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Research Article

Application of Finnish Diabetes Risk Score (FINDRISC) in Detecting Subjects at Risk for Type 2 Diabetes Mellitus: Results from Community Pharmacies in Sulaimani City, Iraq

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Abstract

Background: The FINDRISC tool was used to screen subjects at risk for type 2 diabetes mellitus (T2DM) with no involvement of laboratory tests. Subjects with undiagnosed diabetes mellitus face a significant risk of developing complications. Thus, early detection is important to minimize its complications. *Objective*: To evaluate the efficiency of the FINDRISC in screening for undiagnosed T2DM (UT2DM) in Sulaimani community pharmacies. *Methods*: This cross-sectional study was carried out in four community pharmacies in Sulaimani city, Iraq. A questionnaire that included the FINDRISC variables was utilized in collecting data from 384 participants after giving informed consent. If the FINDRISC was ≥15 points and blood glucose was ≥140mg/dL, the participant was referred to a physician. *Results*: Approximately half of the participants (48.2%) were under 45 years old, and the majority (63%) of all participants were female. Based on the score definition of FINDRISC, the risk of T2DM was found to be high in 23.4%, moderate in 23.4%, and low in 18.5% of the participants. Additionally, 44.3% had a body mass index (BMI) between 25 and 30kg/m², while 30.7% had >30 kg/m². A waist circumference of <94cm was found only in 6% of males, and just 3.1% of females had a waist circumference of <80cm. Age, family history, gender, daily activity, and BMI were related to the risk of developing diabetes mellitus. *Conclusions*: The Finnish Diabetes Risk Score was found to be a helpful tool in determining the risk of T2DM among the study sample.

Keywords: Community pharmacy, Diabetes risk assessment, FINDRISC.

تطبيق المقياس الفنلندي لمخاطر الاصابة بمرض السكري (FINDRISC) في الكشف عن الأشخاص المعرضين للإصابة بمرض السكري من النوع الثاني: نتائج من صيدليات المجتمع في مدينة السليمانية ـ العراق

الخلاصة

الخلفية: FINDRISC اداة المستخدمة في فحص الأشخاص المعرضين لمخاطر الإصابة بمرض السكري من النوع الثاني دون الحاجة إلى فحص مختبري. يواجه الأشخاص الذين لم تشخص إصابتهم بمرض السكري خطرًا كبيرًا لحدوث المضاعفات، وبالتالي، فإن الكشف المبكر عن هذا المرض مهم لتقليل مضاعفاته. **الهدف:** تقييم كفاءة FINDRISC في فحص داء السكري من النوع الثاني غير المشخص في صيدليات المجتمع في السليمانية-العراق. **الطرائق:** أجريت هذه الدراسة المقطعية في أربع صيدليات مجتمع في مدينة السليمانية-العراق. تم جمع البيانات باستخدام استبانة شملت متغيرات مقياس FINDRISC من 384 مشاركًا بعد موافقة مستنيرة. إذا كانت درجة مقياس الفنلندي لمخاطر الاصابة بمرض السكري ≥15 نقطة وكان مستوى الجلوكوز في الدم ≥140 ملجم/ديسيلتر، فتم إحالة المشارك إلى الطبيب. **النتائج:** ان اعمار ما يقارب من نصف المشاركين (48.2%) كانت اقل من 45 عاما، وكانت أغلبية المشاركين (63%) اناثا. بناءً على تعريف النتائج في FINDRISC، وجد أن خطر الإصابة بمرض السكري من النوع الثاني مرتفع لدى 23.4%، ومعتدل لدى 23.4%، ومنخفض لدى 18.5% من المشاركين. بالإضافة إلى ذلك، كان مؤشر كتلة الجسم لدى 44.3% من المشاركين بين 25 و30 كجم/م2، بينما كان لدى 30.7% من المشاركين >30 كجم/م2. وأوضحت النتائج بان قياس محيط الخصر <94 سم كان فقط لدى الذكور والبقية كانت أكثر. وان قياس محيط الخصر <80 سم كان 3.1% فقط لدى الاناث والبقية كانت أكثر. كان العمر والتاريخ العائلي والجنس والنشاط اليومي ومؤشر كتلة الجسم مرتبطين بشكل كبير بمخاطر الإصابة بمرض السكري. **الاستنتاجات:** تبين أن مقياس FINDRISC أداة مفيدة في تحديد مخاطر الإصابة بمرض السكري من النوع الثاني بين عينة الدراسة.

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INTRODUCTION

Type 2 diabetes mellitus (T2DM) is considered a serious health issue worldwide. Recent studies emphasize a significant diabetes burden in the Middle East. The prevalence across the region is supposed to be 14.6%, impacting around 46 million people [1]. The International Diabetes Federation-Middle East and North Africa (IDF-MENA) region reports a 16.2% prevalence, while Iraq shows an alarming 47.1% of undiagnosed cases. A study conducted in Basrah, Iraq, reported the prevalence of diabetes as 19.7%, with 55.7% of cases previously undiagnosed [2]. The prevalence of diabetes mellitus (DM) among Iraqi adults is 10.4%, which means that around three million individuals are suffering from DM in Iraq [3]. Many Iraqi people consume excessive calories, particularly carbohydrate- and sugar-rich foods, which increases the risk of T2DM [4]. Countries such as Saudi Arabia, Kuwait, and Bahrain are among those with the highest

type 2 diabetes rates worldwide [5]. Furthermore, a retrospective study found an increased incidence of T2DM among men in the Gulf Cooperation Council states, with rates of 33.6% in Bahrain and 29.1% in Saudi Arabia [6]. Additionally, according to a study conducted in Spain, about 30% of the participants experienced some sort of carbohydrate metabolism abnormality [7]. The risk of microvascular and macrovascular complications is high in undiagnosed patients with diabetes mellitus because of the mild intensity of the symptoms. So, early detection of this disease is very important to reduce such complications [8]. Managing patients with T2DM has shifted from secondary care to primary care in the last two decades [9,10]. Current evidence shows that lifestyle interventions have an important role in preventing T2DM [8]. So detecting it during the asymptomatic phase can help in preventing or postponing the disease through the management of its risk factors [11]. In the last several years, a significant number of prediction models have been published for the identification of undiagnosed T2DM patients or the estimation of future type 2 diabetes development based on recognized risk factors over the next years [12,13]. These prediction models mostly rely on risk factors that can be assessed non-invasively and appear highly suitable for implementation in clinical practice [14]. Screening questionnaires are nowadays more commonly utilized since they cover the main risk factors that can be easily administered [15]. As one of the models, the Finnish Diabetes Risk Score (FINDRISC) is an easy-to-use, non-invasive, and affordable screening tool designed to assess the risk for developing T2DM within a ten-year timeframe [16,17]. There are studies showing FINDRISC as an effective tool for the screening of T2DM [18,19]. Screening for major diseases performed by community pharmacists is feasible and helpful to identify risk factors and accelerate early detection [20]. A community pharmacist, as a healthcare professional, can detect and screen the risk factors of disease by measuring some of the clinical parameters [21]. Community pharmacies have a crucial role in the early detection and avoidance of T2DM using the FINDRISC assessment tool. Studies conducted in Italy and Spain have shown that a considerable number of pharmacy customers were identified as having a high risk of developing T2DM in the next decade [22]. Conducting such tests in community pharmacies contributes to optimizing healthcare expenditures and promoting patients' quality of life [22,23]. The high prevalence of DM and its complications in Iraq demonstrates a substantial burden on the healthcare system, highlighting the critical importance of early diagnosis and lifestyle modifications to prevent or mitigate disease progression [2,24]. In Sulaimani city, pharmacies provide health guidance and pharmaceutical services such as patient counseling to enhance the quality of life and clinical outcome of the patients [25]. As higher education health professionals, pharmacists are responsible for performing clinical activities for the patients, such as screening, education, and monitoring [13]. However, to the best of our knowledge, no research has investigated the population at risk of UT2DM using the FINDRISC tool in Sulaimani city. Therefore, we conducted a cross-sectional study to assess the efficacy of the FINDRISC tool for screening UT2DM in a representative sample of the Kurdish population living in Sulaimani city, which is essential since early detection of individuals at risk of developing DM will enable them to make a modification in their lifestyle within the shortest time frame.

METHODS

Study setting and sample size

This is a cross-sectional and observational epidemiological study that was conducted in community pharmacies in Sulaimani city, Kurdistan Region of Iraq, from 1st September to 1st November 2024. Four pharmacies were chosen by using simple random sampling to be included in the study. All the pharmacists who participated were taking a short training course on methodology and the procedure of the work. The estimated sample size for this study is 384 participants. To calculate an appropriate representative sample, the Cochran formula was used, and a sample size of 384 was calculated to demonstrate a statistically significant result for the study [26].

Inclusion and exclusion criteria

This study included individuals with an age range from 30 to 75 years, having good communication in the native languages, without a previous history of diabetes, and not having any mental health problems or being in an emergency condition. Meanwhile, any customers with DM and those who refused to participate in the study were excluded.

Data collection, consent, and ethical consideration

During the study period, as per the inclusion criteria, individuals visiting the participating pharmacies to purchase medications were invited to take part in the research. The participants were either in their routine feeding or fasting. All the participants were informed that their participation was voluntary, and their information would be kept confidential and used exclusively for research purposes. Furthermore, the protocol of this study was approved by the Ethics and Research Registration Committee of the College of Pharmacy-University of Sulaimani with the registration number PH132-24 on 09.09.2024. By using the face-to-face interview method, a questionnaire was prepared by the researchers to collect sociodemographic data and anthropometric measurements. FINDRISC was used to determine the individuals at risk for T2DM [18,19]. Capillary blood glucose (CBG) was performed for each participant by capillary puncture and measured with a

validated and self-calibrating glucometer. Capillary blood glucose levels less than 100 mg/dL were considered normal when fasting or less than 140 mg/dL in a casual feeding state [27]. If CBG was more than the levels mentioned, the participant was referred to the physician.

FINDRISC tool

This tool is used to screen people at risk for T2DM [13,16]. In which eight variable components related to anthropometric parameters and lifestyle models are assessed. The components are age, body weight, height to find BMI, measurement of waist circumference, vegetable, fruit, or berry consumption, daily physical activity, taking antihypertensive medications, previous diagnosis of high blood sugar, and family history of diabetes. The weight of the participants was measured by a standard weighing scale, and the participant's height was measured by stadiometer. While BMI was calculated using this formula, BMI = Weight (kg)/ Height^2 (m^2). Finally, waist circumference was measured midway between the lowest rib and the iliac crest. The measurement was performed by the researcher to reduce the error rate. At the end of the FINDRISC scoring process, each participant was informed of his/her score, and appropriate health education was offered as a reward in this study. In addition, those participants were strongly advised on the need for regular blood sugar testing. The total risk score of everyone was summed up from the respective scores of the different components, followed by analysis and comparison [18].

Piloting and validation process

For checking any difficulties in understanding, the questionnaire was first tested on 15 people. Regarding the reliability of the questionnaire, a biostatistician checked the questionnaire by calculating Cronbach's alpha factor and gave a 0.84 value. All those questionnaires were excluded from the analysis.

Data analysis

For analyzing the data, 27th version of the Statistical Package for Social Science (SPSS) was used. The quantitative and qualitative variables were described using numbers, frequencies, and percentages.

RESULTS

In the current study, 384 customers were interviewed to assess the risk of developing T2DM in the population aged between 30 and 75 years. The sociodemographic characteristics of the participants are described in Table 1. The highest percentage of participants, 242 (63%), were females. Regarding educational level, 262 (68.2%) had no academic degree.

Table 1: Sociodemographic data of the study individuals (n=384)

Variables	Category	Frequency (%)
	Single	31(8.1)
Marital status	Married	344(89.6)
	Widowed	9(2.3)
Educational level	Academic education	122(31.8)
	Under diploma	262(68.2)
	< 500,000	109(28.4)
Monthly income (ID)	500,000-1000,000	198(51.6)
	>1000,000	77(20)
Gender	Male	142(37
	Female	242(63)

Values were expressed as frequency and percentage

Table 2: FINDRISC score variables among the study individuals (n=384)

Factor	Category	n(%)
	< 45	185(48.2)
Age (year)	45-54	121(31.5)
	55-64	56(14.6)
	>65(5.7)	22(5.7)
	<25 kg/m^2	96(25)
Body mass index (BMI)	25-30 kg/m^2	170(44.3)
	>30 Kg/m^2	118(30.7)
	Male <94 cm	23(6)
	Male 94-102 cm	71(18.5)
Gender, waist circumference (WC)	Male >102 cm	48(12.5)
	Female <80 cm	12(3.1)
	Female 80-88 cm	36(9.4)
	Female >88 cm	193(50.3)
Physically active for more than 30 minutes every day	Yes	214(55.7)
	No	170(44.3)
History of taking medication for high blood pressure regularly	No	85(22.1)
	Yes	299(77.9)
History of high blood glucose	No	342(89.1)
	Yes	42(10.9)
Immediate family members or other relatives with diabetes (type 1 or type 2)?	No	181(47.1)
	Yes (only second degree)	35(9.1)
	Yes (only first degree)	168(43.8)

Values were expressed as frequency and percentage.

The characteristics of the participants in FINDRISC categories are demonstrated in Table 2. The highest percentage of participants (48.2%) was <45 years, while only 5.7% were above 65 years old. Additionally, risk factors for having DM are shown in Table 2; 170 (44.3%) participants had a BMI between 25 and 30.7%

had >30 kg/m². A WC of > 94 cm was found in 119 (31%) males, while in females, 229 (59.7%) had a WC of > 80 cm. Moreover, 170 (44.3%) individuals did not do daily exercise. In addition, 299 (77.9%) of participants were hypertensive and on regular antihypertensive medications. A history of hyperglycemia was found only in 42 (10.5%) of the participants. About 168 (43.8%) of the study samples had a first-degree relative with DM, and 35 (9.1%) had second-degree relatives with DM (Table 2). Figure 1 illustrates the risk of developing type 2 diabetes mellitus as evaluated by the FINDRISC assessment tool. Low risk was reported at 18.5%, a slightly elevated risk was found in 38.5%, moderate and high risk in 23.4%, and very high risk in 2.9%. Table 3 demonstrates the risk of T2DM among individuals relating to different factors. Age, sex, daily physical exercise, BMI, and family history of DM were found to be linked with the developing of the disease. Most of the cases (78%) who are at low risk are under the age of 45 years, and 9.1% who are at a very high risk are above the age of 65 years. Additionally, 81.8% of the females were in the very high-risk group, and 18.2% of the males were in the very

high-risk group. About 81.7% of low-risk cases have physical activity for 30 min per day, while 18.3% have no physical activity.
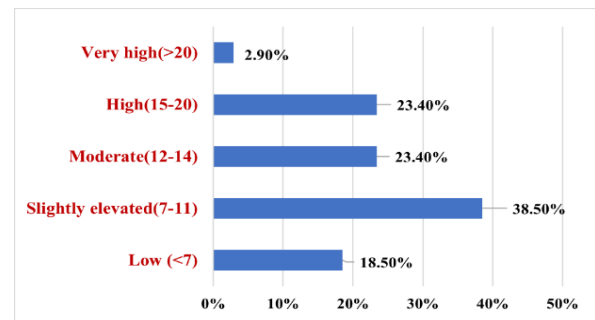

Figure 1: The risk of developing type 2 diabetes mellitus utilizing the FINNISH Type 2 Diabetes Risk Assessment (FINDRISC) assessment tool (n=384).

As is shown in Table 3, nearly 81.8% of the very high-risk cases have no daily physical activity. Most of the low-risk cases (69.1%) have a BMI below 25 kg/m², while (81.8%) who are at very high risk have a BMI above 30 kg/m².

Table 3: Distribution of different factors and risk of developing diabetes mellitus among study participants (n=384)

FINDRISC score		Low	Slight	Moderate	High	Very high	Total
Age (year)	<45	57(78)	72(48.6)	32(35.6)	23(35.9)	1(9.1)	185(48.2)
	45-54	9(12.3)	46(31.1)	40(44.4)	22(34.4)	4(36.4)	121(31.5)
	55-64	5(6.8)	22(14.9)	12(13.3)	12(18.8)	5(45.5)	56(14.6)
	>64	0(0)	8(5.4)	6(6.7)	7(10.9)	1(9.1)	22(5.7)
Gender	Male	42(59.2)	59(39.9)	26(28.9)	13(20.3)	2(18.2)	142(37)
	Female	29(40.8)	89(60.1)	64(71.1)	51(79.7)	9(81.8)	242(63)
Physical activity	Yes	58(81.7)	92(62.2)	41(45.6)	21(32.8)	2(18.2)	214(55.7)
	No	13(18.3)	56(37.8)	49(54.4)	43(67.2)	9(81.8)	170(44.3)
BMI (kg/m²)	<25	49(69.1)	31(20.9)	12(13.3)	3(4.7)	1(9.1)	96(25)
	25-30	22(30.9)	81(54.7)	43(47.8)	23(35.9)	1(9.1)	170(44.3)
	>30	0	36(24.3)	35(38.9)	38(59.4)	9(81.8)	118(30.7)
Family members with DM	No	60(84.5)	93(62.8)	20(22.2)	7(10.9)	1(9.1)	181(47.1)
	2nd relative	3(4.2)	17(11.5)	10(11.1)	5(7.8)	0	35(9.1)
	1st relative	8(11.3)	38(25.7)	60(66.7)	52(81.3)	10(90.9)	168(43.8)

Values were expressed as frequency and percentage. BMI: body mass index; FINDRISC: FINNISH Type 2 Diabetes Risk Assessment; kg/m²: kilogram per square meter.

Around 90.9% of very high-risk cases and 81.3% of high-risk cases have a first-degree relative with DM, while only 11.3% of the low-risk cases had a first-degree relative with DM. The result of the capillary blood glucose level for all the participants after their feeding state is shown in Table 4; the blood glucose level of 50 (13%) of the participants was greater than or equal to 140 mg/dL.

Table 4: Capillary blood glucose results (n=384)

Capillary blood glucose	n(%)
≥140 mg/dL	50(13)
<140 mg/dL	334(87)

Values were expressed as frequency and percentage.

The total number of patients that were referred to the physician was 50; only 4 returned to the pharmacy to be notified about the results; the HbA1c test was done for them, and the result was between 5.8 and 6.5%. If we consider the total number of participants (n=384), the

new patients diagnosed with prediabetes represent 1% of the analyzed sample.

DISCUSSION

Diabetes mellitus is a highly prevalent condition that frequently remains undiagnosed until significant complications have developed [28,29]. Given the challenges posed by inadequate healthcare systems, the rising prevalence of diabetes, the substantial cost of its management, and the lifelong nature of its treatment, prevention of the disease's onset or progression is crucial. The present study utilized the FINDRISC assessment tool as a screening tool for identifying T2DM and prediabetes for the study population. The efficacy of this tool in identifying undiagnosed T2DM was appropriate. The finding of the present study in respect of the value of the FINDRISC tool is consistent with the studies that utilized the same. In New Zealand, FINDRISC is confirmed as an effective tool in

identifying undiagnosed prediabetes and T2DM [30]. Similarly, studies in Nigeria highlighted its utility in detecting unrecognized diabetes and assessing future risk [18]. Another research further validated FINDRISC's effectiveness in identifying undiagnosed T2DM and predicting diabetes risk among overweight and obese individuals [31]. On the other hand, a study from Tanzania reported FINDRISC's low sensitivity and specificity for prediabetes and T2DM screening among young adults; however, it showed promise for identifying metabolic syndrome [32]. From the findings of the present study, we can suggest FINDRISC as a suitable screening tool for detecting T2DM. To our knowledge, it is the first study that has investigated the risk factors for DM utilizing the FINDRISC assessment tool in the Kurdish population in the Kurdistan-north region of Iraq. Community pharmacists play a crucial role in managing chronic diseases, particularly diabetes. They are involved in various aspects of care, including medication management, disease monitoring, and patient education. Pharmacists' interventions in diabetes care have shown similar or greater effectiveness compared to those delivered by other healthcare professionals [33]. Patients with T2DM recognize pharmacists' expertise in medicines and value their advice on side effects and drug interactions [34]. However, the integration of pharmacists into existing healthcare models remains limited, and their role is not always well recognized by patients or other healthcare professionals [33,34]. In this study, the role of community pharmacists in the early diagnosis of T2DM through identifying the risk factors of the disease has been shown. The study identified a significant number of participants at moderate to high risk of T2DM, suggesting that community pharmacies could serve as an effective screening point for undiagnosed T2DM. This would help raise awareness among the population about the potential complications of the disease if left uncontrolled in its early stages. Moreover, patients can get advice about nutrition and physical activity to postpone the onset of the disease. The number of individuals analyzed in the community pharmacy demonstrates the interest of pharmacists in engaging in such a kind of activity. By engaging in early disease identification and prevention, community pharmacists take a pivotal step in expanding their roles in public health and patient-centered care. The concept of expanding the roles of community pharmacists beyond just offering basic dispensing services to more initiative activities has also been targeted in many developed countries [35,36]. In comparing the demographic characteristics of the participants in the current study with previous studies [37, 38], in our study 52% of individuals were above 45 years old, compared to 80% and 75% of the other studies [38]. Nearly 63% of our customers were female, and 60% of the mentioned sample studies were female. The higher number of female participants can be explained by the fact that they are more frequent users of community pharmacy

services or medications. In the present study (2.9%) of the participants showed a very high-risk for DM in comparison to Sudanese (7.1%) [39] and Turkish (3.2%) [37] populations with a larger sample size. However, about 18.5% of our participants had a low risk for T2DM in comparison to a study conducted by Fornos-Perez et al. [40,41], the risk of developing diabetes was about (33.7%), which may be linked to genetic or physical inactivity of the population. A waist circumference above 88 cm for females and 102 cm for males is suggestive of a higher risk of DM and cardiovascular problems [42]. The present study reported that more females (50.3%) than males (12.5%) reached the threshold values. Which is comparable to a study in the Nigerian population [43]. As it is known that central adiposity has a stronger link to an increased risk of myocardial infarction in females than in males [44]. So, those young women could be at higher risk for DM and heart attack. Studies have shown that excessive weight is linked to diseases such as T2DM [43,37]. The current study reported that 44.3% of participants were overweight (BMI 25–29.9), while 30.7% of them were obese (BMI ≥ 30). Our findings are almost higher than the results of Khalid *et al.*'s study, which mentioned that (11.5%) of individuals were obese but (32%) of the participants were overweight [39]. Because the current study was taking place in an urban area, the rates of excessive weight could be due to physical inactivity of the population. Regarding physical activity, 81.8% of the very high-risk cases in this study had no daily physical activity; this finding is lower than that found in Khalid *et al.*'s study conducted among Sudanese individuals; it showed that 100% of very high-risk cases had no physical activity [39]. It has been shown that there is a positive correlation between lack of physical activity and elevated blood glucose levels. A sedentary lifestyle can lead to insulin resistance in individuals with undiagnosed diabetes, regardless of obesity [12,13]. Moreover, 90.9% of very high-risk cases and 81.3% of high-risk cases have a first-degree relative with diabetes. Compared to this study, a study conducted in Saudi Arabia showed that 45.5% of their participants had first-degree relatives with diabetes [45]. In the present study, 13% of the participants showed capillary blood glucose levels ≥140 mg/dL. This value is less than the one obtained in the previous study [41], because the latter has a larger sample size. As it is known, prediabetes is a state of intermediate hyperglycemia, and the person with prediabetes is in an at-risk state for developing DM with an annual conversion rate of 5–10% [46]. Therefore, the result of the present study indicates a likelihood of an upcoming increase in cases of DM among the population.

Study limitations

In this study, some limitations can be reported. First, a small sample size; second, the study was conducted in the city-center setting; therefore, exploring this approach in the rural area is needed. However, the main

strengths of this study are the procedure of the work, which was non-invasive, easy, and affordable, and the incorporation of measuring the blood glucose into the study design, which is considered another strong point of the current study. Furthermore, to the best of our knowledge, this is the first time an international tool like FINDRISC has been applied in one city in Iraq to determine the diabetic risks.

Conclusion

The conducted capillary blood glucose test and the anthropometric information gathered from this study provide sufficient evidence for the prevalence of prediabetes and increasing the rate of diabetes mellitus cases. FINDRISC as an effective tool may be used for assessing diabetes risk for an individual over a 10-year period. In future research, it might be necessary to create a more specific risk assessment tool for the Iraqi population.

Recommendation

It is important to increase health awareness among the Iraqi population through media by explaining the important risk factors and the life-threatening complications of diabetes mellitus. Additionally, it will be helpful to use the FINDRISC scale in basic health care and community pharmacy to identify prediabetic individuals and to carry out the necessary preventive actions. Finally, a larger sample size for future studies is recommended on the same topic.

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