and related factors were evaluated using FINDRISK, and high-risk individuals were referred for a definitive diagnosis. In our research, 23% of the participants were found to be low risk, 32% mild, 17.4% moderate, 20.9% high, and 6.7% very high risk. In the population-based study conducted by Çevik et al., 37.5% of the participants had an increased risk (high, very high risk)<sup>9</sup>. In the study of Kutlu et al.,

the increased risk was found to be 15.5%<sup>10</sup>. Our results were similar to the literature.

In the study of Coşansu et al., the FINDRISK mean score of the participants was 7.46<sup>11</sup>. In different studies, similar results were obtained with average scores<sup>12,13</sup>. In a study conducted in Greece using FINDRISK, the mean risk score was found to be 13.1±4.9 (14). The mean FINDRISK score of our study was 11.1±5.68. Similar to the study of Makrilakis et al., 57.1% of the participants in our study were 55 years or older<sup>14</sup>. The difference between the high-risk scores may be due to the high average age of the participants.

Our study's mean FINDRISK score was 12.3±6.3 for women and 11.3±5.2 for men. In different studies in the literature, women had a higher risk score, similar to our study<sup>10,11,15</sup>.

In our study, there was a significant positive correlation between FINDRISK score and capillary blood glucose levels. FINDRISK average score; married, non-diabetic chronic disease, calculated PG ≥200 mg/dl was significantly higher. This

situation was similar in different studies in the literature <sup>10,16</sup>.

When the relationship between diabetes risk and smoking habit was examined, no significant relationship was found. Similar to our results, different studies conducted in Turkey did not find a significant relationship between smoking and FINDRISK score <sup>10,17</sup>.

In their study, Väättäinen et al. found a significantly higher risk of diabetes in individuals who did not work, similar to our findings <sup>16</sup>. This may be due to the high average age of the unemployed population and the lack of physical activity.

Studies have shown that the prevalence of hypertension is 2 times higher in those with a high risk of diabetes compared to those with a low risk <sup>18</sup>. Many studies have also found that systolic and diastolic blood pressure are positively correlated with diabetes risk <sup>10,19,20</sup>. In our study, the calculated PG mean of the participants was 139.5±60.8. This value was higher than other similar studies. Consistent with the literature, this may be supported by the fact that the majority of the participants had a history of high blood pressure.

Obesity is one of the most important risk factors for diabetes. In different studies in the literature, as body mass index increases, diabetes risk and incidence also increase <sup>20,21</sup>. In our study, 30% were of normal weight, while the remainder were overweight or obese. The participants' calculated plasma glucose mean and FINDRISK mean score were higher than in other population-based studies. We think that this may be due to the fact that the majority of the participants in our study had a body mass index above the average.

Our most important limitation is the inability to generalize the results, since our research was conducted in a single city and in one day.

In conclusion, diabetes is a chronic disease that is increasing in prevalence in our country and in the world and can cause many different complications. Early identification of people at high risk of diabetes is extremely important to combat diabetes and its consequences. In this regard, health professionals need to conduct community-based studies with broad participation. The most important limitation of our research is that it was conducted in a single province. Especially primary care plays an important role in increasing the awareness of diabetes in society and minimizing diabetes risk factors. Early identification of risky groups and immediate intervention will reduce the disease burden and financial burden of diabetes. At this stage, using

easy-to-apply and inexpensive scanning methods such as FINDRISK will be advantageous.

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