ACTA MEDICA TRANSILVANICA September;25(3):10-14
DOI: 10.2478/amtsb-2020-0040
Online ISSN 2285-7079

DIABETES RISK PROFILE FOR AN ARGEŞ COUNTY ADULT SAMPLE – FINDRISC SCORE CHARACTERISTICS

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Keywords: *diabetes, FINDRISC score, body mass index*

Abstract: *The prevalence of diabetes has doubled in the last 4 decades in Romania. Our goal was to identify the risk profile in a group of Argeş county patients based on the Finnish Diabetes Risk Score (FINDRISC) score and main variables analysed. Our study was based on a pilot study on a group of 103 patients. The Finnish Diabetes Risk Score was used to calculate the risk of developing diabetes for our patients. In our group, the FINDRISC score was not statistically significantly correlated with body mass index, but was statistically significantly correlated with hypertriglyceridemia, low HDL-Cholesterol levels, hyperuricemia, hyperglycemia, and hypertension. The older you get, the higher your risk of developing diabetes. The present study demonstrates the importance of lifestyle in terms of the risk of developing diabetes, supporting the need to implement more effective health education measures on a balanced lifestyle and establishing interdisciplinary mechanisms of collaboration between physician, nutritionist and psychologist to promote health.*

INTRODUCTION

Lifestyle has an important influence on human physical and cognitive health and includes the aspects that the inhabitants of a certain region have in the spatial and temporal context in which they are, including the daily behavioural and functional features of each person in relation to their diet, work, or daily activities.(1) Low fruit and vegetable versus high saturated fats intake, physical inactivity and high levels of alcohol and tobacco are estimated to contribute to two-thirds of cardiovascular disease, cancer, diabetes and other causes of mortality.(2)

Physical activity is one of the basic needs of man, which inevitably accompanies daily activities, learning, work, or locomotion. Physical inactivity brings high costs to health and the economy, and sedentary prevention methods are a key point in combating this problem.(3,4) The benefits of physical activity are well known and include lowering the risk of diabetes, cardiovascular disease, high blood pressure and colon and breast cancer, but also positive effects on mental state, delaying the onset of dementia and maintaining a body weight within normal limits. Inactivity can accelerate the aging and development of various chronic diseases.(5-7) In 2012, an estimated 1.5 million deaths were caused by diabetes and 2.2 million deaths due to blood glucose levels above the optimal limit. Diabetes increases the risk of developing heart and cerebrovascular disease, obesity, cataracts, fatty non-alcoholic liver disease, to complications such as acute myocardial infarction, stroke, amputation of a limb, kidney failure, nerve damage and vision loss (retinopathy, cataracts), infections (tuberculosis).(8,9) It is estimated that the number of adults with diabetes will increase to 69% in developing countries and to 20% in developed countries between 2010 and 2030, increasing not only the number of complications secondary to diabetes, but also mortality and financial costs.(10)

Identifying individuals with undiagnosed type 2 diabetes mellitus (DM2) may be an important approach to preventing or delaying its complications (11), however, universal screening for DM2 in the population is still controversial.(12) Thus, although the American Diabetes Association recommends testing DM2 for all adults from the age of 45, regardless of weight, or for those who are overweight or obese and have one or more additional risk factors for DM2;(13) The Priorities for Disease Control group recommends testing for people at high risk of diabetes (people ≥40 years of age, those with a family history of T2DM, obesity, physical inactivity, or dyslipidemia).(12) Various risk models, also known as risk scores, have been developed to detect cases of DM2. The Finnish Diabetes Risk Score (FINDRISC) is calculated using a questionnaire to identify people at high risk of developing diabetes and was created using a potential cohort of people aged 35 to 64 years.(14) The original questions included age, body mass index, waist circumference, physical activity, daily consumption of fruits, berries or vegetables, a history of antihypertensive drug treatment and a history of high blood sugar.(15) However, subsequent studies added the family history of Diabetes type 2 to the model and altered dietary patterns and questions about physical activity. Although widely used to estimate the risk of developing DM2 over the next ten years, FINDRISC has also been evaluated as a tool for the identification of undiagnosed diabetes, abnormal glucose tolerance, and metabolic syndrome.(16-18) Nutrition plays a particularly important role in determining a healthy lifestyle.

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Article received on 02.06.2020 and accepted for publication on 10.07.2020

Proper consumption of vegetables and fruits and healthy eating habits are associated with a reduced risk of developing chronic diseases, decreased mortality and morbidity caused by diabetes, cardiovascular diseases (CVD), neurodegenerative diseases or cancer. A high-calories diet promotes the appearance of diabetes, obesity and high blood pressure (HBP), subsequently, obesity being a risk factor for the development of CVD or some types of cancer.(19-21) Numerous studies have been conducted to determine whether there are links between eating habits and the prevention or treatment of diabetes, which have suggested that the Mediterranean diet, DASH (Dietary Approach to Stop Hypertension) and AHEI (Alternative Healthy Eating Index) have the potential to prevent diabetes, even if they are different from each other. These observations prove the importance of a balanced and healthy diet, but especially the importance of methods for preventing and determining the target population at risk of developing diabetes.(22,23)

AIM

Identification of the risk profile in a group of patients based on the Finnish Diabetes Risk Score and the variables analysed.

MATERIALS AND METHODS

We relied on a pilot study conducted between May and June 2019, on a group of 103 adult patients from Curtea de Argeş city, Argeş County, monitored and questioned during a usual consultation at their General Practitioner office.

Data were collected with the approval of the family doctors with whom we collaborated, also after all the participants in this study gave their consent.

The inclusion criteria in the study targeted patients over the age of 18 who had not been diagnosed with diabetes.

Demographic data (age, gender, residency and educational authority), hereditary and personal pathological history (cardiovascular, endocrine, diabetes, gastroenterological or liver diseases, obesity etc.) were collected. Among the biochemical markers, this study took into account the levels of Total cholesterol, LDL-cholesterol, HDL-Cholesterol, Triglycerides (TG), glycemia and uric acid (markers for the risk of diabetes). Subjects included were also evaluated for anthropometric parameters and blood pressure levels.

In order to assess the risk for diabetes mellitus type 2 the FINDRISC score was calculated, validated and used like variable in many independent cohort studies.(24-30)

Our questionnaire consisted of 15 questions and tracked personal data, anthropometric measurements, blood sugar and blood pressure levels, along with and the following questions: “Do you do at least 30 minutes of physical activity daily?”, “Do you eat fruits and vegetables daily?”, “Did you have ever take regular antihypertensive medication?”, “Have you ever had a high blood sugar?”, “Has anyone in your family been diagnosed with diabetes and how related?”, “Has anyone in your family been diagnosed with diabetes/ heart disease / high blood pressure?”, “Have you ever had high cholesterol?”, “Do you smoke and if so, how many cigarettes / day?”, “How many meals do you usually serve a day?”, “Do you consume alcohol?”, “Which of the stress variants (always relaxed / sometimes a little stressed / stressed most of the time) will characterize you?”, “How often do you have a medical consultation?”

Among these questions, 8 items were followed to calculate the FINDRISC score: age, body mass index (BMI), waist circumference, daily physical activity, frequency of consumption of fruits and vegetables, frequency of antihypertensive drugs intake, personal history of high sugar blood levels, family history of type 1 and/ or 2 Diabetes. This score estimates the likelihood that a person will develop type 2 diabetes in the next 10 years.(6,7) The values of the FINDRISC score can be between 0 and 26 and are interpreted as follows:

- ≤ 7 - low risk - it is estimated that 1 in 100 will develop the disease
- 7 - 11 - slightly high risk - it is estimated that 1 in 25 will develop the disease
- 12 - 14 - moderate risk - it is estimated that 1 in 6 will develop the disease
- 15 - 20 - high risk - it is estimated that 1 in 3 will develop the disease
- > 20 - very high risk - it is estimated that 1 in 2 will develop the disease

For data processing and statistical analysis we used the statistical software GraphPad and Excel. For the quantitative variables (age, laboratory tests, FINDRISC score) a descriptive statistical evaluation was applied and we followed the median with minimum and maximum for variables that do not have Gaussian distribution, respectively, the mean and standard deviation for variables with Gaussian distribution. Spearman-type correlations were used for nonparametric data and Pearson-type correlations for parametric data were used to analyse the link between two variables and the intensity of this link.

RESULTS

The average value of the FINDRISC score items was 9.54 + 5.36 points. 31.07% of our subjects have a slightly higher risk of developing diabetes, and 17.48% have a high risk (table no. 1).

Table no. 1. FINDRISC score values for the study group

FINDRISC Score	Risk of developing diabetes	Number of patients	%
<7	Low	33	32.04
7-11	Slightly high	32	31.07
12-14	Moderate	19	18.45
15-20	High	18	17.48
>20	Very high	1	0.97

It was observed that there are statistically insignificant negative correlations between BMI and FINDRISC score and a statistically significant association between FINDRISC score and age (table no. 2).

Table no. 2. Correlations between FINDRISC score, BMI, and age

Variables		FINDRISC Score
Body mass index	Correlation coefficient	**-0.01758**
	Coefficient of determination	0.000309056
	Confidence interval (95%)	-0.2104 şi 0.1766
	Value of p	0.8601
Age	Correlation coefficient	**0.5904**
	Coefficient of determination	0.34857216
	Confidence interval (95%)	0.4434 şi 0.7065
	Value of p	**< 0.0001**

We monitored the values of laboratory parameters for Total Cholesterol, LDL-C, HDL-C, TG, blood glucose and uric acid, recorded in the last year (table no. 3).

The average total cholesterol values were 203±43 mg/dl (between 90 and 287 mg/dl).

The mean LDL-C values were 115±38 mg/dl (between 43 and 217 mg/dl).

The mean HDL-C values were 58±18 mg/dl (between 30 and 57 mg/dl).

Regarding TG, the average values were 122±71 mg/dl (between 16 and 500 mg/dl).

The Blood Sugar values of the participants had an average of 102±28 mg / dl, and the average Uric Acid values

were 5.04±1.58 mg/dl.

Table no. 3. Test laboratory data in our Argeș county patients

Laboratory tests			Number of patients	%
Total Cholesterol		no analysis	7	6.80
		≤ 190 mg/dl	41	39.81
		>190 mg/dl	55	53.40
LDL - Cholesterol		no analysis	20	19.42
		< 115 mg/dl	44	42.72
		> 115 mg/dl	39	37.86
HDL - Cholesterol		no analysis	25	24.27
		> 40 mg/dl	12	11.65
		< 40 mg/dl	66	64.08
Triglycerides		no analysis	10	9.71
		< 150 mg/dl	71	68.93
		> 150 mg/dl	22	21.36
Glycemia		no analysis	6	5.83
		60–90 mg/dl	33	32.04
		91–120 mg/dl	54	52.43
		> 120 mg/dl	10	9.71
Uric acid	there is no analysis		17	16.50
	Women	< 5.7 mg/dl	41	39.81
		> 5.7 mg/dl	11	10.68
	Men	< 7 mg/dl	28	27.18
		> 7 mg/dl	6	5.83

We observed that there were statistically insignificant negative correlations between BMI and LDL-C, HDL-C, TG, systolic and diastolic BP and statistically insignificant positive correlations between BMI with total cholesterol and blood glucose.

There was a very weak statistically significant positive correlation between BMI and uric acid. Regarding the FINDRISC score, we observed statistically insignificant negative correlations regarding total cholesterol and statistically insignificant positive correlations compared to LDL-C.

The FINDRISC score correlated very strongly with a statistically significant positive with TG, glycemia, uric acid, systolic and diastolic BP and with a statistically significant negative with HDL-C (table no. 4).

Table no. 4. Correlations between BMI, FINDRISC score and blood pressure values

Correlations		BMI	FINDRISC Score
Systolic BP	Correlation coefficient	-0.00462	**0.6892**
	Coefficient of determination	0.000012	0.47499664
	Confidence interval (95%)	-0.2026 și 0.2017	0.5659 și 0.7823
	Value of p	0.9964	**< 0.0001**
Diastolic BP	Correlation coefficient	-0.02242	**0.6357**
	Coefficient of determination	0.000502656	0.40411449
	Confidence interval (95%)	-0.2235 și 0.1805	0.4975 și 0.7424
	Value of p	0.8248	**< 0.0001**

DISCUSSIONS

In the present study we looked at the relationship between the FINDRISC score and BMI, age, respectively the presence or absence of personal pathological antecedents.

We noticed that between the FINDRISC score and BMI there was a very weak negative correlation, statistically insignificant (p=0.8601). Instead, the FINDRISC score correlates positively, very strongly statistically significant (p<0.0001) with age, the older the age, the greater the risk of developing diabetes. In the study by Al-Shudifat et al. on a group of 1821 students in Jordan, it was observed not only that the presence of risk factors for type 2 Diabetes is common among young Jordanians, but also that the FINDRISC score is the most appropriate method of screening these factors in the group of Jordanians' study. Attention is drawn to the importance of a healthy lifestyle, with a balanced diet and adequate physical activity from an early age in order to combat the increasing prevalence of Diabetes.(31)

Kulkarni et al. demonstrated in a study of a group of 9,754 middle-aged black and white Americans with atherosclerotic risk that the prevalence of obesity is higher in the target population assessed by the FINDRISC score than in other German or American populations in which this score was used. Obesity and abdominal girth have been critical in predicting diabetes, but age, antihypertensive treatment, and a family history of diabetes have not been shown to be equally strong predictors of the incidence of it in the study population.(32) Inconsistent consumption of vegetables and fruits, depending on the area of residence, altitude and age, led to an increase in abdominal circumference and BMI in a study group in Central Asia. The FINDRISC score was higher in participants with higher BMI and abdominal circumferences (strong risk factors in the occurrence of DM2).(33) In the present study, a statistically significant positive correlation was observed between BMI and uric acid (p=0.0186), which means that higher uric acid values was correlated with increased BMI, in obese people. Regarding the FINDRISC score, a statistically insignificant negative correlation was identified regarding the total cholesterol (p=0.9668) and a statistically insignificant positive correlation compared to LDL-C (p=0.3797). The FINDRISC score correlated with a statistically significant positive with TG (p<0.0001), glycemia (p<0.0001), uric acid (p<0.0001), systolic BP (p<0.0001) and diastolic (p<0.0001) and negative with HDL-C (p<0.0001). In other words, patients with higher levels of BT, blood sugar, uric acid, BP and lower levels of HDL-C have a higher risk of developing diabetes.

In the study conducted by Meijikamn et al, 651 subjects were studied in which the metabolic syndrome was analysed (increased abdominal circumference, hypertriglyceridemia, low HDL-C level, BP>130/85 mmHg or patients with antihypertensive medication, high blood sugar levels, fasting) compared to the FINDRISC score for diabetes screening in obese patients and it was found that the prevalence of metabolic syndrome increased with increasing FINDRISC score values.(34) Also, Bernabe-Ortiz et al. showed in a study of 1609 Peruvian participants that the diagnostic accuracy for newly detected cases of type 2 diabetes is similar using both the FINDRISC score and the LA-FINDRISC score (Latin America FINDRISC) and the Peruvian risk score for undiagnosed type 2 diabetes, but the conclusion of the study is that the FINDRISC score or a simplified version of it may be more useful for detecting new cases of diabetes. The FINDRISC score can therefore be used not only to assess the risk of developing diabetes, but also to diagnose new cases of diabetes, impaired glucose tolerance or metabolic syndrome.(35)

In the SPREDIA-2 study conducted on 1592 Spanish participants, aiming to evaluate the efficiency of using the FINDRISC score and a simplified variant of this score in screening new cases of type 2 diabetes and dysglycemia, it was shown that the two scores are methods of extremely useful investigation. The efficiency of the diagnosis was compared comparatively using the FINDRISC score, glycosylated hemoglobin or the oral glucose tolerance test. It was found that a FINDRSIC score above 12 best indicates patients with dysglycemia compared to the diagnosis based on glycosylated

hemoglobin values or in combination with the oral glucose tolerance test. The FINDRISC score above 13 is optimal for the diagnosis of type 2 diabetes, which was confirmed by the determination of glycosylated hemoglobin and the oral glucose tolerance test. These aspects suggest that the FINDRSIC score is a simple, noninvasive, cheap and effective method in diagnosing the risk of developing diabetes or even diagnosing this pathology, being much easier to use an investigative tool than the determination of glycosylated hemoglobin or the test of oral glucose tolerance.(36) However, there are studies (Shahin et al.) in which it was found that applying the FINDRISC score as a first step in screening for dysglycemia does not bring any benefit to a group of patients treated with antihypertensives, antipyretics or antidiabetics. Determining fasting blood glucose at two hours postprandial is the best method to diagnose type 2 diabetes, fasting blood glucose being the best diagnostic method for diabetes that can be used without the association of other paraclinical tests. Glycosylated hemoglobin is the least effective investigation for the diagnosis of type 2 diabetes and impaired glucose tolerance.(37) Agarwal et al. have shown in their study of a group of Filipino urban subjects that the FINDRSIC score is more appropriate for assessing the risk of developing diabetes than other risk assessment tools for diabetes. In this study, the FINDRISC score was the most effective method of investigation, having the highest sensitivity (0.94) compared to the other instruments used (the Canadian Diabetes Risk Score, The Indian Diabetes Risk Score, the American Diabetes Risk Score, Indonesian undiagnosed diabetes mellitus scoring system and a Fillipino tool) and a specificity with mean values (0.45). It has been observed that increased values of the FINDRSIC score between 7 and 11 correlate with the increase in sensitivity and specificity of this score.(38) In the study conducted by Fizelova et al. showed results similar to those of our study. The FINDRISC score is significantly associated with increased BMI, abdominal circumference, body fat, systolic and diastolic BP, blood glucose (fasting blood glucose, 2-hour postprandial blood sugar), triglycerides, transaminases and reduced LDL-C, HDL - C, ApoA and the estimated glomerular filtration rate. Impaired insulin secretion or insulin resistance, conversion to type 2 diabetes, antihypertensive treatments, cardiovascular events and mortality can be anticipated by calculating the FINDRISC score.(39)

Proper intervention in lifestyle aspects in subjects with a high risk profile for type 2 diabetes may bring long-term benefits in terms of biological parameters such as serum lipids and also upon their body weight and can have a good preventive impact.(40)

CONCLUSIONS

The present study demonstrated the importance of lifestyle in reducing the risk profile for DM2 and other chronic inflammatory diseases, being necessary both the implementation of better founded health education measures and the establishment for more efficient multidisciplinary teams based on collaboration between healthcare specialists, nutritionists and psychologist for health promotion target. We also propose the introduction of the FINDRISC score in the diagnostic protocols for dysglycemia, type 2 diabetes and metabolic syndrome, for preventive and management purposes.

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