ORIGINAL RESEARCH

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Non-invasive Assessment of Insulin Resistance and Diabetes Risk with FINDRISC Score Among Physicians in a Tertiary Care Hospital

Üçüncü Basamak Bir Hastanede Hekimler Arasında İnsülin Direnci ve Diyabet Riskinin FINDRISK Skoru ile Değerlendirilmesi

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Abstract

Objective: To assess insulin resistance (IR) and diabetes risk levels with Finnish diabetes risk score (FINDRISC) questionnaire in physicians from a tertiary care hospital.

Method: A cross-sectional study was carried out on 200 physicians working in a tertiary hospital. Data were collected using the FINDRISC tool, "fasting blood glucose", and "fasting insulin". "The homeostatic model assessment of insulin resistance" (HOMA-IR) was calculated. FINDRISC is an eight-question score. FINDRISC scores and 10-year diabetes mellitus risk rates are; <7 points (low) and 1%, 7-11 points (mild/slightly elevated) and 4%, 12-14 points (moderate) and 16%, 15-20 points (high) and 33%, 21-26 points (very high) and 50% (respectively).

Results: The FINDRISC categories were low in 16.0%, mild (slightly elevated) in 36.5%, moderate in 23.5%, high in 18.5%, and very high in 5.5%. HOMA-IR was high in 49.5%, while impaired fasting glucose (IFG) was present in 24% of the doctors. The majority of the physicians (n=155) had a body mass index of ≥25 kg/m^2, did not exercise regularly (n=178), did not consume daily vegetables and/or fruits (n=125), and had diabetic relatives (n=144). The relationships of the FINDRISC score with IFG, the presence of daily fruit/vegetable in-take and regular physical activity were significant (p=0.001). Although the association of FINDRISC score with HOMA-IR was insignificant, the risk of the development of new

Öz

Amaç: Üçüncü basamak bir hastanede çalışan doktorlarda insülin direncini (IR) ve diyabet risk düzeylerini Finlandiya Diyabet Risk skor (FINDRISK) anketi ile değerlendirmek amaçlanmıştır.

Yöntem: Çalışmamız üçüncü basamak bir hastanede çalışan 200 hekim üzerinde kesitsel olarak gerçekleştirilmiştir. Çalışmamızda FINDRISK, açlık kan şekeri ve açlık insülini kullanıldı. IR HOMA-IR ile hesaplandı. FINDRISK sekiz sorudan oluşan, 10 yıllık diyabet riskini belirleyen bir ölçektir. FINDRISK puanları ve 10 yıllık diabetes mellitus risk oranları; <7 puan (düşük) ise % 1, 7-11 puan (hafif) ise % 4, 12-14 puan (orta) ise % 16, 15-20 puan (yüksek) ise % 33, 21-26 puan (çok yüksek) ise % 50 (sırasıyla).

Bulgular: Çalışmaya dahil edilen sağlık çalışanlarının FINDRISK skorları % 16'sında düşük, % 36,5'inde hafif, % 23,5'inde orta, % 18,5'inde yüksek ve % 5,5'inde çok yüksekti. Doktorların %49,5'inde HOMA-IR ve % 24'ünde bozulmuş açlık glukozu (BAG) mevcuttu. Katılımcıların 155'inin vücut kitle indeksi ≥25 kg/m^2 idi, 178'i düzenli egzersiz yapmıyordu, 125'i günlük sebze ve/veya meyve tüketmiyordu ve 144'ünün diyabetik akrabaları mevcuttu. FINDRISK skoru ile BAG, günlük sebze/meyve tüketimi ve düzenli egzersiz yapmak arasında istatistiksel olarak ileri düzeyde anlamlı ilişki bulundu (p=0,001). FINDRISK skoru ile HOMA-IR arasında anlamlı ilişki saptanmamakla birlikte, HOMA-IR yüksek

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onset diabetes for patients with high HOMA-IR was low in 8.1%, mild in 32.3%, moderate in 33.3%, high in 20.2%, and very high in 6.1%. The risk of diabetes (FINDRISC) was higher among the consultants compared to the residents (p=0.001), which persisted even after controlling for age.

Conclusion: FINDRISC scores showed weak but highly significant positive correlations with insulin, glucose, and HOMA-IR levels. Age groups and job position revealed that even after adjustment for age, the job position was high risk (2.9 fold) for diabetes. Diabetes is more prevalent among hypertensive physicians. The FINDRISC assessment may be used in the screening of physicians for diabetes in Turkey.

Keywords: Diabetes mellitus type 2, FINDRISC insulin resistance, occupational health, physicians

görülen olguların % 8,1'inin diyabet riski düşük, % 32,3'ünün hafif, % 33,3'ünün orta, %20,2'sinin yüksek ve %6,1'inin çok yüksek saptandı. Yaş düzenlendikten sonra bile uzmanlarda diyabet riski asistanlara göre daha yüksek bulundu (p=0,001).

Sonuç: FINDRISK skoru, insülin, glukoz ve HOMA-IR seviyeleri ile anlamlı pozitif korelasyon göstermektedir. Yaş grupları ve iş pozisyonu, yaşa göre ayarlama yapıldıktan sonra bile, iş pozisyonunun diyabet için yüksek risk (2,9 kat) oluşturduğunu ortaya koymaktadır. Ayrıca hipertansif hekimler arasında diyabet riski daha yüksek saptanmıştır. Bulgularımız, FINDRISK değerlendirmesinin Türkiye'deki tıp doktorlarında diyabet taraması için kullanılabileceğini düşündürmektedir.

Anahtar kelimeler: İnsüline bağımlı olmayan diabetes mellitus, FINDRISK insülin direnci, iş sağlığı, tıp doktorları

Introduction

Type 2 Diabetes Mellitus (T2DM) is the most common endocrinological disease in the world as well as in Turkey, with a rising frequency day by day. According to the data of the International Diabetes Federation (IDF), the worldwide number of diabetic people aged 20-79 years old was 463 million in 2019 and is estimated to reach 700 million in 2045 (1). According to the IDF, Turkey has the third highest diabetes rate in Europe with a prevalence of 11.1% in 2019 (1).

The Framingham heart study indicated that the impact of parental diabetes on the development risk of diabetes in an offspring is similar to that of genetic risk. However, the role of metabolic risk factors, diet, physical activity and genetic on the risk of offspring diabetes is not adequately understood, which reflects the influence of familial factors other than genetic background.

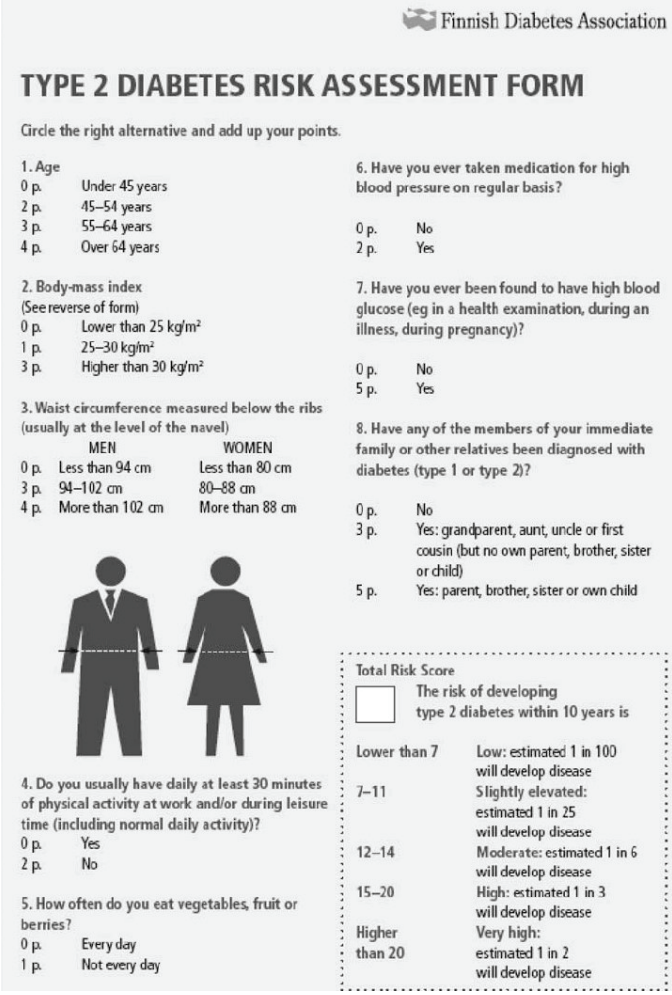
It is essential to define and manage the risk groups on an individualized basis. A two-step approach is recommended, where first a risk score is calculated, followed by confirmatory tests such as fasting blood glucose (FBG), hemoglobin A1c, and oral glucose tolerance test (2).

The Finnish diabetes risk score (FINDRISC) T2DM risk assessment form has traditionally been used as a predictor of type 2 diabetes (3). It takes into account the usual clinical characteristics, such as age, body mass index (BMI), waist circumference (WC), physical activity, dietary consumption of fruits, vegetables, and berries, use of antihypertensive medication, history of high blood glucose, and family history of diabetes. Brodovicz et al.'s (4) study showed that FINDRISC was associated with insulin sensitivity. In the Lima-Martínez et al.'s (5) study, BMI, WC, plasma insulin concentration, and HOMA-IR index were higher in the high-risk group compared to subjects in the low-moderate risk group according to the FINDRISC. FINDRISC is one of the tools referred by Turkish scholars in screening T2DM. This tool is based on demographic data, clinical information, and modifiable lifestyle factors, such as diet and physical activity, requiring no blood tests. Therefore, it is cheap and easy to apply, especially in areas where fasting glucose tests or other blood markers are not available (6).

Materials and Methods

This cross-sectional study was approved by the Local Ethics Committee of the Ethics Committee of University of Health Sciences Turkey, İstanbul Bağcılar Training and Research Hospital (IRB number: GOKAEK/2013-120). Written informed consent was provided from all participants. A total of 260 consultants and 189 residents were actively working in the hospital during the study time. Of the 449 medical doctors in the hospital, 220 were randomly (selected using the list of employees based on random numbers tables) invited to participate in the study. Two-hundred seven of the invited physicians agreed to participate in this study. Participants were asked about their medical history, and seven participants diagnosed with diabetes were excluded. The physicians with DM, hypothyroidism, malignancy, pregnancy and use of medications for hypertension and diabetes (oral antidiabetic drug or insulin) were excluded.

FINDRISC is a non-invasive screening tool to identify individuals at high risk for diabetes and pre-diabetes, and consists of eight questions. It collects data on sex, age, BMI, WC, physical activity level, daily consumption of vegetables, fruits or berries, history of antihypertensive drugs, history of increased FBG, and family history of DM (7). The primary outcome of the study was to determine FINDRISC scores (Figure 1) (8). FINDRISC scores and 10-year DM risk rates are <7 points (low) and 1%, 7-11 points (mild/slightly elevated) and 4%, 12-14 points (moderate) and 16%, 15-20 points (high) and 33%, 21-26 points (very high), and 50% (respectively) (Table 1) (9,10).



Finnish Diabetes Association

TYPE 2 DIABETES RISK ASSESSMENT FORM

Circle the right alternative and add up your points.

1. Age
0 p. Under 45 years
2 p. 45–54 years
3 p. 55–64 years
4 p. Over 64 years

2. Body-mass index
(See reverse of form)
0 p. Lower than 25 kg/m²
1 p. 25–30 kg/m²
3 p. Higher than 30 kg/m²

3. Waist circumference measured below the ribs (usually at the level of the navel)

	MEN	WOMEN
0 p.	Less than 94 cm	Less than 80 cm
3 p.	94–102 cm	80–88 cm
4 p.	More than 102 cm	More than 88 cm

4. Do you usually have daily at least 30 minutes of physical activity at work and/or during leisure time (including normal daily activity)?
0 p. Yes
2 p. No

5. How often do you eat vegetables, fruit or berries?
0 p. Every day
1 p. Not every day

6. Have you ever taken medication for high blood pressure on regular basis?
0 p. No
2 p. Yes

7. Have you ever been found to have high blood glucose (eg in a health examination, during an illness, during pregnancy)?
0 p. No
5 p. Yes

8. Have any of the members of your immediate family or other relatives been diagnosed with diabetes (type 1 or type 2)?
0 p. No
3 p. Yes: grandparent, aunt, uncle or first cousin (but no own parent, brother, sister or child)
5 p. Yes: parent, brother, sister or own child

Total Risk Score
The risk of developing type 2 diabetes within 10 years is

Lower than 7	Low: estimated 1 in 100 will develop disease
7–11	Slightly elevated: estimated 1 in 25 will develop disease
12–14	Moderate: estimated 1 in 6 will develop disease
15–20	High: estimated 1 in 3 will develop disease
Higher than 20	Very high: estimated 1 in 2 will develop disease

Figure 1. Type 2 diabetes risk assessment form

Table 1. The determination of 10-year risk and risk class according to the FINDRISC score

Total FINDRISC score	10-year risk	Risk class
<7 points	1%	Low
7-11 points	4%	Slightly elevated/mild
0-14 points	1-17%	Moderate
15-20 points	33%	High
21-26 points	50%	Very high

FINDRISC: Finnish diabetes risk score

The formula is BMI=weight (kg)/height² (m²) where kg is a person's weight in kilograms and m² is his/her height in meters squared.

Additionally, demographic features were recorded, anthropometric measurements were performed and FBG and fasting insulin were tested. Blood samples were collected after 12 hours of fasting. Blood glucose was measured by the photometric method using the Siemens Advia 1800 device. The insulin levels were analyzed by the chemiluminescence immunoassay method in a Siemens Advia Centaur device. The Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) was calculated as "glucose x insulin/405" (11). Insulin resistance was defined as a HOMA-IR ≥2.5 (11).

Power analysis determined a sample size of 200 participants to reach 95% confidence interval.

Statistical Analysis

Data were analyzed using the SPSS for Windows 15.0 computer program (release 22.0; SPSS Inc. Chicago, IL, USA). Descriptive data were expressed as mean ± standard deviation. Differences between categorical variables were compared by the chi-square test. The Pearson correlation analysis was used to evaluate the correlation of variables. The combined effects of age and job category on increased FINDRISC were evaluated by performing logistic regression analysis. Based on the percentage measurement values that were observed in the literature review, the total sample size should be 200 using the G-POWER program with a 0.3 (cohen) effect size, 97.5% power and 0.05 margin of error. A p-value <0.05 was considered to be statistically significant.

Results

Data of 200 participants were analyzed. In our study, 58.0% of the participants were males. Half of the participants were residents, while the remaining were consultant physicians with more experience, but also higher working years (12).

While the BMI was below 25 kg/m² in 45 physicians, it was between 25 and 29.9 kg/m² in 117, and above 30 kg/m² in 38. High or very high WC was found in 76% of the participants. Only 11% of the participants exercised at least 30 minutes a day, and only 37.5% consumed daily vegetables and/or fruits. The rate of smoker participants was 58.0%. Of the physicians, 19.5% were previously diagnosed with high blood pressure, and 17% had been told that their blood glucose level was high or borderline. While 28% of the cases had no diabetes in their family, 47% had second-degree relatives with T2DM, and 25% had first degree relatives with DM. A total of 72% had genetic predisposition. The risk of diabetes was low in only 16.0%. On the other hand, FBG levels were below 100 mg/dL in most cases, while HOMA-IR was determined positive in 49.5% of the physicians. The proportion of moderate to very high-risk diabetes according to the FINDRISC categorization was 47.5% (Table 2).

Table 2. Descriptive findings of the study

		n	%
Age	<45 y	169	84.5
	45-54 y	29	14.5
	55-64 y	2	1.0
Body mass index (BMI) (kg/m²)	Normal <25	45	22.5
	Overweight 25-29.9	117	58.5
	Obese ≥30	38	19.0
Waist circumference (WC)	Normal (m: <94 cm, f: <80 cm)	48	24.0
	High (m: 94-102 cm, f: 80-88 cm)	99	49.5
	Very high (m: >102 cm, f: >88 cm)	53	26.5
Physically active (at least 30 min per day)	Yes	22	11.0
	No	178	89.0
Consumption of fruits and vegetables (at least one portion per day)	Every day	75	37.5
	Not every day	125	62.5
Antihypertensive treatment	No	161	80.5
	Yes	39	19.5
History of high blood glucose	No	166	83.0
	Yes	34	17.0
Family history of type 2 diabetes mellitus	No	56	28.0
	Yes (second degree-relatives)	94	47.0
	Yes (first degree-relatives)	50	25.0
FINDRISC category	Low	32	16.0
	Mild	73	36.5
	Moderate	47	23.5
	High	37	18.5
	Very high	11	5.5
Fasting blood glucose (FBG) (mg/dL)	<100	153	76.5
	100-125 (IFG)	45	22.5
	≥126	2	1.0
Insulin resistance (HOMA-IR)	Yes	99	49.5
	No	101	50.5
Daily smoking	Yes	64	32.0
	No	136	68.0

High HOMA-IR was observed in almost equal ratios of residents and consultants. However, increased HOMA-IR was significantly more common among males, people with IFG, higher BMI groups, larger WC, and participants with a history of hypertension (Table 3).

FINDRISC scores showed weak but highly significant positive correlations with insulin (r=0.278, p<0.001), glucose (r=0.256, p<0.001), and HOMA-IR (r=0.283, p<0.001) levels (Table 4, 5). There is a statistically significant relationship between fruit and vegetable consumption and FINDRISC, but not with HOMA-IR (p<0.01) (Table 6). There is a statistically significant correlation between regular exercise and FINDRISC (p<0.01) (Table 7).

The independent effects of age and job position in the FINDRISC category were evaluated by constructing a logistic regression profile, where age groups and job position were used as independent variables, which revealed that even after adjustment for age, the job position was a 2.9 fold high risk for diabetes (Table 8) (3). Consultants had significantly higher diabetes as defined by the FINDRISC categories, compared to the resident doctors (p<0.001).

Discussion

This study demonstrated significantly high diabetes risk among medical doctors in a tertiary care hospital in Turkey. As to the FINDRISC categories, 84% of the participants had mild to very high risk of DM. Furthermore, the HOMA-IR was above the threshold in almost half of the doctors. The risk of diabetes was higher among the consultants, which persisted even after controlling for age.

Multiple approaches have been recommended for population-based screening, and various risk scores have been proved to be useful for identifying high-risk populations (13). FINDRISC is an established risk prediction tool, which is widely employed in Europe with an accuracy of 85% (14).

The epidemiological data have demonstrated that hypertension and T2DM are commonly related conditions, and their concordance is expanded in populations. Hypertension affects up to 40% or more of diabetic patients (15). In our study, values of HOMA-IR were significantly different in patients with and without a history of hypertension. Our findings demonstrate that higher HOMA-IR plays a role in the development of hypertension. A 3-year follow-up study by Baghbani-Oskouei et al. (16) found that, independent of BMI and multiple variables, fasting insulin and IR index parameters were strong risk factors for the development of hypertension in normotensive healthy adults without diabetes.

Additionally, the study of Brodovicz et al. (4) has confirmed that the FINDRISC is associated with IR. Furthermore, the FINDRISC modified for Latin America significantly correlated with IR in obese subjects (5), and FINDRISC has been shown to predict impairments in insulin sensitivity and insulin secretion, the conversion to T2DM, drug-treated hypertension, cardiovascular events, as well as total

Table 3. Comparison of the studied variables according to the HOMA-IR categories

		HOMA-IR category					
		<2.5		2.5 and above			
		n	%	n	%	χ^2	p
Sex	Male	47	40.5	69	59.5	11.01	**0.001**
	Female	54	64.3	30	35.7		
Age groups	<45 y	84	52.8	75	47.2	1.68	0.194
	45 y and above	17	41.5	24	58.5		
Impaired fasting glucose (IFG)	No	90	59.2	62	40.8	19.22	**<0.001**
	Yes	11	22.9	37	77.1		
Body mass index (BMI) groups (kg/m²)	<25	36	80.0	9	20.0	28.99	**<0.001**
	25-29.9	57	48.7	60	51.3		
	≥30	8	21.1	30	78.9		
Waist circumference (WC)	Normal (m: <94 cm, f: <80 cm)	35	72.9	13	27.1	20.13	**<0.001**
	High (m: 94-102 cm, f: 80-88 cm)	51	51.5	48	48.5		
	Very high (m: >102 cm, f: >88 cm)	15	28.3	38	71.7		
Daily min. 30 m exercise	Yes	14	63.6	8	36.4	1.70	0.191
	No	87	48.9	91	51.1		
Fruit/vegetable consumption	Daily	40	53.3	35	46.7	0.38	0.535
	Not daily	61	48.8	64	51.2		
Hypertension history	No	89	55.3	72	44.7	7.54	**0.006**
	Yes	12	30.8	27	69.2		
History of high blood glucose	No	81	48.8	85	51.2	1.13	0.287
	Yes	20	58.8	14	41.2		
Family history of diabetes mellitus	No	34	60.7	22	39.3	3.68	0.158
	Yes (first degree)	20	42.6	27	57.4		
	Yes (second degree)	47	48.5	50	51.5		
Position	Resident	51	51.0	49	49.0	0.02	0.888
	Consultant	50	50.0	50	50.0		
Smoking	No	68	50.0	68	50.0	0.04	0.837
	Yes	33	51.6	31	48.4		

HOMA-IR: Homeostatic model assessment of insulin resistance

Table 4. The classification of HOMA-IR positive patients according to the FINDRISC scores

	FINDRISC scores	n	%
HOMA-IR positive patients (n=99)	Low	8	8.1
	Mild	32	32.3
	Moderate	33	33.3
	High	20	20.2
	Very high	6	6.1

Chi-square test, p<0.01, FINDRISC: Finnish diabetes risk score, HOMA-IR: Homeostatic model assessment of insulin resistance

Table 5. The classification of patients with impaired fasting glucose according to the FINDRISC scores

		Impaired fasting glucose		p
		Yes n (%)	No n (%)	
FINDRISC scores	Low	2 (4.2%)	31 (20.4%)	**0.001****
	Mild	13 (27.1%)	61 (40.1%)	
	Moderate	14 (29.2%)	35 (23.1%)	
	High	13 (27.1%)	20 (13.1%)	
	Very high	6 (12.4%)	5 (3.3%)	

Chi-square test, ** p<0.01, FINDRISC: Finnish diabetes risk score

mortality. In current study, according to FINDRISC logistic regression model created to control the independent effects of age and job position on the FINDRISC category, when the job position was used as independent variable, which revealed that even after adjustment for age, the job position was a 2.9 fold risk for high risk or T2DM. It

seems likely that age and workplace factors such as heavy working conditions may hinder optimal self-management and contribute to high risk of diabetes. While the rates of incidence increase until the age of 65 years, the incidence and prevalence levels remain constant after the age of 65 years (17).

The American Diabetes Association recommends T2DM testing from those at the age of 45 years to adults who are overweight or obese and have any risk factors for T2DM (18). The high risk (mild to very high risk of DM: 84%) and relatively young age (84.5% below 45 years) of our sample suggests that screening blood checks should be considered even at an earlier age.

Table 6. Diabetes risk and HOMA-IR relationship by fruits and vegetables intake

		Fruits and vegetables intake (consumption) (at least one portion per day)		p
		Every day	Not every day	
		n (%)	n (%)	
FINDRISC scores	Low	22 (29.3%)	11 (8.8%)	0.001**
	Mild	28 (37.3%)	46 (36.8%)	
	Moderate	17 (22.7%)	32 (25.6%)	
	High	6 (8%)	27 (21.6%)	
	Very high	2 (2.6%)	9 (7.2%)	
HOMA-IR	Yes	35 (46.7%)	64 (51.2%)	0.535
	No	40 (53.3%)	61 (48.8%)	

Chi-square test, ** p<0.01, FINDRISC: Finnish diabetes risk score, HOMA-IR: Homeostatic model assessment of insulin resistance

Table 7. Diabetes risk assessment according to exercise status

		Exercise status		p
		Yes n (%)	No n (%)	
FINDRISC scores	Low	10 (45.5%)	23 (12.9%)	0.001**
	Mild	8 (36.4%)	66 (37.2%)	
	Moderate	3 (13.6%)	46 (25.8%)	
	High	1 (4.5%)	32 (17.9%)	
	Very high	0 (0%)	11 (6.2%)	

Chi-square test, ** p<0.01, FINDRISC: Finnish diabetes risk score

Type 2 diabetes mellitus' onset in individuals develops especially during working life. The highest level of incidence is observed in the first four decades of life. Stress sources, such as job stress and working in shifts, may predispose to the development of T2DM by increased cortisol production as a result of overactivation of the hypothalamic-pituitary-adrenal axis (19).

Implementation studies have proven that lifestyle interventions followed by organized physical activity sessions combined with counseling to increase physical activity in the prevention of T2DM can be effective. Hellgren et al.'s (20) study aimed to explore the feasibility and effect of an intervention in clinical practice with isolated physical activity in individuals with IGT, recruited by the FINDRISC questionnaire. The authors showed that focusing on solitary physical activity inevitably led to changes in diet with weight loss and significant improvement of essential risk factors. The FINDRISC score was not significantly associated with physical activity in Roşescu et al.'s (21) study. Moreover, they found that patients who rarely exercised had a moderate-high risk of developing diabetes in the next ten years (21). Hamilton et al.'s (22) study showed that low physical activity compared to a sedentary lifestyle contributed to reducing the incidence of DM. Only 11% of the physicians included in our study were exercising at least 30 minutes a day, which might be the result of a busy life.

Irregular intake of vegetables and fruits, increased WC, and increased BMI were identified as leading risk factors of T2DM development. In our study, only 37.5% of the patients consumed vegetables and fruits every day. Variations in the glycemic index/glycemic load ratio of consumed vegetables and fruits did not count for the relationship of specific fruits with risk of T2DM, but the glycemic index/glycemic load ratio of fruits did not seem to be the fact that specified their relationship with T2DM.

Positive family history is another accepted risk factor for diabetes. Around 40% of people with a positive family history

Table 8. Logistic regression analysis to determine the risk of the development of diabetes

					95% CI for EXP (B)	
	B	Wald	Sig.	Exp (B)	Lower	Upper
Age groups (45 y and above vs. <45 y)	2.123	13.062	<0.001	8.355	2.642	26.418
Experience (resident vs. consultant)	1.096	10.127	0.001	2.993	1.524	5.881
Constant	0.615	4.616	0.032	1.850		

CI: Confidence interval

might have moderate to high risk for developing diabetes (23). However, although 72% (n=144) of our participants had some family history of DM, we could not demonstrate a statistically significant relationship between HOMA-IR and family history. However, studies on this subject are still unclear (24). Walker et al. (25) demonstrated that there was no association between genetic predisposition and insulin sensitivity but there was an association with insulin secretion.

According to 2019 Diabetes Atlas (1), 2 in 3 people with DM live in urban areas, and 1 in 13 adults has IGT. Our sample consisted of doctors living in an urban city in a developing country. Thus, our figures of 22.5% IFG can be regarded as relatively high. On the other hand, senior doctors had a higher risk compared to the relatively younger residents. More years spent under heavy working conditions can be a factor increasing the incidence of DM. Since the consultants have a busier work schedule and the risk persisted after adjustment for age, this finding can be attributed to work stress, which requires further verification.

Study Limitations

Our study has some limitations. This study was conducted in a single-center on a representative sample for the studied population. Although it demonstrates the diabetes-related risk of the participants, caution is warranted for generalizing the findings.

Conclusion

The FINDRISC tool can cover the need for cost-effective and evidence-based solutions to struggling with DM. Medical doctors are significantly prone to diabetes, possibly due to their lifestyles lacking exercise and regular consumption of fruits and vegetables. Strenuous, stressful, and long working hours may contribute to the increased DM risk, too. Hypertension is common among physicians with high insulin resistance, probably related to similar pathogenetic mechanisms involved in both disorders.

We suggest using FINDRISC as one of the tools used in the screening of medical doctors for diabetes in Turkey. Furthermore, projects are needed to modify the reversible diabetes risk factors among medical doctors.

Ethics

Ethics Committee Approval: The study was approved by the Ethics Committee of University of Health Sciences Turkey, İstanbul Bağcılar Training and Research Hospital (IRB number: 2013/120, date: 18 February 2013).

Informed Consent: Informed consent form (BGOF) has been signed.

Peer-review: Internally and externally peer-reviewed.

Authorship Contributions

Concept: E.S., S.Y., B.A., H.K., S.P., D.Ş., Design: E.S., S.Y., B.A., H.K., S.P., D.Ş., S.Yı., Data Collection or Processing: E.S., S.Y., B.A., H.K., D.Ş., Analysis or Interpretation: E.S., S.Y., H.K., S.P., D.Ş., Drafting Manuscript: H.K., S.Y., S.P., S.Yı., D.Ş., Final Approval and Accountability: E.S., H.K., B.A., Critical Revision of Manuscript: E.S., D.Ş., S.Yı., B.A., Writing: E.S., H.K., B.A., Supervision: E.S., S.Y., S.Yı., D.Ş.

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