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Diagnostic Accuracy of the FINDRISC Score for Detecting Undiagnosed Type 2 Diabetes Mellitus and Prediabetes

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Abstract: Background: Type 2 diabetes mellitus represents a major global public health challenge, particularly in low- and middle-income countries, with a large proportion of cases remaining undiagnosed. Early identification of high-risk individuals is essential to prevent disease progression and complications. The Finnish Diabetes Risk Score is a simple, non-invasive screening tool that has been widely used to estimate the risk and diagnosis of type 2 diabetes mellitus and may offer a practical alternative to laboratory-based screening in resource-limited settings.

Aim of the study: To assess the ability of the Finnish Diabetes Risk Score to identify undiagnosed type 2 diabetes mellitus and prediabetes among Iraqi adults.

Patients and methods: Cross-sectional study was conducted at primary health care centers in Karbala Health Directorate/ Iraq from February 2025 to February 2026 and included 200 adult participants without previously diagnosed diabetes or prediabetes. Data collection included anthropometric measurements, and clinical history. The Finnish Diabetes Risk Score was calculated for each participant. Laboratory assessment included fasting blood sugar and glycated hemoglobin. analysis was used to evaluate diagnostic accuracy.

Results: According to laboratory findings, 26 participants (13%) were diabetic, 35 (17.5%) were prediabetic, and 139 (69.5%) were non-diabetic. The mean fasting blood sugar was 180.7 ± 63.1 mg/dL, and the mean HbA1c was 7.5 ± 4.2%. The mean FINDRISC score was 13.8 ± 4.6 (range: 4–24), with 71 participants (35.5%) classified as high risk (≥15 points), 14 (7.0%) as moderate risk (12–14 points), and 115 (57.5%) as low risk (<12 points). FINDRISC demonstrated good diagnostic accuracy for detecting diabetes, with an area under the curve (AUC) of 0.86 at a cutoff ≥15, yielding a sensitivity of 82.2%, specificity of 71.3%, positive predictive value of 77.5%, negative predictive value of 76.4%, and overall accuracy of 77.6%. For prediabetes, the AUC was 0.78 at a cutoff ≥12, with sensitivity of 74.6%, specificity of 64.5%, and accuracy of 69.2%. Significant associations with glycemic status were observed for age ($p = 0.021$), body mass index ($p = 0.033$), central obesity ($p = 0.031$), physical inactivity ($p = 0.041$), low fruit and vegetable intake ($p = 0.028$), hypertension ($p = 0.009$), family history of diabetes ($p = 0.022$), and history of hyperglycemia ($p < 0.001$), while gender was not significantly associated ($p = 0.063$).

Conclusions: The Finnish Diabetes Risk Score showed good diagnostic accuracy in identifying undiagnosed type 2 diabetes mellitus and acceptable accuracy for prediabetes among Iraqi adults.

Introduction: Type 2 diabetes mellitus (T2DM) is one of the most common chronic metabolic disorders worldwide and represents a major public health challenge, particularly in low- and middle-income countries (1).

The global prevalence of T2DM has risen markedly over recent decades, largely attributed to rapid urbanization, sedentary lifestyles, unhealthy dietary patterns, and the increasing prevalence of overweight and obesity (2).

The Middle East and North Africa (MENA) region is among the regions with the fastest-growing prevalence of T2DM worldwide. (3).

In Iraq, the prevalence of T2DM has increased substantially over recent years, reflecting regional and global trends. Overweight and obesity are highly prevalent among Iraqi adults and are strongly associated with an increased risk of developing T2DM. (4)

According to the International Diabetes Federation, a considerable proportion of adults with T2DM remain undiagnosed, exposing them to a higher risk of long-term microvascular and macrovascular complications of diabetes (5).

Early identification of individuals at high risk for developing T2DM is essential for implementing lifestyle modifications and preventive interventions that can delay or prevent disease onset (6).

Conventional screening methods for T2DM include fasting plasma glucose, oral glucose tolerance test, and glycated hemoglobin (HbA1c) measurements (7).

Although these laboratory-based tests are effective, their widespread use for population screening may be limited by cost, availability, particularly in resource-limited settings (8).

The Finnish Diabetes Risk Score (FINDRISC) is a simple, non-invasive, questionnaire-based screening tool developed to estimate the 10-year risk of developing type 2 diabetes mellitus (T2DM). In addition to risk prediction, it has demonstrated good diagnostic accuracy as a screening instrument for identifying undiagnosed T2DM and prediabetes (9).

It includes easily obtainable clinical and lifestyle variables such as age, body mass index, waist circumference, physical activity level, dietary habits, family history of diabetes, and history of hypertension or hyperglycemia (10).

Aim of the study

To assess the ability of the Finnish Diabetes Risk Score (FINDRISC) to identify undiagnosed type 2 diabetes mellitus and prediabetes among a sample of Iraqi patients in Karbalaa.

2. Patients and Methods

2.1. Study Design

Cross-sectional study conducted to evaluate the accuracy of the Finnish Diabetes Risk Score (FINDRISC) in detecting type 2 diabetes and prediabetes among Iraqi adults.

2.2. Study Setting

The study was conducted at primary health care centers in Karbala Health Directorate/ Iraq over a period of one year from February 2025 to February 2026. A total of 200 patients were included. Patients were recruited from the primary health centers visitors or staff during the study period.

2.3. Inclusion Criteria

1. Adult patients Age ≥ 35 years of both genders.
2. No previously diagnosed type 2 diabetes mellitus or prediabetes
3. Agreed to participate in the study.

2.4. Exclusion Criteria

1. Patients that were previously diagnosed with type 1 or type 2 diabetes mellitus or on treatment with antidiabetic medications or insulin
2. Pregnant women
3. Patients with severe acute illness or critical condition
4. Chronic systemic disease affecting glucose metabolism (e.g., chronic liver failure, end-stage renal disease)
5. Use of medications known to significantly alter glucose levels (e.g., systemic corticosteroids)

2.5. Data Collection

Data were collected and the variables recorded included:

- **Sociodemographic Variables:** Age, gender, and residence.
- **Anthropometric Measurements:**
  - Height (cm) and weight (kg) were measured using standardized equipment with participants wearing light clothing and no shoes.
  - Body Mass Index (BMI) was calculated as weight (kg) divided by height in meters squared (kg/m^2). (43)
  - Waist circumference (cm) was measured at the midpoint between the lower margin of the last palpable rib and the iliac crest using a non-stretchable measuring tape.
- **Lifestyle Variables**

- o Physical activity.
- o Daily consumption of fruits and/or vegetables.

- **Clinical History Variables**

- o Current use of antihypertensive medication
- o Previous history of elevated blood sugar
- o Family history of diabetes mellitus

- **Blood Pressure Measurement:** Blood pressure (mmHg) was measured using a sphygmomanometer after the participant had been asked to sit and rest for at least 5 minutes.

- **Finnish Diabetes Risk Score (FINDRISC)**

The FINDRISC score was calculated for each participant after direct interviews and physical examination based on eight variables:

1. Age
2. BMI
3. Waist circumference
4. Daily physical activity
5. Daily fruit/vegetable intake
6. Use of antihypertensive medication
7. History of elevated blood glucose
8. Family history of diabetes

Each variable was assigned a specific number of points according to the standardized FINDRISC scoring system (Figure 1.1.) The total score ranged from 0 to 26 points.

The total FINDRISC score was interpreted as the following:

- < 12 points: non diabetic
- 12–14 points: prediabetic
- ≥ 15 points: diabetic. (44)

- **Laboratory Assessment**

Patients were sent to do the investigations and all laboratory analyses were done in the health center laboratory using standardized procedures. Venous blood samples were obtained by laboratory personnel after 8–12 hours of overnight fasting and included:

- Fasting Blood Sugar (FBS) (mg/dL)
- Glycated Hemoglobin (HbA1c) (%)

Laboratory results were obtained by the researcher and recorded.

- Diabetes was defined as:
- HbA1c ≥ 6.5%.
- Prediabetes was defined as:
- HbA1c between 5.7%–6.4%. (45)

2.6. Statistical Analysis

Data analysis was done using SPSS version 27 for Windows 11. The results were expressed in simple measures of mean, standard deviation, frequencies and percentages illustrated as tables and figures.

Comparisons between variables using the independent samples t-test for continuous variables (age, BMI, waist circumference, FBS, HbA1c, blood pressure, FINDRISC score) and the Chi-square test for categorical variables (gender, BMI groups, waist circumference group, physical activity, fruit/vegetable intake, antihypertensive use, history of elevated blood sugar, family history of diabetes).

Receiver operating characteristic (ROC) curve analysis was conducted to evaluate the ability of the FINDRISC score to detect diabetic and non-diabetic participants. The area under the curve (AUC), sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated. A p-value <0.05 was considered statistically significant.

2.7. Ethical Considerations

- Verbal consent was obtained from each participant.
- All patient data were kept confidential.

3. Results

The current study included 200 patients that were assessed for diabetes and prediabetes. According to the FINDRISC score the mean score of the study participants was 13.8 ± 4.6, with values ranging from 4 to 24. Based on the cutoff points, 71 participants (35.5%) were classified as diabetic (≥15 points), 14 (7.0%) as prediabetic (12–14 points), and 115 (57.5%) as non-diabetic (<12 points). As shown in table 3.1. and figure 3.1

Table 3.1.: FINDRISC score of the study sample (n=200)

FINDRISC score	
Mean ± SD	13.8 ± 4.6
Range	4-24
Glycemic Status	
Diabetic (≥ 15 points)	71 (35.5%)
Prediabetic (12–14 points)	14 (7.0%)
Non-Diabetic (< 12 points)	115 (57.5%)

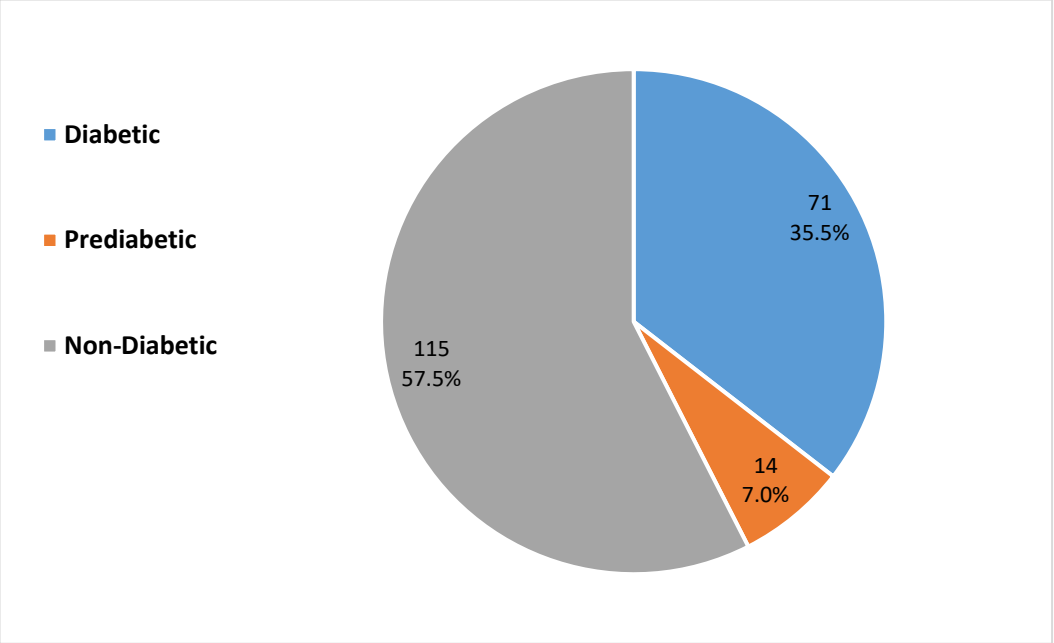

Figure 3.1.: Incidence of diabetes and prediabetes among the study sample participants according to FINDRISC score.

Patients were sent for laboratory investigations and the mean fasting blood sugar (FBS) of the study sample was 180.7 ± 63.1 mg/dL, with range from 82-512 mg/dL. The mean glycated hemoglobin (HbA1c) was 7.5 ± 4.2%, range from 4.5% to 16%. 26 participants (13%) were diabetic, 35 (17.5%) were prediabetic, and 139 (65.5%) were non-diabetic. As shown in Table 3.2 and Figure 3.2.

Table 3.2.: Laboratory results of the study sample (n=200)

Parameter	N (%)
FBS (mg/dL)	
Mean ± SD	180.7 ± 63.1
Range	82-512
HbA1C	
Mean ± SD	7.5 ± 4.2
Range	4.5-16
Glycemic Status	
Diabetic	26 (13%)
Prediabetic	35 (17.5%)
Non-Diabetic	139 (65.5%)

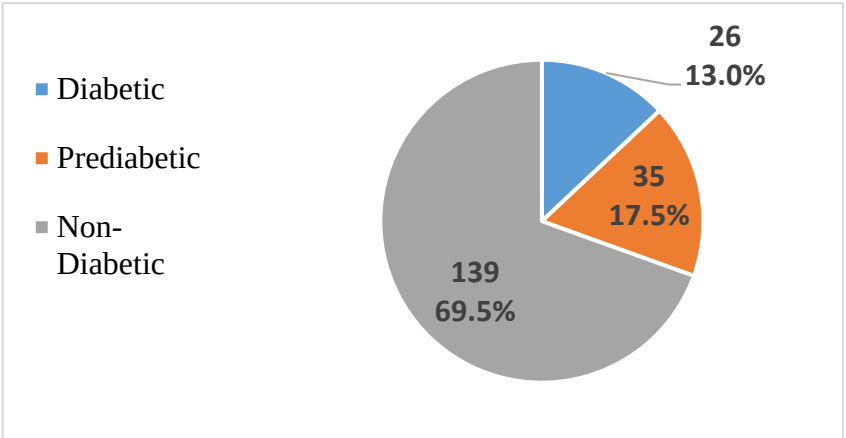

Figure 3.2.: Incidence of diabetes and prediabetes among the study sample participants according to laboratory results.

For detection of diabetes, the FINDRISC score showed good diagnostic accuracy, with an area under the ROC curve (AUC) of 0.86, indicating high discriminative ability. The optimal cutoff value was ≥15, with sensitivity of 82.2% and specificity of 71.3%. The positive predictive value was 77.5%, and the negative predictive value was 76.4%, with an overall diagnostic accuracy of 77.6%. (Figure 3.3.)

For detection of prediabetes, the AUC was 0.78, indicating acceptable accuracy. The optimal cutoff was ≥12, with sensitivity of 74.6% and specificity of 64.5%. The positive predictive value was 61.8%, and the negative predictive value was 75.9%, with an overall diagnostic accuracy of 69.2%. (Figure 3.4.)

Table 3.3.: Diagnostic accuracy of FINDRISC.

Parameter	Diabetic	Prediabetic
Area under ROC curve (AUC)	0.86	0.78
Optimal cutoff value	≥15	≥12
Sensitivity	82.2%	74.6%
Specificity	71.3%	64.5%
Positive predictive value (PPV)	77.5%	61.8%
Negative predictive value (NPV)	76.4%	75.9%
Overall diagnostic accuracy	77.6%	69.2%

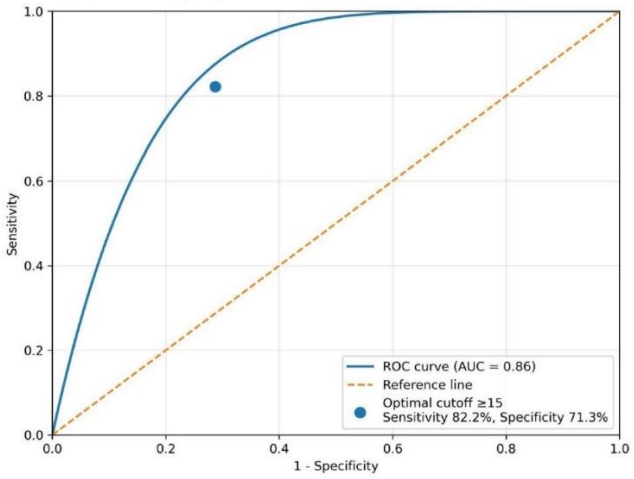

Figure 3.3. Receiver operating characteristic (ROC) curve of FINDRISC for detection of type 2 diabetes mellitus.

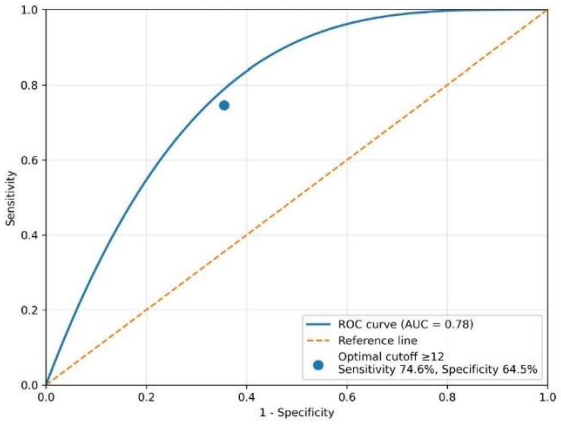

Figure 3.4. Receiver operating characteristic (ROC) curve of FINDRISC for detection of pre diabetes.

The age distribution showed that non-diabetic participants were younger. The mean age decreased across groups from 58.7 ± 10.4 years in diabetics to 49.6 ± 11.2 years in non-diabetics. This difference was statistically significant (p = 0.021). females were 38.5% of diabetics, 45.7% of prediabetics, and 51.1% of non-diabetics. For gender the difference was not statistically significant (p = 0.063).

The mean BMI was highest in diabetics (33.8 ± 4.6 kg/m²) and lowest in non-diabetics (27.4 ± 4.8 kg/m²) and the difference was statistically significant (p = 0.033). Central obesity was present in 21 diabetics (80.8%), 26 prediabetics (74.3%), and 72 non-diabetics (51.8%). This difference was statistically significant (p = 0.031). As shown in table 3.4.

Table 3.4.: Associations between sociodemographic and anthropometric measures and glycemic status by laboratory results.

Variable	Diabetic (n=26)	Prediabetic (n=35)	Non-Diabetic (n=139)	P-value
Age (years)				
35–49	6 (23.1%)	12 (34.3%)	72 (51.8%)	0.021
50–64	11 (42.3%)	14 (40.0%)	48 (34.5%)	
≥65	9 (34.6%)	9 (25.7%)	19 (13.7%)	
Mean ± SD	58.7 ± 10.4	54.2 ± 9.8	49.6 ± 11.2	
Gender				
Male	16 (61.5%)	19 (54.3%)	68 (48.9%)	0.063
Female	10 (38.5%)	16 (45.7%)	71 (51.1%)	
BMI (kg/m²)				
25.0–29.9	5 (19.2%)	10 (28.6%)	60 (43.2%)	0.033
30.0–34.9	8 (30.8%)	11 (31.4%)	44 (31.7%)	
35.0–39.9	7 (26.9%)	8 (22.9%)	23 (16.5%)	
≥40	6 (23.1%)	6 (17.1%)	12 (8.6%)	
Mean ± SD	33.8 ± 4.6	31.1 ± 4.2	27.4 ± 4.8	
Waist Circumference (cm)				
Central obesity present	21 (80.8%)	26 (74.3%)	72 (51.8%)	0.031
Central obesity absent	5 (19.2%)	9 (25.7%)	67 (48.2%)	
mean ± SD	109.5 ± 11.2	103.3 ± 10.6	94.8 ± 12.4	

Regarding the lifestyle and clinical risk factors related to diabetes lack of physical activity was more common among diabetics (18 patients, 69.2%) compared to prediabetics (20, 57.1%) and non-diabetics (58, 41.7%). This difference was statistically significant (p = 0.041).

Low daily intake of fruits and vegetables was seen in 17 diabetics (65.4%), compared to 19 prediabetics (54.3%) and 60 non-diabetics (43.2%). This difference was statistically significant (p = 0.028).

Hypertension was present in 17 diabetics (65.4%), compared to 18 prediabetics (51.4%) and 51 non-diabetics (36.7%). This difference was statistically significant (p = 0.009).

Positive family history of diabetes was reported in 18 diabetics (69.2%), 21 prediabetics (60%), and 57 non-diabetics (41%). This difference was statistically significant (p = 0.022).

History of hyperglycemia was present in 21 diabetics (80.8%), compared to 21 prediabetics (60%) and 27 non-diabetics (19.4%). This difference was highly statistically significant (p < 0.001). As in table 3.5.

Table 3.5.: Associations between lifestyle and clinical risk factors and glycemic status by laboratory results.

Variable	Diabetic (n=26)	Prediabetic (n=35)	Non-Diabetic (n=139)	P-value
Physical activity ≥30 min/day				
No	18 (69.2%)	20 (57.1%)	58 (41.7%)	0.041
Yes	8 (30.8%)	15 (42.9%)	81 (58.3%)	

Daily fruit/vegetable intake				
No	17 (65.4%)	19 (54.3%)	60 (43.2%)	0.028
Yes	9 (34.6%)	16 (45.7%)	79 (56.8%)	
Hypertension				
No	9 (34.6%)	17 (48.6%)	88 (63.3%)	0.009
Yes	17 (65.4%)	18 (51.4%)	51 (36.7%)	
Family history of DM				
Negative	8 (30.8%)	14 (40.0%)	82 (59.0%)	0.022
Positive	18 (69.2%)	21 (60.0%)	57 (41.0%)	
History of hyperglycemia				
Negative	5 (19.2%)	14 (40.0%)	112 (80.6%)	<0.001
Positive	21 (80.8%)	21 (60.0%)	27 (19.4%)	

4. Discussion

The current study included 200 previously undiagnosed Iraqi adults with suspicion of diabetes. The distribution of FINDRISC scores in this study revealed that 35.5% of participants were classified as diabetics (≥15 points). The mean FINDRISC score of the study population was 13.8 ± 4.6, indicating an overall moderate-to-high risk profile. This reflects the ability of the FINDRISC tool to identify a substantial proportion of individuals at increased risk of diabetes in this population.

According to laboratory findings, 13% of participants were classified as diabetic and 17.5% as prediabetic, with markedly elevated mean fasting blood glucose level of 180.7 ± 63.1 mg/dL and mean HbA1c of 7.5 ± 4.2%, indicating that a proportion of participants were not only undiagnosed but had already progressed to relatively advanced stages of hyperglycemia. These findings suggest delayed detection and possibly inadequate routine screening practices.

A study by Jin et al. that included 713 participants, 9.1% were identified as having prediabetes and 5.2% as having type 2 diabetes mellitus, also showed that 172 individuals were diagnosed with metabolic syndrome. They found that higher FINDRISC scores were significantly associated with increased prevalence of both diabetes and metabolic syndrome. They concluded that metabolic syndrome outperformed FINDRISC alone; however, combining FINDRISC with glucose measurements in a stepwise screening approach provided an effective strategy for identifying type 2 diabetes. (11)

Meijnikman et al. study that included 651 participants, 50.4% were classified as prediabetic and 11.1% as having type 2 diabetes mellitus, also showed that the FINDRISC score increased progressively with worsening glycemic status, rising from 11 ± 3 in non-diabetic individuals to 13 ± 4 in prediabetics and 15 ± 5 in diabetics. They concluded that FINDRISC demonstrated moderate diagnostic accuracy for detecting diabetes, with an AUC of 0.76, sensitivity of 64%, and specificity of 63% at a cutoff value of 13 and that its predictive ability improved significantly when combined with fasting plasma glucose or HbA1c, with the AUC increasing to 0.91 and 0.93, respectively ($p < 0.001$). (12)

The diagnostic accuracy of FINDRISC in this study was good for detecting diabetes, with an AUC of 0.86, indicating high discriminative ability, with an optimal cutoff value of ≥15.

A study by Agarwal et al. that assessed six diabetes risk assessment tools among 200 participants in the Philippines to determine their effectiveness in detecting dysglycemia found that the FINDRISC performed best, showing the highest sensitivity (0.94) and an AUC of 0.80. They concluded that FINDRISC is the most suitable screening tool among those evaluated for identifying dysglycemia particularly when using a higher cutoff value. (13)

These results are consistent with a study by Cahyaningsih et al. in Indonesia that included 25,432 participants and found that the FINDRISC demonstrated good diagnostic accuracy with an AUC of 80.9%, sensitivity of 74.0%, and specificity of 75.5%. The tool showed potential as an initial screening

method, helping to reduce the need for further confirmatory testing, supporting its applicability in routine clinical practice. (14)

While in Jin et al. study, the FINDRISC score showed moderate diagnostic accuracy for detecting diabetes, with an AUC of 0.708, sensitivity of 44.6%, and high specificity of 90.1% at a cutoff value of 11. The predictive accuracy improved when fasting blood glucose or 2-hour plasma glucose was combined with FINDRISC, increasing the AUC to 0.785 and 0.731, respectively. (11)

For prediabetes, the FINDRISC score showed acceptable accuracy with AUC of 0.78, sensitivity of 74.6%, and specificity of 64.5%. Although these values are lower than those observed for diabetes, they remain clinically useful.

Similar findings have been reported by Arnardóttir et al. that concluded that the FINDRISC is a simple, non-invasive, and practical screening tool for identifying individuals with diabetes and prediabetes. When used prior to more costly and invasive diagnostic tests, it facilitates early detection and supports timely intervention, thereby aiding clinical decision-making, promoting preventive strategies, and reducing disease burden within primary healthcare settings. (15)

The current study results show that age was significantly associated with glycemic status ($p = 0.021$), the mean age decreased from 58.7 ± 10.4 years in diabetics to 49.6 ± 11.2 years in non-diabetics. Advancing age is associated with progressive β-cell dysfunction, increased insulin resistance, and cumulative exposure to metabolic risk factors. (16)

There was no statistically significant correlation with gender ($p = 0.063$), suggesting that gender alone does not independently influence glycemic status, and that its effect is likely mediated through behavioural and hormonal factors.

These findings are consistent with previous research demonstrating that age is a strong predictor of diabetes risk, while gender differences are often inconsistent across populations. (17)

Anthropometric measures in the present study confirmed the central role of obesity in diabetes pathogenesis. The mean BMI was significantly higher among diabetics (33.8 ± 4.6 kg/m²) compared to non-diabetics (27.4 ± 4.8 kg/m²), with a statistically significant difference ($p = 0.033$). Central obesity was more common among diabetics (80.8%) and showed a significant association with glycemic status ($p = 0.031$). These findings show the importance of both general and visceral adiposity in the development of insulin resistance, as excess adipose tissue, particularly in the abdominal region, contributes to chronic inflammation, altered adipokine secretion, and impaired glucose metabolism.

Hypertension was present in 65.4% of diabetics and showed a strong association with glycemic status ($p = 0.009$), supporting the concept of metabolic syndrome, where hypertension and diabetes share common pathophysiological mechanisms including endothelial dysfunction and insulin resistance.

Lifestyle and clinical risk factors in this study were also significantly associated with diabetes. Physical inactivity was more common among diabetics (69.2%) compared to non-diabetics (41.7%), with a statistically significant difference ($p = 0.041$). This reflects the role of physical activity in improving insulin sensitivity and glucose uptake. (18)

Low intake of fruits and vegetables was significantly associated with diabetes ($p = 0.028$), suggesting that dietary patterns characterized by poor nutritional quality may contribute to metabolic dysregulation.

Safabakhsh et al. study on 300 individuals, 150 subjects with normal fasting blood glucose (FBG), and 150 pre-diabetic subjects who were matched for sex and age also concluded that higher consumption of total fruits and vegetables, particularly fruits, was associated with a reduced likelihood of prediabetes, suggesting a protective effect of these dietary components against impaired glucose metabolism. (19)

Family history of diabetes was also significantly higher among diabetics (69.2%, $p = 0.022$), showing the contribution of genetic predisposition. The strongest association was observed with history of hyperglycemia (80.8% in diabetics, $p < 0.001$), which likely reflects prior undiagnosed or intermittent elevations in blood glucose, making it a powerful predictor of current diabetes.

These findings are in agreement with Alharithy et al. study that concluded that parental history of type 2 diabetes was significantly associated with earlier disease onset as well as higher body mass index and waist circumference, whereas a sibling history of type 2 diabetes was significantly linked to poorer cerebrovascular outcomes. (20)

Study limitations

1. The study was conducted at the city of Karbalaa which may limit the generalizability of the findings to all the Iraqi population.

2. Some FINDRISC variables like physical activity and dietary intake are self-reported and subjective

Conclusion

1. The FINDRISC score showed good diagnostic

accuracy for detecting diabetes (AUC = 0.86) high sensitivity (82.2%) and fair specificity (71.3%) for diabetes detection and acceptable accuracy for prediabetes (AUC = 0.78).

2. FINDRISC is a simple, non-invasive, and cost-effective screening tool suitable for use in clinical practice in Iraq.

3. Overall, the findings of this study indicate that the FINDRISC score performs well in the Iraqi population, with diagnostic accuracy comparable to or slightly higher than that reported in international studies.

Recommendations

1. Incorporate the FINDRISC score into routine screening in primary care centers and outpatient settings in the hospitals to identify diabetes and prediabetic early.
2. Use FINDRISC as an initial triage tool to prioritize patients for confirmatory laboratory testing (HbA1c, FBS, or OGTT).
3. Conduct further studies across different regions of Iraq to validate the findings and to evaluate the predictive value of FINDRISC.
4. Promote public health campaigns focusing on lifestyle modification, including increased physical activity and improved dietary habits.
5. Develop screening programs utilizing FINDRISC as a low-cost and accessible tool.

References

1. Cannon A, Handelsman Y, Heile M, Shannon M. Burden of illness in type 2 diabetes mellitus. Journal of managed care & specialty pharmacy. 2018 Sep;24(9-a Suppl):S5-13.

2. Ye J, Wu Y, Yang S, Zhu D, Chen F, Chen J, Ji X, Hou K. The global, regional and national burden of type 2 diabetes mellitus in the past, present and future: a systematic analysis of the Global Burden of Disease Study 2019. Frontiers in endocrinology. 2023 Jul 14;14:1192629.

3. Moradinazar M, Babakhani M, Rostami R, Shakiba M, Moradi A, Shakiba E. Epidemiological status of type 2 diabetes mellitus in the Middle East and North Africa, 1990-2019. Eastern Mediterranean Health Journal. 2022 Jul 1;28(7).

4. Mansour AA, Alibrahim NT, Alidrisi HA, Alhamza AH, Almomin AM, Zaboon IA, Kadhim MB, Hussein RN, Nwayyir HA, Mohammed AG, Al-Waeli DK. Prevalence and correlation of glycemic control achievement in patients with type 2 diabetes in Iraq: A retrospective analysis of a tertiary care database over a 9-year period. Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2020 May 1;14(3):265-72.

5. Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, Colagiuri S, Guariguata L, Motala AA, Ogurtsova K, Shaw JE. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas. Diabetes research and clinical practice. 2019 Nov 1;157:107843.

6. Dugani SB, Mielke MM, Vella A. Burden and management of type 2 diabetes in rural United States. Diabetes/metabolism research and reviews. 2021 Jul;37(5):e3410.

7. Selph S, Dana T, Blazina I, Bougatsos C, Patel H, Chou R. Screening for type 2 diabetes mellitus: a systematic review for the US Preventive Services Task Force. Annals of internal medicine. 2015 Jun 2;162(11):765-76.

8. DeFronzo RA, Ferrannini E, Groop L, Henry RR, Herman WH, Holst JJ, Hu FB, Kahn CR, Raz I, Shulman GI, Simonson DC. Type 2 diabetes mellitus. Nature reviews Disease primers. 2015 Jul 23;1(1):1-22.

9. Salinero-Fort MA, Burgos-Lunar C, Lahoz C, Mostaza JM, Abánades-Herranz JC, Laguna-Cuesta F, Estirado-de Cabo E, García-Iglesias F, González-Alegre T, Fernández-Puntero B, Montesano-Sánchez L. Performance of the finnish diabetes risk score and a simplified finnish diabetes risk score in a community-based, cross-sectional programme for screening of undiagnosed type 2 diabetes mellitus and dysglycaemia in madrid, Spain: The SPREDIA-2 study. Plos one. 2016 Jul 21;11(7):e0158489.

10. Janghorbani M, Adineh H, Amini M. Evaluation of the Finnish Diabetes Risk Score (FINDRISC) as a screening tool for the metabolic syndrome. The review of diabetic studies: RDS. 2014 Feb 10;10(4):283.

11. Jin S, Chen Q, Han X, Liu Y, Cai M, Yao Z, Lu H. Comparison of the Finnish Diabetes Risk Score model with the metabolic syndrome in a Shanghai population. Frontiers in Endocrinology. 2022 Feb 22;13:725314.

12. Meijnikman AS, De Block CE, Verrijken A, Mertens I, Van Gaal LF. Predicting type 2 diabetes mellitus: a comparison between the FINDRISC score and the metabolic syndrome. Diabetology & metabolic syndrome. 2018 Mar 1;10(1):12.

13. Agarwal G, Guingona MM, Gaber J, Angeles R, Rao S, Cristobal F. Choosing the most appropriate

existing type 2 diabetes risk assessment tool for use in the Philippines: a case-control study with an urban Filipino population. BMC Public Health. 2019 Aug 27;19(1):1169.

14. Cahyaningsih I, Rokhman MR, Sudikno, Postma MJ, van der Schans J. Accuracy of the Modified Finnish Diabetes Risk Score (Modified FINDRISC) for detecting metabolic syndrome: Findings from the Indonesian national health survey. Plos one. 2025 Feb 12;20(2):e0314824.

15. Arnardóttir E, Sigurðardóttir ÁK, Graue M, Kolltveit BC, Skinner T. Using HbA1c measurements and the Finnish Diabetes Risk Score to identify undiagnosed individuals and those at risk of diabetes in primary care. BMC Public Health. 2023 Jan 31;23(1):211.

16. De Tata V. Age-related impairment of pancreatic Beta-cell function: pathophysiological and cellular mechanisms. Frontiers in endocrinology. 2014 Sep 3;5:138.

17. Kautzky-Willer A, Harreiter J, Pacini G. Sex and gender differences in risk, pathophysiology and complications of type 2 diabetes mellitus. Endocrine reviews. 2016 Jun 1;37(3):278-316.

18. Muraszewski Ł, Muraszewska E, Kwitowska P, Pyjecka M, Ubysz E, Król A, Lewandowska E, Łuczyński C, Paczkowski M, Wręczycki M. The Role of Physical Activity in Improving Insulin Sensitivity: A Narrative Review. Quality in Sport. 2026 Mar 17;52:69768-.

19. Safabakhsh M, Koohdani F, Bagheri F, Siassi F, Khajehnasiri F, Sotoudeh G. Fruit and vegetable intake and pre-diabetes: a case–control study. European journal of nutrition. 2018 Dec;57(8):2953-62.

20. Alharithy MK, Alobaylan MM, Alsugair ZO, Alswat KA. Impact of family history of diabetes on diabetes control and complications. Endocrine Practice. 2018 Sep 1;24(9):773-9.