Screening For Type 2 Diabetes Mellitus In Adult Population In Beni-Suef Governorate

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Abstract:
The objective of the current study is to investigate the prevalence of undiagnosed dysglycemia and the risk for type 2 diabetes using the FINDRISC questionnaire in adult population in Beni-Suef Governorate. 500 subjects who are aged above 20 years and who are not known diabetics, who are not known on steroids and hormonal therapy and have not renal impairment. More than half of the studied population (52.8%) had low to moderate risk to developing type 2 DM, with no statistically significant difference between males and females regarding the total FINDRISC score. Total FINDRISC score was moderately positive correlated with patient’s age in years with a person correlation coefficient 0.648 and p-value <0.001. Total FINDRISC score was moderately positive correlated with patient’s BMI with a person correlation coefficient 0.648 and p-value <0.001. Total FINDRISC score was strongly positive correlated with blood glucose tests (FBS, 2hPP and Hb A1C) with a person correlation coefficient >0.7 and p-value <0.001.

Keywords: DM; FINDRISC; FBS;2HPPG;HBA1C.

1. Introduction:
Type 2 diabetes is a common chronic disease in the general population [1]. Approximately 7-30% of diabetes cases remain undiagnosed [2]. In addition, there is a significant number of individuals with impaired fasting glucose (IFG) or impaired glucose tolerance (IGT), who are at risk of developing diabetes if no actions are undertaken [3].

An important risk factor for diabetes, besides a person's genetic background, is overweight due to unhealthy life style. The use of validated risk calculators to quickly
identify and subsequently follow – up people at high risk of type 2 diabetes is recommended by several international organizations [4].

The Finnish Diabetes Risk Score (FINDRISC) questionnaire is a validated risk assessment tool to predict type 2 diabetes [5]. It estimates the probability of a person to develop diabetes within the next 10 years. The aim of the current study is to investigate the prevalence of undiagnosed dysglycemia and the risk for type 2 diabetes using the FINDRISC questionnaire in adult population in Beni-Suef Governorate.

2. Patients and Methods:

2.1 Inclusion criteria:
Subjects aged above 20 years.

2.2 Exclusion criteria:
1. Subjects who are known diabetics.
2. Subjects who are known on steroids and hormonal therapy.
3. Subjects who are known have renal impairment.
4. Subjects who are known have liver disease.
5. Females who are known pregnant.

Statistical methodology
All subjects will be subjected to:
1- Through history and clinical examination.
2- Diabetes risk assessment using Finnish Diabetes Risk Score (FINDRISC) [5].

by the following items:

| Risk factor | score |
|-------------|-------|
| 1- Age       |       |
| Under 45 years | 0   |
| 45-54 years   | 2     |
| 55-64 years   | 3     |
| Over 64 years | 4     |

2- Body mass index

| Score | Waist circumference measured below the ribs |
|-------|---------------------------------------------|
|       | MEN                           WOMEN         |
| Lower than 25 kg/m² | Less than 94 cm     Less than 80 cm | 0 |
| 25-30 kg/m²          | 94-102 cm            80-88 cm         | 3   |
| Higher than 30 kg/m² | More than 102 cm     More than 88 cm    | 4   |

4- Do you usually daily at least 30 minutes of physical activity at work and or during leisure time including normal daily activity?
Yes | 0 |
No  | 2 |

5- How often do you eat vegetables or fruits or berries?
Every day | 0 |
Not every day | 1 |

6- Have you even taken antihypertensive medication regularly?
NO | 0 |
Yes | 2 |

7- Have you ever been found to have high blood glucose (e.g. in a health examination, during an illness, during pregnancy)?
8-Have any of the members of immediate family or other relatives been diagnosed with diabetes type1 or 2?

| NO | 0 | NO | 0 |
| Yes | 5 | Yes; grandparent,aunt,uncle;firstcousin | 3 |

| Table (1); Ten-year risk of developing T2DM according to FINDRISC |
|---|---|---|
| Score | Risk | Interpretation |
| <7 | Low | Estimated 1 in 100 will develop disease |
| 7-11 | slightly elevated | Estimated 1 in 25 will develop disease |
| 12-14 | Moderate | Estimated 1 in 6 will develop disease |
| 15-20 | High | Estimated 1 in 3 will develop disease |
| >20 | Very high | Estimated 1 in 2 will develop disease |

3-Calculation of the total risk score of the FINDRISK questionnaire for each individual of the study.

4-Laboratory investigations include FBS, 2HPPG, HBA1C, Serum creatinine and blood urea.

3. Results:

The current study was conducted at Beni-Suef university outpatient clinic. A total of 500 subjects over 20 years old were randomly subjected into FINDRISC, FBS, 2HPPG, BA1C, urea, creatinine.

| Table (2); Age and Sex Distribution of the studied Population; (n= 500): |
|---|---|
| Age; (years) | Descriptive Statistics |
| Mean ±SD | 48.48 ±13.2 |
| Minimum | 20 |
| Maximum | 80 |
| Range | 60 |
| Sex; N (%) | |
| Male | 248 (49.6%) |
As demonstrated in table (2); a total of 500 subjects recruited from Beni-Suef University hospital outpatient clinic were included in our study. They were distributed as 49.6% males and 50.4% females. Subjects’ age was ranged from 20 to 80 years old with an average of 48.48 years.

Table (3); Distribution of the studied population by sex according to risk factors as assessed by FINDRISC questionnaire; (N= 500):
Medication for high blood pressure on a regular basis

|                  | No        | Male        | Female       |
|------------------|-----------|-------------|--------------|
|                  | 140 (55.6)| 110 (44.4)  | 250 (50.0)   |
| Yes              | 112 (44.4)| 138 (55.6)  | 250 (50.0)   |

High Blood Glucose

|                  | No        | Male        | Female       |
|------------------|-----------|-------------|--------------|
|                  | 160 (63.5)| 224 (91.1)  | 384 (77.1)   |
| Yes              | 92 (36.5) | 22 (8.9)    | 114 (22.9)   |

Family History (family or other relatives diagnosed with diabetes)

|                  | No        | Male        | Female       |
|------------------|-----------|-------------|--------------|
|                  | 64 (25.4) | 58 (23.4)   | 122 (24.4)   |
| Yes: 2nd degree  | 50 (19.8) | 36 (14.5)   | 86 (17.2)    |
| Yes: 1st degree  | 138 (54.8)| 154 (62.1)  | 292 (58.4)   |

*p-value ≤ 0.05 is considered significant by Chi-Square ($\chi^2$) test.

As demonstrated in table (3); the studied females were significantly in a younger age category as compared with males. Near half of females were 18-44 years old with a statistically significant p-value (0.001).

Regarding taken medication for high blood pressure on a regular basis; males had reported significantly higher usage of medication for high blood pressure on a regular basis (55.6% vs. 44.4%) in males and females significantly with a statistically significant p-value (0.016).

Female patients who had ever been found to have high blood glucose (e.g. in a health examination, during an illness, during pregnancy) were significantly higher than males (36.5% vs. 8.9%) in females and males respectively with a significant p-value (0.001).

Other studied risk factors (BMI, Waist circumference, physical activity, Eating Vegetables & Fruits and Family History) showed no statistically significant differences between males and females; (p-values>0.05).

| FINDRISC score | Risk         | Patient’s Sex |
|----------------|--------------|---------------|
|                | Female N= 252| Male N= 248   |
| 0-7 Points     | Low Risk     |               |
| 7-11 Points    | Slightly Elevated |     |
| 12-14 Points   | Moderate Risk|               |

Table (4); Total FINDRISC score among the Studied Population; (N= 500):
Table (4) illustrated that more than half of the studied population (52.8%) had Low to Moderate Risk to developing type 2 DM, with no statistically significant difference between males and females regarding the total FINDRISC score.

*\( p\)-value \( \leq 0.05 \) is considered significant by Chi-Square \((\chi^2)\) test.

![Figure (6): Distribution of the Studied Population by Total FINDRISC score Risk Factors.](image)

### Table (5): Blood Glucose Tests for the Studied Population (N=500):

|                      | Mean ±SD  | Minimum | Maximum | Range | Normal BGL | IFF, IGT, HA1C (Prediabetes) |
|----------------------|-----------|---------|---------|-------|------------|-----------------------------|
| FBS                  | 101.64 ±18.5 | 70      | 185     | 115   |            |                             |
| 2h PP                | 149.62 ±28.2 | 105     | 198     | 93    |            |                             |
| HbA1C                | 5.32 ±0.8  | 3.50    | 6.40    | 2.90  |            |                             |
| Serum Creatinine     | 0.78 ±0.17 | 0.43    | 1.20    | 0.77  |            |                             |
| Blood Urea           | 29.45 ±6.1 | 18      | 40      | 22    |            |                             |
| Total                | 280       |         |         |       | 220        | Males=106, Females=114      |
Table (5) demonstrates the blood glucose tests of the studied population; fasting blood sugar level (FBS) was ranged from 70 to 185 with an average of 101.64. Two hours post prandial blood sugar level ranged from 105 to 198 with an average of 149.62. While Glycated hemoglobin A1C ranged from 3.50 to 6.40 with an average of 5.32.

Table (5) also demonstrates that number of studied population with normal BGL were 280(56%). Number of studied population with prediabetes (IFG, IGT and HbA1C 5.7-6.4%) were 210(44%) with 114 females and 106 males without significant difference between males and females.

Serum Creatinine level for the studied cases were ranged from 0.43 to 1.20 with an average of 0.78.

Blood Urea level for the studied cases were ranged from 18 to 40 with an average of 29.45.

Table (6); Correlation between Total FINDRISC score with Age of the Studied Population;

| Total FINDRISC score | Age of the studied cases |
|----------------------|--------------------------|
|                      | $r = 0.648$              | $p$-value = $0.001^*$ |

*p-value ≤ 0.05 is considered significant.

$r$ Pearson correlation coefficient

As demonstrated in table (6); Total FINDRISC score was moderately positive correlated with patient’s age in years with a Pearson correlation coefficient 0.648 and p-value <0.001.

Table (7); Correlation between Total FINDRISC score with Body Mass Index (BMI) of the Studied Population;

| Total FINDRISC score | BMI of the studied cases |
|----------------------|--------------------------|
|                      | $r = 0.654$              | $p$-value = $0.001^*$ |

*p-value ≤ 0.05 is considered significant.

$R$ Pearson correlation coefficient.
As demonstrated in table (7); Total FINDRISC score was moderately positive correlated with patient’s BMI with a Pearson correlation coefficient 0.648 and p-value <0.001.

Table (8); Correlation between Total FINDRISC score with Blood Glucose Tests of the Studied Population:

| Studied Parameters | Total FINDRISC score |
|--------------------|----------------------|
|                    | r\(^a\)              | p-value       |
| FBS                | 0.742                | 0.001*        |
| 2h PP              | 0.788                | 0.001*        |
| HbA1C              | 0.709                | 0.001*        |

FBS= Fasting Blood Sugar, 2h PP= 2 Hours Post Prandial, HbA1C= Glycated hemoglobin.

*\(p\)-value ≤ 0.05 is considered significant.

\(r\) = Pearson correlation coefficient

As illustrated in table (8); Total FINDRISC score was strongly positive correlated with blood glucose tests (FBS, 2hPP and Hb A1C) with a Pearson correlation coefficient >0.7 and p-value <0.001.

Table (9); Correlation between Total FINDRISC score with Serum Creatinine of the Studied Population:

| Total FINDRISC score | Serum Creatinine of the studied cases |
|----------------------|--------------------------------------|
|                      | r = - 0.135                          | p-value= 0.203 |

*\(p\)-value ≤ 0.05 is considered significant.

\(r\) Pearson correlation coefficient

As demonstrated in table (9); No detected correlation between Total FINDRISC score and Serum Creatinine of the studied cases where p-value was >0.05.

Table (10); Correlation between Total FINDRISC score with Blood Urea of the Studied Population:

| Total FINDRISC score | Blood Urea of the studied cases |
|----------------------|----------------------------------|
|                      | r = 0.211                        | p-value= 0.001* |

As demonstrated in table (10); Correlation between Total FINDRISC score with Blood Urea of the Studied Population:
As demonstrated in table (10); Total FINDRISC score was slightly positive correlated with blood urea level with a Pearson correlation coefficient 0.211 and p-value <0.001.

4. Discussion:
Chronic non-communicable diseases have become worldwide epidemic that threatens life expectancy and quality of life and increases cases of death and disability [6]. Type 2 Diabetes mellitus (T2DM) is becoming one of the most prevalent diseases in the 21st century and is a global public health challenge [7].

The World Health Organization (WHO) estimated in 2014 that 422 million people had diabetes, of which 90% had T2DM [8]. It should be remembered that prediabetes increases the absolute risk for T2DM in the short term by 3 to 10 times [9].

FINDRISC is one of the most commonly used tools to determine type 2 DM risk. It includes anthropometric (BMI and WC), metabolic, and lifestyle factors that predict type 2 DM and alterations in glucose metabolism. FINDRISC may be helpful in identifying diabetes in the early stages because the type 2 diabetes diagnosis processes has taken a long time [10]. Because insulin resistance always precedes IGT, the FINDRISC may be a useful instrument to identify people at the earliest stage of disease development[11]. FINDRISC questionnaire represents a simple and cost-efficient tool with a good predictive value to detect undiagnosed diabetes, which can be used in large-scale studies and even on a care level [5].

In this study we tried to evaluate the FINDRISC for estimating the probability of a person to develop type 2 DM within the next 10 years. Use of such a scoring system is of great significance and could prove to be cost effective, reliable, valuable and easy to use screening tool for detecting risk of diabetes. In this study we use FINDRISC questionnaire in survey of 500 subjects from Beni-Suef University hospital outpatient clinic who are known not diabetic, not on steroids or hormonal therapy and not have renal impaired. They were distributed as 49.6% males and 50.4% females. Subjects’ age was ranged from 20 to 80 years old with an average of 48.48 years. Female patients who had ever been found to have high blood glucose (e.g. in a health examination, during an illness, during pregnancy) were significantly higher than males (36.5% vs.
8.9%) in females and males respectively with a significant p-value (0.001). Other studied risk factors (BMI, Waist circumference, physical activity, Eating Vegetables & Fruits and Family History) showed no statistically significant differences between males and females; (p-values>0.05). We found that total FINDRISC score Mean ±SD= 13.88 ±5.8. Also we found that more than half (52.8%) of the studied population had low to moderate risk, 27.2% had high risk, 20% had very high risk to develop type 2 DM in the next 10 years with no statistically significant difference between males and females regarding the total FINDRISC score. Total FINDRISC score was moderately positive correlated with patient’s age in years and with patient’s BMI and was strongly positive correlated with blood glucose tests (FBS, 2hPP and Hb A1C). Total FINDRISC score was slightly positive correlated with blood urea level. No detected correlation between Total FINDRISC score and Serum Creatinine of the studied cases. At present, the FINDRISC, which is the most accurate and widely questionnaire used in Europe, can easily identify people with either unrecognized diabetes or impaired glucose regulation, before any blood test needs to be carried out [12]. According to a cross-sectional analytical study carried out from April 2016 to May 2017 in the nursing staff of an institution specialized in reproductive health in Mexico City the estimated risk of the FINDRISC was 59% participants with moderate to very high risk were identified. 59% of participants who were in the high risk category had prediabetes, based on fasting glucose and HbA1c [13]. The efficiency of risk scores may vary between populations with different ethnic backgrounds. Therefore, risk scores should be validated in each population before use [14].

Although the FINDRISC tool was developed and validated in European populations. It is also valid for Middle-Eastern populations, despite different lifestyles [15].

One limitation of our study is that we cannot evaluate the FINDRISC in predicting the future incident diabetes because this study is a cross-sectional study which did not provide follow-up data. Another limitation was non adjustment for hypertension but such adjustment is difficult as prediabetes would predispose for hypertension.

5. Conclusion and Recommendation:
In conclusion our data provide further evidence that FINDRISC can be a suitable, reliable, valuable and easy tool to predict type 2 DM in the next 10 years.

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