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Performance of the Finnish Diabetes Risk Score (FINDRISC) in the Identification of Dysglycemia in an Urban Population in Ouagadougou (Burkina Faso)

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Abstract

Background: Diabetes mellitus is a real public health problem worldwide and is growing in developing countries. Our aim was to determine the prevalence of undiagnosed type 2 diabetes mellitus (T2DM) and to evaluate the performance of the Finnish Diabetes Risk Score (FINDRISC) questionnaire to identify type 2 diabetics in the urban population of Ouagadougou, Burkina Faso. **Methodology:** This was a cross-sectional study among volunteers aged 18 years and older recruited systematically from November 11 to 16, 2019, in the city of Ouagadougou, Burkina Faso, FINDRISC score was used. Analysis of the Receiver Operating Characteristic (ROC) curve was used to study the diagnostic performance of FINDRISC for the identification of type 2 diabetics. The optimal threshold was determined by the sum of the highest sensitivity and specificity. Multivariate logistic regression was used to analyze the association of each variable used in the calculation of the FINDRISC score. **Results:** A total of 1276 individuals were included in the analyses, of which 667 (52.27%) were women. The average age was 34.16 years (SD: ±12.42). The prevalence of T2DM was 10.74%. The mean FINDRISC score was 5.85 (SD: ±4.31). The majority (58.54%) of individuals had a low risk of diabetes according to the FINDRISC score 0 - 7, while 3.61% had a score ≥ 15. The FINDRISC score showed good performance (AUC = 0.70) in identifying undiagnosed type 2 diabetics. However, the variables in the score that best pre-

dicted the likelihood of being diabetic were age (p < 0.001), daily physical activity (p = 0.004), use of antihypertensive medication (p = 0.007) and waist circumference (p < 0.001). The optimal cut-off score ≥ 7 was the best predictor of the likelihood of having T2DM. **Conclusion**: The Finnish Risk Score (FINDRISC) is a good predictor of the risk of dysglycemia in Burkina Faso. It is a score to be promoted in daily clinical practice because it is easy to use, affordable and non-invasive. Further studies are needed to make modifications to the FINDRISC questionnaire in case it is applied to other ethnic groups.

Keywords

1. Background

In developing countries, a large number of chronic diseases such as diabetes remain undiagnosed [1] [2] [3]. Health systems limited in personnel, medical equipment and infrastructure are particularly focused on emergency and infectious disease management [4] [5] [6]. Yet the World Health Organization (WHO) estimates that by 2030, the most significant increase in the prevalence of chronic diseases such as diabetes will occur in developing countries [6] [7].

According to data from the International Diabetes Federation (IDF), the prevalence of diabetes mellitus for the African region was 19 million in 2019 [1]. Estimates for the same region reported a proportion of 60% of glyco-ignorant diabetics [1].

Burkina Faso, like other developing countries, is faced with the problem of the emergence of non-communicable diseases with its consequences in terms of morbidity and mortality, constituting a public health challenge. According to the STEPS survey on risk factors for non-communicable diseases, conducted in 2013 in the country: the prevalence of diabetes mellitus was 4.9% nationally [8]. However, screening for type 2 diabetes mellitus (T2DM) is not systematic in clinical practice. Blood glucose measurement had never been performed in 94.2% of the participants in the STEPS 2013 survey. Many patients are diagnosed with the cardinal signs of diabetes or with a complication [8].

In this context, it is important to implement a screening tool that is simple to use and non-invasive, at the practitioner's initiative, and that is used to recognize and early diagnose those at high risk of developing T2DM, and to make them a target for prevention and management strategies [9] [10]. The Finnish Diabetes Risk Score questionnaire (FINDRISC) is a validated, recommended and widely used risk assessment tool for the development of type 2 diabetes [11]. It estimates an individual's probability of developing type 2 diabetes within 10 years. The FINDRISC for T2DM provides a low-cost, accessible, non-invasive alternative for identifying risk groups. The use of this score should enable the implementation of primary prevention measures for diabetes [12] [13] [14].

However, the FINDRISC questionnaire was developed from a Finnish population and has been widely used in European studies [15]-[22]. Its performance in an African [23] [24] [25] [26] [27] population such as Burkina Faso, with different habits and lifestyles, has not been evaluated.

The objective of this study was to determine the prevalence of undiagnosed T2DM and to evaluate the diagnostic performance of the FINDRISC questionnaire for identifying type 2 diabetics in the urban population of Ouagadougou, Burkina Faso.

2. Methodology

Framework of the study

The study took place in the city of Ouagadougou, the political capital of Burkina Faso. Ouagadougou is a large urban center in epidemiological transition marked by a high burden of morbidity due to endemic epidemics and by the progressive increase in the burden of non-communicable diseases [8].

Type and population of study

We conducted a cross-sectional study. The target population of the study was the adult population of the city of Ouagadougou. This screening campaign was conducted in conjunction with World Diabetes Day 2019, which was dedicated to the theme "Family and Diabetes". In this context, a series of activities was initiated from November 11 to 16, 2019, including a diabetes screening campaign at five (5) sites spread throughout the city of Ouagadougou. These screening days were preceded by ten (10) days of information campaign through the media: television, radio and web. The information was given in French, then translated into the two (2) most widely spoken national languages including Mooré and Dioula.

All screening participants who were at least 18 years old and gave their oral consent were included in the study. We did not include known diabetic individuals and pregnant women in the analysis. Respondents whose blood glucose results were missing and those who had missing information for variables needed to calculate the FINDRISC score were excluded from the study.

Data collection

The collection tool was an anonymous questionnaire that included the variables of interest from the FINDRISC score and variables on participants' habits and lifestyles. The SD CodeFree™ Glucose Analyzer (SD BIOSENSOR, Inc.) was used to measure capillary blood glucose. The investigative team consisted of nurses and physicians trained in the technique of anthropometric measurements, capillary blood glucose measurement, blood pressure measurement and questionnaire administration. The questionnaire was translated orally into Mooré or Dioula for those who did not understand French.

To establish the diagnosis of diabetes mellitus, capillary whole blood was taken by finger prick and immediately analyzed using an SD CodeFree™ glucose analyzer. A control solution test was performed each time a new vial of strips

was opened. All other procedures described by the manufacturer were followed. Blood pressure was measured, using a mercury sphyngomanometer, in a seated position, using the right arm after a five (5) minutes rest period. Only one measurement was taken during the interview. Height was measured in the standing position to the nearest centimetre (cm) with a tape measure. Weight was measured with subjects in light clothing and without shoes, using a digital floor scale to the nearest 0.1 kg. The body mass index (BMI) was calculated by dividing the weight (kg) by the square of the height (m^2). In the standing position, waist circumference was measured using a tape measure placed midway between the lower part of the ribs (at the bottom of the last rib) and the iliac crest (the upper part of the pelvic bone). The value was measured to the nearest centimetre (cm) at the end of a normal exhalation at navel height.

Variables of interest in FINDRISC

The variables of interest in FINDRISC were gender, which was categorized as either female or male. Age was a continuous variable that was reported as an age group. Family history of diabetes was categorized into three classes: no family history, immediate family history and other relatives. Weight was a numeric variable with a value expressed in kilograms (kg). Normal weight, overweight and obesity were defined for BMIs between 18 kg/m^2 and 24.9 kg/m^2, between 25 kg/m^2 and 29.9 kg/m^2, and greater than or equal to 30 kg/m^2, respectively. Height was a numerical variable with a value expressed in centimetres (cm). Body mass index (BMI) was a continuous variable expressed in kg/m^2. Waist circumference, which was a continuous variable expressed in centimetres (cm). According to the thresholds, abdominal obesity was defined by a waist circumference greater than 80 cm for women and greater than 94 cm for men [28]. Daily physical activity of at least 30 minutes duration was dichotomized (yes or no). Daily fruit and vegetable consumption was dichotomized as either daily or not daily. For vegetables, respondents were asked how often they ate the equivalent of one bowl of fresh, raw, leafy green vegetables (spinach, lettuce, etc.) and half a bowl of other vegetables each day, cooked or raw, cut into small pieces (tomatoes, squash, green beans, etc.), or half a bowl of vegetable juice. For fruit, respondents were asked how often they consumed the daily consumption of the equivalent of one medium-sized fruit (orange, banana, apple, etc.) or half a bowl of fruit pieces, cooked (without artificial flavors). The history of hyperglycemia has been dichotomized (yes or no). Use of antihypertensive treatment was dichotomized (yes or no).

Diabetes-related variables

Diabetes was the dependent variable in our study. Capillary blood glucose was a continuous variable reported in mmol/l. Diabetes was defined by fasting capillary blood glucose (after at least 8 hours of fasting) ≥ 6.1 mmol/L or postprandial blood glucose ≥ 11.1 mmol/L [6].

The variables of interest in the Findrisc score were weighted with points ranging from 0 to 5. The addition of the points of these eight (08) variables leads

to a score ranging from 0 to 26 points [11]. A score below 7 points indicates an estimated low risk of 1% (1/100) of developing diabetes mellitus. A score of 7 - 11 points reflects a slightly elevated risk estimated at 4% (1/25) that will develop diabetes mellitus. A score of 12 - 14 points reflects an estimated moderate risk of 17% (1/6) that will develop diabetes mellitus. A score of 15 - 20 points reflects an estimated high risk of 33% (1/3) that will develop diabetes mellitus. A score of more than 20 points indicates a very high risk estimated at 50% (1/2) that will develop diabetes mellitus. A risk of 4% means that 4 out of 100 people with this score may develop type 2 diabetes within the next 10 years.

Analysis

The study population was described by numbers and frequencies for the qualitative variables. Quantitative variables were described by their mean and standard deviation. We estimated the prevalence of T2DM and its 95% confidence interval.

Receiver operating characteristic (ROC) curve analysis was used to study the diagnostic performance of FINDRISC for the identification of type 2 diabetics. The area under the ROC curve (AUC) was determined for the FINDRISC score. We also calculated the sensitivity (Se), specificity (Sp). The optimal threshold was determined by the sum of the highest sensitivity and specificity.

Multivariate logistic regression was used to analyze the association of each variable used in the calculation of the FINDRISC score. The final model was obtained using a manual stepwise top-down procedure. Thus, the variables with the highest p-values > 0.05 were removed one by one as the procedure progressed.

Ethical consideration

The oral consent of screening participants was a prerequisite for the administration of the questionnaire. The questionnaire was anonymous.

3. Results

A total of 1276 individuals were included in the analyses, of which 667 (52.27%) were women. The average age was 34.16 years (standard deviation [SD]: ±12.42), with extremes ranging from 18 to 80 years. Approximately 1006 (78.84%) of the participants were under 45 years of age. A total of 40.28% of participants presented with abdominal obesity, 26.49% with overweight and 14.81% with obesity (Table 1).

The prevalence of diabetes was 10.74%. The mean FINDRISC score was 5.85 points (SD: ±4.31 points) with extremes ranging from 0 to 23. The majority (58.54%) of individuals had a low risk of diabetes according to the Findrisc score 0 - 7, while 3.61% had a score ≥15 (Table 1).

A significant association was found between the FINDRISC score and the probability of being diagnosed with diabetes with OR = 1.17 (p < 0.001, 95% CI = 1.13; 1.22). The AUC of predictive ability of the FINDRISC score in our study population was 0.70 (95% CI: 0.65 - 0.74) (Figure 1).

Table 1. Description of inclusion participants (N = 1276).

	Total (n)	Percentage (%)
Gender		
Female	667	52.27
Male	609	47.13
Age		
<35 years	747	58.54
[35 - 45 years[	259	20.30
[45 - 55 years[	164	12.85
[55 - 64 years]	77	6.03
>64 years	29	2.27
Family History of Diabetes		
No	1027	80.49
Immediate family[a]	132	10.34
Other relatives[b]	117	9.17
Daily physical activity ≥ 30 minutes		
Yes	631	49.45
No	645	50.55
Daily consumption vegetables, fruits, berries		
No	1077	84.40
Yes	199	15.60
History of antihypertensive medication		
Yes	94	7.37
No	1182	92.63
History of impaired blood glucose		
Yes	60	4.70
No	1216	95.30
Waist circumference[c]		
F < 80 cm; M < 94 cm	762	59.72
F: ≥80 and <88 cm M: ≥94 et <102 cm	230	18.03
F: ≥88 cm; M: ≥102 cm	284	22.26
Body mass index [kg/m²]		
<25[d]	749	58.70
[25 - 30][e]	338	26.49
>30[f]	189	14.81
Diabetes type 2		
No	1139	89.26
Yes	135	10.74

Continued

Findrisc Score (points)		
Score 0 - 7	747	58.54
Score 7 - 11	386	30.25
Score 12 - 14	97	7.60
Score 15 - 20	43	3.37
Score more than 20	3	0.24

Abbreviations: M: male; F: female; cm: centimeter; kg: kilogram; m: meter; a: Immediate family: close relatives, *i.e.*, father, mother, children, sisters, brothers; b: Other relatives: distant relatives, *i.e.*, grandparents, aunts, uncles, cousins; c: Thresholds of waist circumference were defined by **the reference 28**. d: Normal: BMI < 25 kg/m^2; e: Overweight: BMI [25 - 30 kg/m^2[; f: Obesity: BMI ≥ 30 kg/m^2.
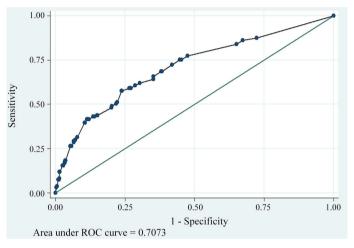

Figure 1. ROC curve of diabetes and FINDRISC.

Table 2 presents the sensitivity and specificity associated with each threshold of the FINDRISC score. The optimal cut-off score value ≥ 7 was the best predictor of the likelihood of having T2DM.

In multivariate analysis, age ($p < 0.001$), daily physical activity ($p = 0.004$), use of antihypertensive medication ($p = 0.007$) and waist circumference ($p < 0.001$) were significantly associated with the risk of developing diabetes (**Table 3**).

4. Discussion

In this study including adult volunteers from the city of Ouagadougou, the prevalence of undiagnosed type 2 diabetes was high (10.74%). The FINDRISC score showed good performance (AUC = 0.70) in identifying undiagnosed type 2 diabetics. However, the variables in the score that best predicted the likelihood of being diabetic were age, daily physical activity, use of antihypertensive medication and waist circumference.

Prevalence of diabetes mellitus

The prevalence of diabetes was 10.74% in our study. The prevalence of diabetes in our study was higher than that of the national baseline survey on noncommunicable diseases in Burkina Faso for the central region (4.9%) [8]. Millo-

go also reported a low prevalence of 5.8% in a Burkinabe national cohort [29]. Our diabetes prevalence remained high compared to that reported by the International Diabetes Federation (IDF) of Burkina Faso (7% - 8%) [1].

It is currently accepted that interventions on diet and/or exercise can significantly reduce the incidence of T2DM, even for people with glucose intolerance [30] [31] [32]. However, abdominal obesity, overweight and obesity were found in proportions of 40.28%, 26.49% and 14.81% respectively in our study. These proportions, excluding abdominal obesity, were similar to those found in the STEPS wise for the central region, with proportions of 48.7%, 30.6% and 16.1% respectively for abdominal obesity, overweight and obesity [8].

FINDRISC scores

The study identified a score < 7 (no or little risk in the next 10 years) in the majority (58.54%) of participants, between 7 and 11 (cautious, slightly increased risk) of 30.25%, between 12 and 14 (start implementing prevention measures) of 7.60%, between 15 and 20 (really at risk, danger) of 3.37%, and > 20 (the need for action is imminent) in 0.24%.

Table 2. Threshold value predictive of diabetes risk in the coming years.

Threshold	Sensitivity (Se)	Specificity (Sp)	Se + Sp	Classification
≥0	100.00%	0.00%	100.00%	10.74%
≥1	100.00%	5.44%	105.44%	15.60%
≥2	91.24%	22.74%	113.98%	30.09%
≥3	90.51%	28.01%	118.52%	34.72%
≥4	86.13%	41.88%	128.01%	46.63%
≥5	76.64%	48.90%	125.54%	51.88%
≥6	74.45%	52.85%	127.30%	55.17%
≥7	**70.80%**	**62.07%**	**132.87%**	**63.01%**
≥8	61.31%	69.36%	130.67%	68.50%
≥9	48.91%	76.03%	124.94%	73.12%
≥10	42.34%	81.30%	123.64%	77.12%
≥11	37.23%	86.48%	123.71%	81.19%
≥12	28.47%	90.87%	119.34%	84.17%
≥13	24.09%	93.59%	117.68%	86.13%
≥14	16.79%	96.05%	112.84%	87.54%
≥15	12.41%	97.45%	109.86%	88.32%
≥16	6.57%	98.51%	105.08%	88.64%
≥17	6.57%	99.21%	105.78%	89.26%
≥18	2.19%	99.65%	101.84%	89.18%
≥19	1.46%	99.82%	101.28%	89.26%
≥21	1.46%	99.91%	101.37%	89.34%
≥23	0.73%	100.00%	100.73%	89.34%
>23	0.00%	100.00%	1000.0%	89.26%

Table 3. Univariate and multivariate analyses.

	n diabetic/ N total	Univariate			Multivariate		
		OR	95% IC	p	OR	95% IC	p
Gender							
Female	86/667	1					
Male	51/609	0.61	0.42; 0.88	0.010			
Age							<0.001
<35 years	43/747	1		<0.001	1		
[35 - 45 years[	41/259	3.07	1.95; 4.84	<0.001	2.42	1.51; 3.89	<0.001
[45 - 55 years[	30/164	3.65	2.21; 6.05	<0.001	2.33	1.36; 4.01	0.002
[55 - 64 years]	17/77	4.63	2.49; 8.62	<0.001	2.81	1.46; 5.41	0.002
>64 years	6/29	4.27	1.5; 11.04	<0.001	2.59	0.95; 7.05	0.06
Family history of diabetes				0.20			
No	102/1027	1					
Immediate family[a]	22/132	1.81	1.09; 2.99	0.02			
Other relatives[b]	13/117	1.13	0.61; 2.08	0.68			
Daily physical activity ≥ 30 minutes							
Yes	46/645	0.45	0.31; 0.66	<0.001	0.56	0.38; 0.82	0.004
No	91/631	1			1		
Daily consumption vegetables, fruits, berries							
Yes	122/1077	1					
No	15/199	0.63	0.36; 1.11	0.11			
History of antihypertensive medication							
Yes	25/94	3.46	2.10; 5.69	<0.001	2.09	1.22; 3.60	0.007
No	112/1182		1		1		
History of impaired blood glucose							
Yes	14/60	2.70	1.45; 5.06	0.002			
No	123/1216						
Waist circumference[c]				<0.001			<0.001
F < 80 cm M < 94 cm	48/762	1			1		
F: ≥80 and <88 cm M: ≥94 and <102 cm	31/230	2.31	1.43; 3.73	0.001	1.59	0.97; 2.63	0.06
F: ≥88 cm M: ≥102 cm	58/284	3.81	2.53; 5.75	<0.001	2,39	1.53; 3.71	<0.001
Body mass index [kg/m²]				<0.001			
<25[d]	50/749	1					
[25 - 30][e]	54/338	2.65	1.76; 3.99	<0.001			
>30[f]	33/189	2.95	1.83; 4.74	<0.001			

Abbreviations: OR: odds ratio; CI: confidence interval; p: value; M: male; F: female; cm: centimeter; kg: kilogram; m: meter; a: Immediate family: close relatives, *i.e.*, father, mother, children, sisters, brothers; b: Other relatives: distant relatives, *i.e.*, grandparents, aunts, uncles, cousins; c: Thresholds of waist circumference were defined by **the reference 28**; d: Normal: BMI < 25 kg/m²; e: Overweight: BMI [25 - 30 kg/m²[; f: Obesity: BMI ≥ 30 kg/m².

In Burkina Faso, Bagbila in a student study [33], found that 95.7% of participants had a score of less than 7. We included individuals between 18 and 80 years of age in the study, so our proportion could be explained by the advanced age of the participants in our study. Older volunteers may have multiple risk factors for diabetes compared to younger students. Indeed, the American Diabetes Association 2015 recommended screening for diabetes for all subjects aged 45 years and older and also for subjects with multiple risk factors for diabetes [34].

In Africa, compared to our score of less than 7 (58.54%), Omech in Botswana [24], Olamoyegun in Nigeria [25] and Azzouz in Algeria [27] had lower scores of 15.1%, 14% and 7.9% respectively. While Metonnou-Adanhoume in Benin [26] reported a high score of 68.28%. These differences in the proportion of scores are methodological: small sample size for the Botswana study [24]; semi-urban setting for the Nigerian study versus urban [25]; retrospective collection with data from 2006 for the Benin study versus prospective [26]. As for the Algerian study, the difference would be due to the eating habits and lifestyles of its populations [27].

In Europe, Mavrogianni in a large cohort study (six European countries) [35], with participants in the same age group as our study, found a proportion of 16.4%. Our score frequency of less than 7 was not surprising as only 4.7% of our study population reported a history of hyperglycemia. This low rate could be explained by the lack of data regarding the history of hyperglycemia in our study volunteers in a context of low socio-economic level marked by the absence of health insurance and 94.2% of the Burkinabe population had never performed blood glucose testing [8]. The history of hyperglycemia was not only a determining factor in the calculation of the final FINDRISC score because it alone accounted for 5 points, but also in the original FINDRISC study, it was the variable that had the greatest predictive power for T2DM [11].

Threshold value of the score

In our study, we found a threshold score value ≥ 7 that predicted well the risk of T2DM diagnosis because the area under the ROC curve was 0.73 with a sensitivity of 70.8% and a specificity of 62.07%.

Compared to the African studies, our prediction score threshold value was close to that of the Beninese study (≥8.5) in West Africa [26] and lower than that of the Algerian studies (≥13 for women and ≥11 for men) in North Africa [27] and Botswana (≥17) in Southern Africa [2].

As for the European series, the Evaluation of Screening and Early Detection Strategies for Type 2 Diabetes and Impaired Glucose Tolerance study (DETECT-2) [22] reported a prediction score threshold value identical to that of our study. Our prediction score threshold value was similar to that reported in both the original FINDRISC study and the European cross-sectional studies in which the threshold values varied widely from 9 to 15 [11] [18] [36].

FINDRISC performance

According to a systematic review, diabetes prediction scores in general do not

appear to be applicable to African populations. Indeed, the authors of this systematic review reported that family history of diabetes and personal history of hypertension were the main variables causing bias and therefore source of error in the African context of information [23]. However, the International Diabetes Federation (IDF) and European guidelines recommend targeted screening for diabetes, and favour risk scores and questionnaires to identify subjects at high risk of T2DM, and who should benefit from biological screening [12]. These scores offer an accessible, non-invasive means of diabetes prevention in a health care setting where biological means are not available, and do not require any additional financial means for the patient [12] [13] [14]. As such, the Finnish risk score developed in the Finnish population [11], is considered as a tool that is easy to apply in clinical practice, validated and discriminating in the Caucasian population [15]-[22].

The discriminating qualities of scores from studies in different African countries are varied. In West Africa (Benin), one study gave an AUC of 0.86 [26]. In North Africa (Algeria) an AUC of 0.67 was scored [27]. And in Southern Africa Botswana, an AUC of 0.63 was found [24]. Compared to our results, the Beninese study [26] is the only African study that predicted very well (AUC = 0.86) the risk of developing diabetes. Moreover, the results of the Botswana study (0.63) and those of the Algerian study (0.67) were not sufficiently discriminating in the prediction of the risk of diabetes than those of our study.

In the DETECT-2 study which involved European, Australian and African populations (Mauritania), the authors found an AUC of 0.76 with a sensitivity of 76% and a specificity of 63% [22]. This study highlighted the good performance of FINDRISC in european population only [22]. The difference in performance of the FINDRISC score between different populations can be explained by the diabetes risk factors specific to each locality (eating habits, lifestyle, genetics, etc.) which may have a different impact in different populations [22]. Nevertheless, these results were close to those of our study in both prediction and specificity indicating early and optimal management. The same trend of lower specificity was found in the original FINDRISC study with a sensitivity of 81% and a specificity of 76%. However, very good predictive power was reported in the original FINDRISC study with an area under the ROC curve of 0.85 [11]. The area under the ROC curve was also reported to be 0.85 [11]. As for the different scores developed in non-African contexts, the area under the ROC curve ranged from 0.63 to 0.8 in studies evaluating their performance in the populations concerned [23].

Factors associated with the FINDRISC score

In our study, in multivariate analysis, age (p < 0.001), daily physical activity (p = 0.004), use of antihypertensive medication (p = 0.007) and waist circumference (p < 0.001) were score variables significantly associated with the risk of T2DM developing.

In the European cohort led by Mavrogianni, in multivariate analysis, age

greater than 45 years, body mass index greater than 30 kg/m^2, and history of hyperglycemia were statistically associated variables [35].

It seems that some of the variables that make up the original findrisc score can be removed depending on the specificities of populations around the world. While it is true that diabetes risk assessment should be validated for each population under consideration it seems appropriate to make changes to the Findrisc questionnaire if it is applied to other ethnic groups [27] [37].

Limitations of the study

This study assessed the performance of FINDRISC in an African population in the south of the Sahara. However, there were limitations and biases that need to be taken into account when interpreting the results. These were related to:

- an overestimation bias due to the lack of repeat blood sampling to retain the diagnosis of diabetes mellitus as suggested by the recommendations of learned societies.
- a selection bias due to the awareness campaign conducted in the media in the days preceding the screening. This could explain the high prevalence of T2DM found in our study. However, this sample is not representative of the entire population making it difficult to generalize the data from this study.

5. Conclusion

The Finnish Diabetes Risk Score (FINDRISC) predicts well the risk of occurrence of dysglycemia in Burkina Faso. It is a score that should be promoted in daily clinical practice because it is easy to use, inexpensive and does not require blood sampling in a context of insufficient medical-technical equipment (countries with limited resources) and in the absence of universal health insurance. This will allow early screening and management of T2DM by identifying those at risk who will benefit from blood sampling for confirmation at a later stage.

A future study will be indicated to see if the Findrisc score variables can be modified according to local peculiarities, based on the results of this study.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix 1. Finnish Diabetes Risk Score (FINDRISC) questionnaire [11].

Variables du score Findrisc	Score
Age	
<35 years	0
[35 - 45 years[	1
[45 - 55 years[	2
[55 - 64 years]	3
>64 years	4
Family history of diabetes	
No	0
Immediate family	5
Other relatives	3
Daily physical activity ≥ 30 minutes	
Yes	0
No	2
Daily consumption vegetables, fruits, berries	
Yes	0
No	1
History of antihypertensive medication	
Yes	2
No	0
History of impaired blood glucose	
Yes	5
No	0
Waist circumference	
M: <94 cm F: <80 cm	0
M: 94 - 102 cm F: 80 - 88 cm	3
M: >102 cm F: >88 cm	4
Body Mass Index	
<25 kg/m^2	0
25 - 30 kg/m^2	1
>30 kg/m^2	3

M: male; F: female; cm: centimeter; kg: kilogram; m: meter.