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Original article

Use of the FINDRISC scale in the department of Cundinamarca, Colombia: A descriptive and cross-sectional study

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Abstract

Background: Type II diabetes (T2D) is a chronic disease with high rates of morbidity and mortality, which implies a great impact on the economy and health systems due to its high prevalence rates, complications, and costs. Prediabetes arises as an abnormal state that precedes type II diabetes and is associated with multiple risk factors. Therefore, strategies such as the FINDRISC survey have emerged to identify people at risk of developing prediabetes and type II diabetes as early as possible.

Objective: The objective of this study is to identify individuals with a high risk of developing type II diabetes and prediabetes using the FINDRISC scale in a cohort of adults in Cundinamarca, Colombia.

Methodology: Descriptive observational cross-sectional study developed in 3257 people over 18 years of age without a previous diagnosis of type II diabetes. Results are presented in absolute frequency measures and percentages. FINDRISC variables included age, body mass index (BMI), waist circumference (WC), diet, physical activity, history of hypertension, history of hyperglycemia, and family history of type II diabetes.

Results: Of the total respondents, 48% had at least a moderate risk of developing type II diabetes within the following 10 years (FINDRISC >=12). It was observed that a large number of subjects were not meeting goals for modifiable risk factors evaluated by the scale, such as physical activity (69%), diet (60%), and body mass index (70%). The family history of diabetes mellitus was a positive factor in more than half of the respondents.

Highlights

- The FINDRISC score is a cost-effective strategy that can reduce the associated complications of diabetes, as people could get an early diagnosis.
- A healthy lifestyle is key to prevent prediabetes and diabetes, particularly in patients with family history of diabetes.
- The risk of developing diabetes increases with age, so we consider that prevention and health promotion campaigns should be implemented with more emphasis on older adult populations.

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Conclusion: The FINDRISC scale may allow us to reduce the high rates of morbidity and mortality, associated complications, and high rates of people undiagnosed with these conditions. The results emphasize the importance of habits and lifestyle in the population at risk for diabetes and prediabetes.

Keywords: Diabetes mellitus, Prediabetic state, Primary prevention, FINDRISC, early diagnosis, Hyperglycemia, Chronic disease.

Uso de la escala FINDRISC en el departamento de Cundinamarca, Colombia: un estudio descriptivo y de corte transversal

Resumen

Contexto: la diabetes tipo II (DT2) es una patología crónica con elevadas tasas de morbi-mortalidad, lo que implica un gran impacto en la economía y los sistemas de salud debido a sus altas tasas de prevalencia, complicaciones y costos. La prediabetes surge como un estado anormal que precede a la diabetes tipo II y está asociada con múltiples factores de riesgo para su desarrollo. Por lo tanto, estrategias como la encuesta FINDRISC surgen para identificar a las personas en riesgo de desarrollar prediabetes y diabetes tipo II lo antes posible.

Objetivo: el objetivo de este estudio es identificar individuos con un riesgo elevado para desarrollar diabetes tipo II o prediabetes a través de la escala FINDRISC en adultos de Cundinamarca, Colombia.

Metodología: estudio descriptivo observacional de corte transversal, desarrollado en 3257 personas mayores de 18 años, sin diagnóstico previo de diabetes tipo II. Los resultados se presentan en medidas de frecuencia absoluta y porcentajes. Las variables FINDRISC incluyen edad, índice de masa corporal (IMC), circunferencia abdominal (CA), dieta, actividad física, antecedentes de hipertensión, antecedentes de hiperglucemia y antecedentes familiares de diabetes.

Resultados: del total de encuestados, el 48 % tenía al menos un riesgo moderado de desarrollar diabetes tipo II en los próximos 10 años (FINDRISC >=12). Las principales variables modificables con más resultados fuera de objetivo en los sujetos fueron la actividad física (69 %), la dieta (60 %) y el índice de masa corporal (70 %). Además, el antecedente familiar de diabetes mellitus fue un factor positivo en más de la mitad de los encuestados.

Conclusión: la escala FINDRISC puede permitir reducir las altas tasas de morbilidad y mortalidad, las complicaciones asociadas y las altas tasas de personas no diagnosticadas con estas condiciones. Los resultados destacan la importancia de los hábitos y el estilo de vida de la población en riesgo de diabetes tipo II y prediabetes.

Palabras clave: diabetes mellitus, prediabetes, prevención primaria, FINDRISC, diagnóstico temprano, hiperglucemia, enfermedad crónica.

Destacados

- La escala FINDRISC es una estrategia rentable y eficaz que puede reducir las complicaciones asociadas con la diabetes, ya que permite obtener un diagnóstico temprano.
- Un estilo de vida saludable es clave para prevenir prediabetes y diabetes, en especial en pacientes con antecedentes familiares de diabetes.
- El riesgo aumenta con la edad, por lo que consideramos que las campañas de prevención y promoción de la salud deberían centrarse con mayor énfasis en la población de adultos mayores.

Introduction

Type 2 diabetes (T2D) may result from either insufficient production or acquired resistance to the insulin hormone (1). This disease represents an important and growing challenge for public health. According to a pooled analysis of 1,108 population-representative studies, the global prevalence of T2D increased significantly from 1990 to 2022, with an estimated 828 million

adults affected by T2D in 2022. This represents a substantial rise of 630 million cases since 1990, underlining the growing burden of the disease worldwide (2). Likewise, the International Diabetes Federation (IDF) estimates that the prevalence of T2D in Colombia for the year 2017 was 8.1%, which contrasts with the results of the High-Cost Account (CAC by its Spanish acronym), which indicates that 2,186,861 cases of T2D by November 2024 were identified (approximately 4 out of 100 cases), of which 75.85% were diagnosed with T2D (3,4).

It is essential to understand the pathophysiological development of T2D. Initially an abnormal metabolic state of hyperglycemia, known as prediabetes, may develop prior to T2D. At this stage, glycemic levels are elevated but not high enough to be classified as T2D (5). Prediabetes is specifically defined as any of the following cases: fasting blood glucose levels between 100-125 mg/dl, 2-hour post-load glucose levels between 140-199 mg/dl, or glycated hemoglobin level (HbA1C) of 5.7% to 6.4% (5).

This condition is generally associated with different risk factors, including ethnicity, age, family history of diabetes, birth weight, obesity, low socioeconomic status, and living in urban areas (5). In Latin America, certain ethnicities —such as African Americans and indigenous populations— have shown a higher risk for metabolic syndrome, hyperlipidemia, and T2D. Additionally, migratory movements from rural to urban areas have also been proven to increase the risk for this group of diseases due to negative lifestyle changes (3). In 2022, the median age of women and men with T2D in Colombia was 55-60 years of age and 50-55 years, respectively (2).

According to the Centers for Disease Control and Prevention (CDC), an estimated 90% of people with prediabetes in the United States are unaware of their condition. The IDF estimates that prediabetes has a prevalence between 6-14% worldwide and of 8-10% in Colombia (6). While the number of patients who progress from prediabetes to T2D depends on the specific population, studies have found progression in approximately 40% of patients with fasting glucose levels between 100-125 mg/dl and 42% progression in patients with 2-hour post-load glucose levels between 140-199 (6).

Based on the above, there is a need for low-cost, easily reproducible interventions to reduce the number of undiagnosed people with T2D or prediabetes, as well as their main risk factors (7). For this purpose, strategies such as the FINDRISC (Finnish Diabetes Risk Score) have emerged as a predicting score to identify people at risk of developing T2D within the following 10 years in subjects over 18 years of age (7). In Colombia, the General Social Security Health System recommends the use of FINDRISC as a screening strategy for T2D in the adult population, with a score of 12 points established as the cut-off point (7,8). Nevertheless, there is a lack of information regarding the experiences of the application of the FINDRISC in the Colombian population. Additionally, there is not enough literature supporting the confirmatory test that should be performed after a positive FINDRISC (HbA1C, Basal Glycemia or OGTT).

This tool has been validated and is widely used in different countries around the world. For example, a study conducted in Belgium with 1,898 subjects validated this survey as a high-performance scale to predict the development of T2D in subjects aged 35 to 55 years (9). Similarly, a study developed in Spain involving 824 people found FINDRISC to be a beneficial intervention to detect subjects aged 18 to 65 at risk of developing T2D (10). Regarding its use for risk detection for prediabetes, Bulgarian and Greek studies have also validated the score. Additionally, Colombian clinical guidelines include this score as a screening tool for both prediabetes and T2D (8).

The routine and widespread application of this survey presents challenges for healthcare personnel; therefore, we consider it essential to share our experience to contribute to the existing knowledge about this issue. The objective of this study was to describe the results of the FINDRISC scale in a cohort of patients in Colombia, with the aim of increasing understanding of this population and quantifying the risk of developing T2D or prediabetes in the department of Cundinamarca, Colombia. With this information, new public health policies and population-based

interventions could be developed in the region, thus promoting prevention and reducing negative health outcomes.

Materials and methods

This is a descriptive, quantitative, and cross-sectional study. The target population of the analysis was men and women over 18 years of age in the department of Cundinamarca, Colombia (Bogotá, Chía, Cota, and Zipaquirá). All participants, who were recruited through convenience sampling, underwent a FINDRISC questionnaire (9,10).

Different strategies for data collection were implemented, including an active search of subjects in places of interest such as health centers, programs for the elderly, alliances with private and public companies with occupational safety and health programs, universities, associations, and community action boards. Likewise, specific situations were identified where people could easily provide the requested information, such as waiting lines and activities of health promotion or disease prevention; in those cases, nutritional and medical information was given.

The scale implemented was the FINDRISC survey (Table 1), evaluating the following variables: age, body mass index (BMI), family history of T2D, history of previous findings of hyperglycemia without T2D diagnosis, waist circumference (WC), daily physical activity (at least 30 minutes), previous diagnosis of arterial hypertension referred by the patient, and frequency of fruits and vegetables consumption. The maximum achievable score is 26 points. Based on the total score, the risk is classified as follows: low risk (0-6 points), slightly elevated risk (7-11 points), moderate risk (12-14 points), high risk (15-20 points), and very high risk (21-26 points). A FINDRISC is considered positive if the score is greater than or equal to 12, on the contrary, if a lower score is obtained, it is classified as a negative FINDRISC.

For all participants, across all settings, adequate equipment was used, including calibrated scales and measuring tapes. Special care was taken to ensure accurate and precise data measurements. For each data collection setting, an enclosed and private area was designated for this purpose. BMI values were obtained through measurement of weight (expressed in kilograms) of each subject using a calibrated scale on an even surface, removing shoes and most items of clothing. Tape measure attached to an even wall was used to measure height (expressed in centimeters), with participants standing barefoot. WC measurements (expressed in centimeters) were obtained by drawing a horizontal line at the midpoint between the lower margin of the twelfth rib and the upper edge of the iliac crest, during exhalation, with the subject standing and facing forward. The remaining variables were collected through self-report.

A total of 3,871 risk surveys were conducted, of these 614 were excluded since they did not comply with necessary data or were incorrectly completed. 3,257 surveys were taken into account, of which 2,793 were taken through an online tool and 464 in writing. All surveys were taken in person and directed by a trained healthcare professional to ensure proper data collection. The personnel were committed to reading the questions and clarifying any doubts the participants had. All 3,257 surveys were analyzed for this study.

After digital data storing and transcription of the physical surveys to a digital database, information was exported to a Microsoft-Excel® platform, and its analysis was carried out by evaluating the variables included in absolute and relative frequency measures. Chi-squared tests, made with the RStudio software, were used to analyze each of the variables in the FINDRISC scale in order to evaluate their relationship with a positive or negative FINDRISC score (greater or less than 12). Statistically significant p-values were those <0.05. The subjects accepted the storage and handling of their personal data in accordance with local legislation (Law 1581 of 2012). Additionally, this study was approved by a certified Colombian ethics committee.

Table 1. FINDRISC score

FINDRISC SCORE			
1. Age	Under 45 years	0 points	
	45 – 54 years	2 points	
	54 – 64 years	3 points	
	Over 64 years	4 points	
2. Body mass index	Lower than 25 kg/ m2	0 points	
	25 – 30 kg/m2	1 points	
	Higher than 30 kg/m2	3 points	
3.Waist circumference measured below the ribs	MALE	FEMALE	
	Less than 94 cm	Less than 80 cm	0 points
	94 – 102 cm	80 – 88 cm	3 points
	More than 102 cm	More than 88 cm	4 points
4. Do you usually have daily at least 30 mins of physical activity at work and/or during leisure time?	Yes	0 points	
	No	1 points	
5. How often do you eat vegetables, fruits or berries?	Every day	0 points	
	No every day	1 points	
6. Have you ever taken antihypertensive medication regularly?	Yes	2 points	
	No	0 points	
7. Have you ever been found to have high blood glucose?	Yes	5 points	
	No	0 points	
8. Have any members of your immediate family or other relatives been diagnosed with diabetes?	No		0 points
	Yes	Grandparents, uncles, first cousin	3 points
	Yes	Parents, brothers, sisters or own child	5 points

Source: Taken from (11).

Results

A total of 3,257 subjects were included, where 2,278 (70.2%) corresponded to females and 970 (29.7%) to males. Regarding the site of data collection, 2,072 (63.6%) subjects were recruited in the city of Chia, 527 (16.2%) in the city of Bogotá, 452 (13.9%) in the city of Cota, and 138 (4.2%) in the town of Cajicá. The remaining 68 (2.1%) subjects were recruited from a small community bordering the Chia-Cota limits.

The distribution of risk levels for developing T2D within the following 10 years, as measured by the FINDRISC score, is shown in Figure 1. Of the total population sampled, 17.3% of participants had a low risk (0-6 points), 34.6% had a slightly elevated risk (7-11 points), 21.6% had a moderate risk (12-14 points), 22.7% had a high risk (15-20 points), and finally 3.4% had a very high risk (21-26 points).

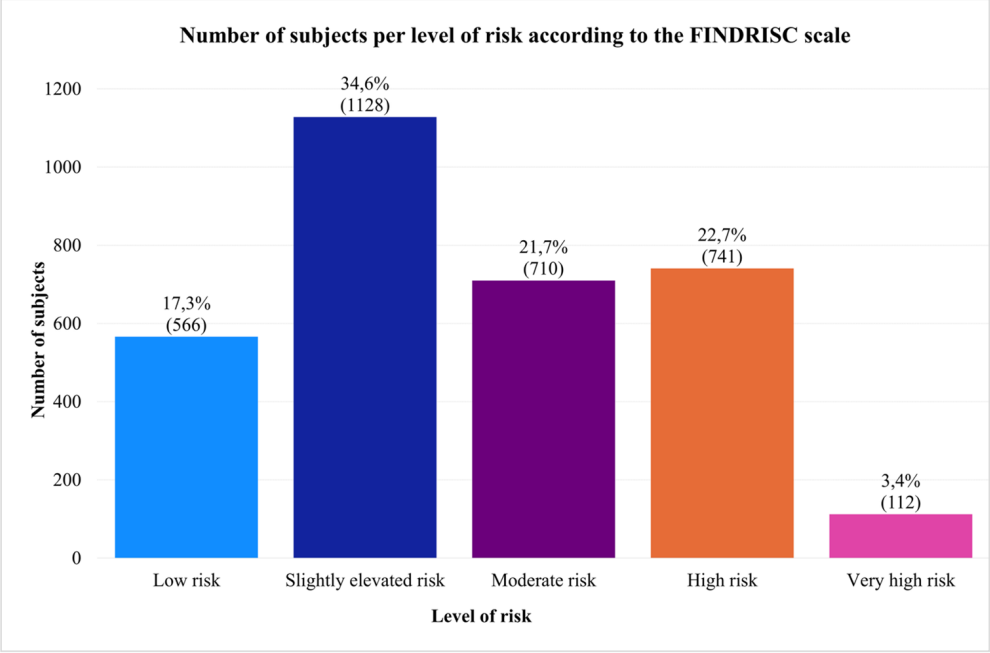

Figure 1. Number of subjects per level of risk according to FINDRISC scale

Note. Participants are classified according to their FINDRISC scores into low risk (between 0 and 6 points), slightly elevated risk (between 7 and 11 points), moderate risk (between 12 and 14 points), high risk (between 15 and 20 points) and very high risk (between 21 and 26 points). Results are shown in percentages, and absolute values are shown in parenthesis.

Source: Own elaboration.

When comparing risk levels by gender, it was observed that in both men and women, the largest number of subjects had a "slightly elevated" risk range, with 37.8% and 33.2%, respectively. Among men, the risk level that follows the slightly elevated risk is the "low risk" with 22.2%, followed by the "moderate risk" with 19.4% and the "high risk" with 17.9%. Finally, there is the "very high risk" with 2.5% of the subjects. In the case of women, the risk level that follows "slightly elevated risk" is "high risk" with 24.8% of subjects, followed by "moderate risk" with 22.7% and "low risk" with 15.3%, while "very high risk" represented 3.8% of all women evaluated.

Table 2 shows the distribution of subjects with a positive (≥12 points) or negative (<12 points) FINDIRSC, according to each of the variables of the score. It is worth mentioning that all 8 variables analyzed were found to be statistically significant with a $p < 0.05$.

Table 2. Distribution of FINDRISC variables within the study population

	POSITIVE FINDRISC ≥12 (n=1563)		NEGATIVE FINDRISC <12 (n=1694)		Total (n=3257)		
	Absolute	**%**	**Absolute**	**%**	**Absolute**	**%**	**p**
Age							<0.001
Under 45 years	379	(24.2)	994	(58.7)	1373	(42.2)	
45 – 54 years	351	(22.5)	268	(15.8)	619	(19)	
54 – 64 years	444	(28.4)	252	(14.9)	696	(21.4)	
Over 64 years	389	(24.9)	180	(10.6)	569	(17.5)	
Body mass index (BMI)							<0.001
Lower than 25 kg/m2	169	(10.8)	704	(41.6)	873	(26.8)	
25 – 30 kg/m2	731	(46.8)	775	(45.7)	1506	(46.2)	
Higher than 30 kg/m2	663	(42.4)	215	(12.7)	878	(27)	
Waist Circumference							
Males	387	(24.8)	583	(34.4)	970	(29.8)	<0.001
Less than 94 cm	36	(2.3)	290	(17.1)	326	(10)	
94 – 102 cm	182	(11.6)	215	(12.7)	397	(12.2)	
More than 102 cm	169	(10.8)	78	(4.6)	247	(7.6)	
Females	1175	(75.2)	1105	(65.2)	2287	(70.2)	<0.001
Less than 80 cm	42	(2.7)	361	(21.3)	403	(12.4)	
80 – 88 cm	226	(14.5)	345	(20.4)	571	(17.5)	
More than 88 cm	907	(58)	399	(23.6)	1306	(40.1)	
At least 30 mins of daily physical activity							<0.001
Yes	329	(21)	679	(40.1)	1008	(30.9)	
No	1234	(79)	1015	(59.9)	2249	(69.1)	
Daily vegetables, fruits or berries consumption							0.032

Every day	534	(34.2)	764	(45.1)	1298	(39.9)	
Not every day	1029	(65.8)	930	(54.9)	1959	(60.1)	
History of regular antihypertensive medication							<0.001
No	953	(61)	1501	(88.6)	2454	(75.3)	
Yes	610	(39)	193	(11.4)	803	(24.7)	
History of high blood glucose?							<0.001
No	1042	(66.7)	1601	(94.5)	2643	(81.1)	
Yes	521	(33.3)	93	(5.5)	614	(18.9)	
Family history of diabetes							<0.001
No	511	(32.7)	1108	(65.4)	1619	(49.7)	
Grandparents, uncles, first cousin	280	(17.9)	364	(21.5)	644	(19.8)	
Parents, brothers, sisters or own child	772	(49.4)	222	(13.1)	994	(30.5)	

Source: Own elaboration.

In relation to age groups, 42.2% of subjects were between 18 and 44 years old, 19.0% between 45 and 54 years, 21.4% between 55 and 64 years, and 17.5% were over 65 years of age. Figure 2 shows the level of risk of developing T2D within the following 10 years according to each age group. As age increases, there is a progressive rise in risk, with a higher number of individuals aged 55 and older categorized as having a high or very high risk of developing T2D within the next 10 years, compared to younger age groups.

The evaluation of BMI revealed that of the total number of subjects evaluated, only 26.8% had a BMI of less than 25Kg/m2, while the remaining 73.2% were above their ideal weight. Of these, 46.2% were classified as overweight (BMI between 25–30 kg/m2), and 27% as having obesity class I, II, or III (BMI higher than 30 kg/m2). Likewise, it was found that of the total number of subjects with a positive FINDIRSC, 89.2% had an elevated BMI. In contrast, among those with a negative FINDRISC, 41.6% had a BMI within targets (lower than 25 kg/m2). These findings underscore the crucial role of BMI in assessing the risk of developing T2D, as it is a key component of the FINDRISC scale.

When assessing the WC (Table 2), we found that only 22.4% of the subjects evaluated had low cardiovascular risk, defined as a waist circumference <80 cm in women (12.4%) or <94 cm in men (10%). An elevated cardiovascular risk, defined as a WC between 80–88cm for women and 94–102cm for men, was found in 17.5% and 12.2% of cases, respectively. Finally, a severely elevated cardiovascular risk, defined as a WC greater than 88cm in women and >102cm in men, was found in 40.1% and 7.6% of subjects, respectively. When comparing the results with the

10-year risk for developing T2D, of those subjects with a positive FINDRISC, 72.5% of women and 22.4% of men had an elevated or severely elevated cardiovascular risk from their WC, in comparison to the 44% of women and 17.3% of men with the same cardiovascular risk but a negative FINDRISC score (Table 2). These findings suggest that as waist circumference increases, so does the risk of developing pre-diabetes or T2D, particularly in women.

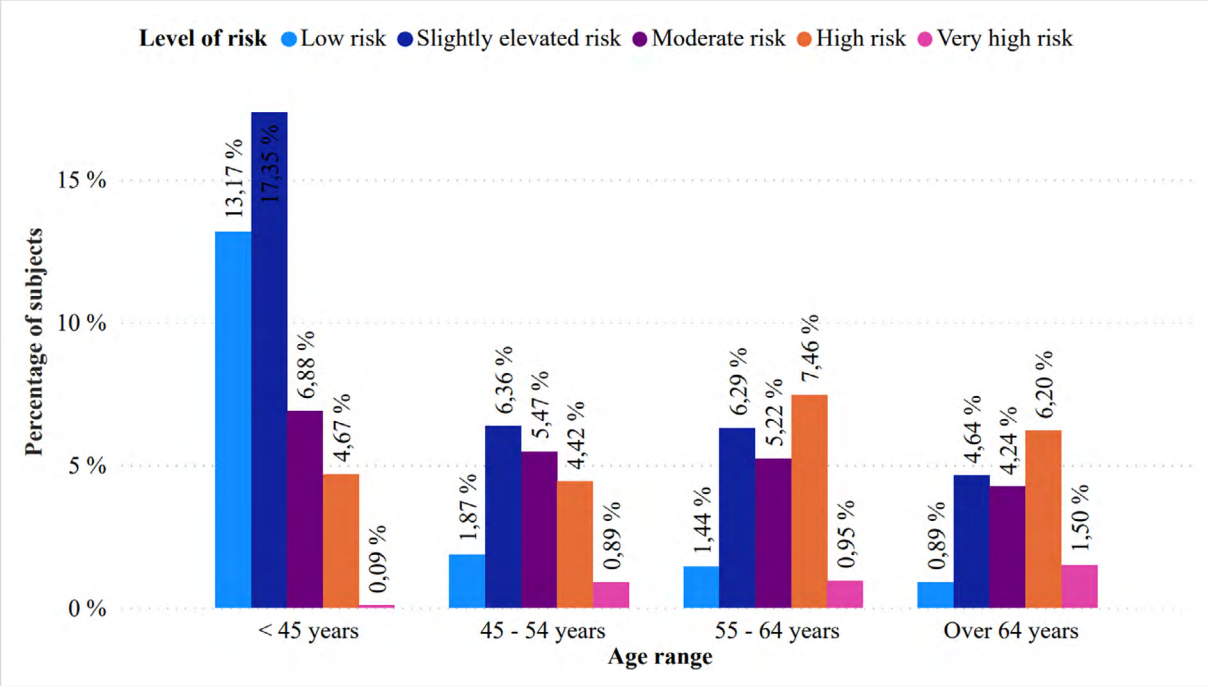

Figure 2. Risk level according to age range

Note. Participants are classified according to their FINDRISC scores into low risk (between 0 and 6 points), slightly elevated risk (between 7 and 11 points), moderate risk (between 12 and 14 points), high risk (between 15 and 20 points) and very high risk (between 21 and 26 points). Results are shown in percentages, and absolute values are shown in parenthesis.

Source: Own elaboration.

Similarly, the proportion of subjects who performed daily physical activity indicates that only 1,008 subjects (30.9%) performed at least 30 minutes of daily physical activity, while 69.1% of the subjects did not. When evaluating this variable based on the risk of presenting T2D, it was found that, of the subjects with a positive FINDRISC score, 79% do not perform daily physical activities compared to the 59.9% of subjects with a negative FINDRISC who do not meet this goal.

Additionally, the FINDRISC scale assessed each subject's diet based on their daily consumption of fruits and vegetables. It was found that 60.1% of those evaluated did not consume fruits and vegetables on a daily basis. When analyzing this variable in relation to the risk of developing T2D within the next 10 years, it was found that 65.8% of individuals with a positive FINDRISC did not consume fruits and vegetables daily. On the other hand, 45.1% of the FINDRISC negative group did report daily consumption. This suggests a potential reduction in the risk of developing T2D for those with a regular fruits and vegetables intake.

The findings regarding the use of antihypertensive medications as a risk factor for the development of T2D should be noted. Among those evaluated, 75.3% reported not using antihypertensive medications, while 24.7% reported regularly using at least one antihypertensive drug. After comparing the relationship of subjects with hypertension and a positive FINDRISC score, it was found that of the subjects with a positive FINDRISC, 39% reported a history of regular antihypertensive medication consumption. In contrast, 88.6% of the subjects with a negative FINDRISC were not consuming antihypertensive drugs, denoting a close relationship between the diagnosis of hypertension and the risk of presenting T2D.

Regarding the history of hyperglycemia without T2D diagnosis, it was found that of the total of those evaluated, approximately 1 in 5 subjects (18.9%) had obtained high glycemic levels (without T2D ranges) at least once in their lifetime. When evaluating this variable in relation to the age groups, we found a similar trend in each of the groups, however; the proportion of individuals reporting this finding increased with age. This variable becomes relevant because the affirmative answer to this question significantly increases the risk of T2D or prediabetes and, therefore, the score of the FINDRISC survey. Of the 803 subjects who reported a history of hyperglycemia without a diagnosis of T2D, 610 (87.4%) presented a positive FINDRISC score, thus suggesting an association between the history of hyperglycemia without a diagnosis of T2D and the risk of developing T2D (Table 2).

Finally, it is important to mention the family history of T2D referred to by participants. In this variable we found a strong family influence in our environment. Of evaluated subjects, 50.3% reported some type of family history of this disease, either in first-, second-, third-, or fourth-degree relatives of consanguinity. When comparing the results with the FINDRISC score, it was found that of the subjects with a positive score, 67.3% reported a family history of T2D, while the remaining 32.7% did not. This is one of the most significant risk factors for developing T2D and, therefore, increases the score on the FINDRISC scale (Table 2).

Discussion

T2D poses a major challenge for all health systems worldwide due to its high prevalence, the rates of undiagnosed cases, and the economic burden it imposes (12). For this reason, in recent years healthcare and economic efforts have focused on implementing preventive strategies to reduce the number of subjects diagnosed with T2D, its complications, and the costs associated with the disease. Based on the above, the FINDRISC scale emerges as a valuable tool to detect the risk of developing T2D or prediabetes earlier and, subsequently, to take preventive measures or to begin early treatment (13).

As previously mentioned, the use of the FINDRISC scale is recommended as a screening strategy for prediabetes and T2D in the Colombian adult population, thus explaining why this questionnaire has been implemented in different studies and regions nationwide (8). Among them, an analysis carried out in the city of Bogotá with 796 subjects described that 31.4% of the subjects presented a FINDRISC score greater than or equal to 12 (14). Another study in the city of Barranquilla, with 362 subjects, showed that 12.4% obtained a FINDRISC greater than or equal to 12 points, and another study in the same city, with 322 subjects, demonstrated that 54.6% had a positive FINDRISC (15,16).

Likewise, this tool has been applied in different countries of Latin America; for example, a study developed in Argentina described that of those evaluated, 18.6% of men and 27.4% of women obtained at least a high risk on the FINDRISC scale (17). It is important to highlight the items that presented the greatest risk, which included body mass index (BMI), abdominal circumference, and physical activity levels (17). Also, a study from Ecuador with 365 subjects identified that 38.06% of those evaluated obtained a positive FINDRISC (17). In addition, the application of this scale in Mexico was studied, it showed that 51.1% of those evaluated obtained a score greater than or equal to 12 points (18). These findings highlight a considerable difference in the percentage of subjects with positive FINDRISC across different countries. When comparing those previous studies with this research, it seems that our population

presents a higher risk of developing T2D within the following 10 years compared to previous results obtained in Colombia.

This highlights the need to generate and promote early interventions to stop the natural course of prediabetes and T2D itself. Another determinant that must be considered is the population size, since none of the studies that have been carried out regarding this topic in Colombia have described a similar or higher population size as in this study. The largest population found in Colombia in a similar study was conducted by Mariano H. *et al*. (14), which evaluated a population between 35 and 75 years of age, while this study included populations ranging from 18 to 75.

After the application of the FINDRISC survey in the 3,257 subjects mentioned and after the data evaluation, results of great importance emerged. As shown in Figure 1, of the total patient sample, a significant number of patients presented with either moderate risk (21.6%) or high risk (22.7%). This accounts for almost 50% of the sample, which represents a significant risk of developing T2D within the next 10 years. This information shows an alarming need to apply strategies that allow timely interventions in subjects at risk, not only for T2D but also with different undiagnosed diseases. The increased risk associated with growing age leads us to consider that prevention and health promotion campaigns with special focus on the older adult population are essential.

It is also important to highlight that the number of individuals who did not adhere to preventive measures (such as physical activity, body mass index, and diet) was more than double the number of those who met the recommended goals. This suggests that regular physical activity could serve as a protective factor against the development of T2D. Further association measures are required to establish this; however, it is not the focus of this study. This shows that despite the strategies implemented in health promotion, it has not been possible to significantly impact the population in simple and routine measures that reduce the risk of presenting T2D, and other public health interest diseases.

Based on the above, the impact on specific populations at risk of developing T2D —such as patients with metabolic syndrome through higher and stricter paraclinical control— could be a cost-effective strategy for T2D early detection, since patients with a diagnosis of metabolic syndrome have an elevated risk of developing T2D in comparison with people without this condition as a consequence of its typical insulin resistance (19,20). Also, quality of diet may be another important element for T2D prevention, just as intestinal microbiota has an essential role in body homeostasis and the development of metabolic and cardiovascular pathologies such as T2D. Several studies have shown the preventive benefits of adopting a Mediterranean diet. For example, a study conducted in rats demonstrated that following a Mediterranean diet has anti-inflammatory effects by reducing proinflammatory cytokines and increasing the production of anti-inflammatory cytokines (21,22).

Similarly, it should be considered that the most prevalent variables among subjects with a positive FINDRISC were a self-reported history of hyperglycemia referred to by the subject without a diagnosis of T2D, a family history of diabetes, a history of hypertension, and a WC with severely high cardiovascular risk. This was particularly notable in the female population, where 58% of the subjects with positive FINDRISC presented with a WC higher than 88 cm. The above denotes that those subjects with one or more of these characteristics should have closer clinical and paraclinical monitoring and control to prevent the development of T2D.

Finally, although more research is required regarding which confirmatory test should be conducted after a positive FINDRISC result, according to the Colombian 2016 guidelines, the use of fasting glucose is recommended after a score higher than 12 on the FINDRISC scale (8).

Among the limitations of this study, the important subjective component of the FINDRISC scale should be mentioned. Although this scale attempts to be specific with every question, each subject could interpret it differently, generating biases on the possible answers. This must be considered when taking measures against the results of the survey. For this reason, healthcare personnel trained in conducting the survey assisted

in its administration and questioning. Although the sample included a higher proportion of older adults, efforts were made to include a diverse age range by conducting surveys in various locations, such as health centers, elderly programs, and collaborations with public and private entities such as universities and private companies. While the variability in the population across different settings might introduce some bias, the goal was to capture a broad and representative sample. Likewise, this was a cross-sectional study and making inferences of causality may be a limitation; for this reason, longitudinal studies would be necessary to determine the number of positive FINDRISC patients who are eventually diagnosed with T2D.

Conclusions

The application of the FINDRISC scale proved to be an effective strategy for early detection of T2D and prediabetes in the evaluated population. According to previous studies, this scale may allow us to reduce the high rates of morbidity and mortality, associated complications, and high rates of people undiagnosed with these conditions. These results emphasize the importance of healthy lifestyle habits for populations at risk of T2D and prediabetes.

Ethical considerations

The ethical considerations for conducting the study included obtaining signed informed consent from all participants, and approval by an ethics committee, which classified the study as minimal risk due to the diagnostic nature of the intervention. Participants had the right to withdraw from the study at any time and for any reason. The study was conducted in accordance with the principles of the Declaration of Helsinki. The study is registered under Registration Number R00580-21, Record 0036-21.

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Authors' contributions

Angel F. Maestre, Juan Felipe Trujillo-Angel, Carlos Leal Bernal, Constanza Neri Morales, Carlos Julio Corzo Diaz, Nöel Barengo, Ramon A. Castaño, Maria Alejandra Larrarte, DAA, Patrizia Trasmondi, Rossmary Gonzalez, Juan Sebastian Cardona, Natalia Trujillo and Juan Pablo Bernal worked on the conceptualization, investigation, methodology and formal analysis; Maria A. Granados worked on conceptualization, investigation, methodology and formal analysis, and project administration; Humberto Reynales worked on conceptualization, investigation, methodology and formal analysis, project administration and funding acquisition; Derly Carolina Hernandez worked on conceptualization, investigation, methodology and formal analysis, and project administration; and Ramon A. Castaño worked on conceptualization, investigation, methodology, formal analysis and resources, and supervision.

Conflicts of interest

The authors declare that they do not have any conflicts of interest.

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