Sudan Journal of Medical Sciences
Volume 19, Issue no. 1, DOI 10.18502/sjms.v19i1.15766
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Research Article

Benefit of Finnish Score As a Risk Assessment Tool for Predicting Type II DM Among Sudanese Population in North Sudan

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Received: 5 September 2023
Accepted: 16 October 2023
Published: 29 March 2024

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Editor-in-Chief:
Prof. Nazik Elmalaika Obaid Seid Ahmed Husain, MD, M.Sc, MHPE, PhD.

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Abstract

Background: Diabetes mellitus is a major noncommunicable disease worldwide, and its prevalence is rapidly increasing. The Finish score helps in the prediction of the risk of future diabetes development, as well as in the identification of undiagnosed diabetes. The current study was conducted to identify people at risk of developing type II diabetes mellitus in River Nile State, Sudan.

Methods: This cross-sectional community-based study was conducted in River Nile state between 2019 October and 2020 March. Data were collected using a questionnaire that included the Finnish Diabetes Risk Score variables from 400 participants after an informed consent. Chi-square test was used to test the associations, with the *P*-value considered significant when <0.05.

Results: The majority of participants (257 [64.3%]) were <45 years old, and 229 (57.3%) were male. The risk of type II diabetes mellitus was found to be low in 187 (46.8%) people and high in 213 (53.2%). Moreover, 128 (32%) had a body mass index (BMI) between 25and 30 kg/m^2, while 46 (11.5%) had >30 kg/m^2. Waist circumference of <94 cm was found in 147 (36.8%) males, while only 63 females (15.8%) had a waist circumference <80 cm. Age, gender, BMI, daily activity, history of hypertension, history of hyperglycemia, and family history of diabetes were all significantly associated with the risk of developing diabetes mellitus ($P < 0.001$).

Conclusion: The Finnish Diabetes Risk Score was found to be useful in facilitating wider access to the risk of type II diabetes among the study population. More than half of the study population were at risk of developing diabetes mellitus.

Keywords: Finnish score, diabetes risk assessment, type II diabetes risk factors, noncommunicable disease, Sudan

1. Introduction

Diabetes Mellitus (DM) is a major noncommunicable disease, estimated to affect 537 million adults worldwide [1], with a mortality rate of 5 million deaths in 2014. It is thought that DM will be the seventh highest cause of death in 2030. Most diabetic patients live in low- to middle-income countries [2–5].

Diabetes increases morbidity and mortality through its main complications, including nephropathy, heart diseases, and retinopathy – which raise health costs, consume health resources and budgets, and worsen the quality of life, and shorten life expectancy [6].

According to Noor et al., the prevalence of undiagnosed diabetes in River Nile State, Sudan was 2.6% in 2015 [7]. Three years later, another study done in the same geographical area with 5376 participants revealed that the prevalence of diabetes was 18.3% , and 29% of them were newly diagnosed [8]. As Heitham et al. found, the longer the duration of diabetes, the more prevalent its complications like hypertension, ischemic heart disease, peripheral neuropathy, retinopathy, and diabetic foot. The aforementioned study was conducted in Sudan, and participants were selected from diabetic centers in Khartoum and Atbra cities [9].

Different risk scores have been developed to detect or predict type II diabetes, one of which is the Finnish Diabetes Risk Score (FINDRISC) [10]. Although it was formulated to assess individuals' risk to develop DM in the future, it has been effective in recent studies in identifying undiagnosed type II diabetes and metabolic syndrome [11]. FINDRISC score ≥15 indicates a high risk for dysglycaemia, including impaired fasting glucose. In one study, the sensitivity and specificity of FINDRISC score of ≥15 were 67.7% and 67.2%, respectively. The aim of this study is therefore to assess the risk of developing diabetes in Sudanese population in North Sudan using Finish score.

2. Methods

2.1. Study setting

This study was a descriptive cross-sectional community-based household study, conducted in River Nile state during the period of 2019 October–2020 March and targeted the adult population. River Nile state is located to the north of Khartoum state with a population of about 1,212,000 and contains six cities, including Al-Dammar (the capital city of the state), Atbara, Shendi, Al-Matamma, Berber, and Abu Hamad.

2.2. Inclusion criteria

Adult population in River Nile state who accepted to participate were included in the study.

2.3. Exclusion criteria

People who were previously known to have DM and those who refused to participate in the study were excluded.

2.4. Sample size

The sample size was calculated using the following formula: $n = (Z2 \times P \times (1 - P))/e2$,

where n is the sample size, Z is z-score (1.96), P is prevalence (50%), and e is margin of error. The calculated sample size was 384. The questionnaire was filled out by 400 participants accounting for any missing data. Convenience sampling method was used to collect the data.

2.5. Sample technique

Four towns were selected to represent the population of River Nile State; Shendi, Eldamer, Atbara, and Berber. Participants in the study were picked from these urban areas using a multistage cluster random selection approach. The city was segmented into four geographic regions: north, west, south, and east. Two districts were elected from each geographic area using a simple tossing technique. The number of houses was determined based on the population size. A survey (house-to-house) was conducted beginning at house number three on the main street of the district. Homes that were uninhabited or whose residents rejected to participate were replaced with the house next door.

2.6. Data collection

The process of data collection was done using a pretested self-administered questionnaire, which was divided into two sections, the first section was the sociodemographic part and the second included questions.

2.7. Piloting and validation process

The questionnaire was first piloted and tested on 10 people to check for any errors or difficulties in understanding. Questions which were found to be unclear and/or misleading were reformulated to be clear and more understandable. All questionnaires used in the pilot study were excluded from the analysis.

The questionnaire was based on the Finnish Type II Diabetes Risk Assessment Form.

It included eight scored questions about age, BMI, waist circumference (WC), physical activity, consumption of fruits and vegetables, current antihypertensive drug use, family history of DM, and a history of high blood glucose levels [10]. After measuring each subject's height, weight, and WC, the BMI of each patient was determined. Patients' wore light clothes while their weights were measured. Height was measured barefoot on a flat surface to the nearest 0.1 cm. Cronbach's alpha was found to be 0.84 for this questionnaire. The sensitivity of this tool was 86.4% and the specificity was 48.7%.

2.8. Data analysis

The 23rd version of the Statistical Package for Social Science was used to analyze the obtained data.

3. Results

In this study, 400 participants were enrolled to assess the risk of developing type II DM in the adult population of River Nile State, Sudan. The highest percentage of participants (n = 257; 64.3%) were in the age group <45 years, while 41 (10.2%) were >64 years. Males were 229 (57.3%). Regarding occupation, 120 (30%) were free workers , 87 (21.8%) were employees, and 72 (18%) were housewives. Additionally, 130 (32.5%) were from Shendi, 110 (27.5%) from Atbara, and 81 (20.3%) from Berber. The main tribes were Gaali (253 [63.3%]), followed by Rubatab (53 [13.3%]) and Shaigi (41 [10.3%]), as shown in Table 1.

Risk factors for having DM are displayed in Table 2. Moreover, 128 (32%) participants had a body mass index (BMI) between 25 and 30kg/m^2, and 46 (11.5%) had >30 kg/m^2. Whereas, the WC of >93 cm was found in 83 (20.8%) males, while in females, 51 (12.8%) had a WC of 80–88 cm and 56 (14%) of >88 cm. In addition, 158 (39.5%) participants denied daily exercise for more than 30 min.

DOI 10.18502/sjms.v19i1.15766

Furthermore, 26 (6.5%) participants were hypertensive and on regular BP treatment, while 17 (4.3%) were although hypertensive but were not on regular treatment. The presence of first-degree relatives with DM was found in 144 (35.3%), and of second-degree relatives in 106 (26.5%). A history of hyperglycemia during health examination was reported in 18 (4.5%) participants (Table 2).

Regarding the risk of developing type II DM, low risk was reported in 187 (46.7%), a slightly elevated risk was found in 136 (34%), moderate risk in 44 (11%), high risk in 31 (7.8%), and very high risk in 2 (0.5%), as shown in Figure **1** .

Table 3 shows the risk of type II DM among participants when associated with different factors. Age, gender, BMI, daily activity, history of hypertension, history of hyperglycemia, and family history of diabetes were found to be significantly associated with the risk of developing DM ($P < 0.001$).

4. Discussion

To the best of our knowledge, this is the first study about DM risk score to be conducted in Sudan. Regarding the risk of type II DM, higher percentages of diabetic risks were reported in our study, when compared to Ishaque study done in Malaysia, as in our study slightly elevated risk was reported in 136 (34%), low risk in 46.8%, moderate in 11%, high risk in 7.8%, and very high risk in 0.5%, while in Ishaque study it showed that 7.1% had a high risk of developing DM, 11.2% had moderate risk, 28.2% had slightly elevated risk, and 53.5% participants had low risk [12].

A lower percentage of Sudanese population showed high risk (7.1%) in comparison to Italian (14.7%) and Spanish (16.7%) populations in a similar study with a larger sample size conducted by Milovanovic *et al.* [13]. However, a larger percentage of participants in Sudan have a low risk (46.8%) in comparison to European population (43.3%), which may be due to genetic basis or the sedentary lifestyle that European might have in comparison to Sudanese population, which can be generalized through larger studies of African population and developing countries [14].

In another context, more than half of the younger population in our study (age <45) have a low risk of DM (80.2%) , a percentage higher than that found in Al-Shudifat *et al.* done among Jordanian students which showed that of the 1821 participants, 66.9% had a low risk [15].

Our study revealed that a high BMI (>25) is associated with a higher risk of diabetes, this finding is consistent with Meijnikman *et al.*'s study, which revealed that a higher BMI was associated with high and very high risks, as 26% of participants with BMI >30 had high risk,**i**n comparison to 10.1% and 3.5% of the participants with BMI 25–30 [16]. Moreover, Millana *et al.* found that the BMI was >25 kg/m^2 in the majority (75%) of women with diabetes or IGT, and the orientation toward healthy lifestyle modification to control diabetes and its prevention was poor among the study population [17]. Lindstrom *et al.* conducted a research including 522 obese people with impaired glucose tolerance, 265 of them had intensive lifestyle counseling for four years with the goal of 5% body weight loss using a balanced diet (low energy, low saturated fat, high fiber), as well as daily moderate exercise. The intervention group's members showed a 43% decrease in type II diabetes risk [18].

Due to the cross-sectional design and small sample size of our study, there are certain limitations. Additionally, blood sugar levels were not checked to rule out patients with prediabetes.**F**urther studies including large sample sizes

TABLE 1: Sociodemographic factors of study participants.

Factor		N	%
Age (yr)	<45	257	64.3
	45–54	56	14.0
	55–64	46	11.5
	>64	41	10.3
Gender	Male	229	57.3
	Female	171	42.8
Job	Free worker	120	30.0
	Employee	87	21.8
	Farmer	19	4.8
	None	18	4.5
	Housewife	72	18.0
	Student	84	21.0
Residence	Atbara	110	27.5
	Berber	81	20.3
	Al-damar	79	19.8
	Shendi	130	32.5
Tribe	Gaali	253	63.3
	Shaigi	41	10.3
	Nuba	34	8.5
	Arab	19	4.8
	Rubatab	53	13.3
	Total	400	100.0

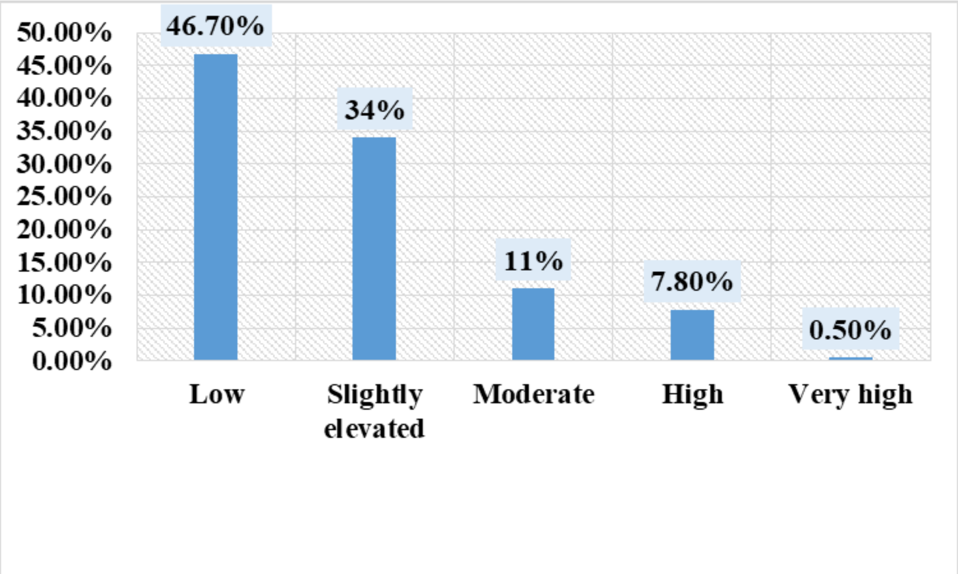

Figure 1: The risk of developing type II diabetes mellitus (n = 400).

and comparing different risk assessment tools for diabetes are recommended.

5. Conclusion

The FINDRISC was found to be useful in facilitating wider access to the risk of type II diabetes among

Table 2: Variables of the FINNISH score among study participants.

Factor		N	%
BMI (kg/m^2)	<25	226	56.5
	25–30	128	32.0
	>30	46	11.5
Hypertension	On AHM (Regularly)	26	6.5
	On AHM (Irregularly)	17	4.3
Gender, Waist circumference	Male, <94 cm	147	36.8
	Male, 94–102 cm	51	12.8
	Male, >102 cm	32	8.0
	Female, <80 cm	63	15.8
	Female, 80–88 cm	51	12.8
	Female , >88cm	56	14.0
Daily vegetable and fruit intake	First-degree relatives	141	35.3
	Second-degree relatives	106	26.5
	No relatives	153	38.3
History of hyperglycemia	Yes	18	4.5
	No	382	95.5
Daily activity at least 30 min	Yes	242	60.5
	No	158	39.5
	Total	400	100.0

the study population. More than half of the study population were found to be at risk of developing DM.

Acknowledgements

The authors are thankful to medical students of the faculty of medicine at the Nile Valley University for their participation in data collection.

Ethical Considerations

Informed verbal consent was obtained from the patients. The Education Developmental Centre of Sudan Medical Specialization Board and other relevant authorities provided the ethical clearance.

Competing Interests

None declared.

Availability of Data and Material

Authors confirm that the data supporting the findings of this study are available within the article.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or nonprofit sectors.

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TABLE 3: Association between different factors and risk of developing diabetes mellitus among study participants using Chi-square test.

FINDRISC score		Low % (N)	Slight	Moderate	High	Very high	P-value
Age (yr)	<45	80.2 (150)	68.4 (93)	18.2 (8)	19.4 (6)	0.0 (0)	0.000
	45–54	10.2 (19)	16.2 (22)	25.0 (11)	12.9 (4)	0.0 (0)	
	55–64	4.8 (9)	9.6 (13)	34.1 (15)	29.0 (9)	0.0 (0)	
	>64	4.8 (9)	5.9 (8)	22.7 (10)	38.7 (12)	100 (2)	
Gender	Male	69.0 (129)	45.6 (62)	40.9 (18)	51.6 (16)	100 (2)	0.000
	Female	31.0 (58)	53.7 (73)	56.8 (25)	45.2 (14)	0.0 (0)	
BMI (Kg/m^2)	<25	78.6 (147)	39.7 (54)	38.6 (17)	19.4 (6)	100 (2)	0.000
	25–30	19.3 (36)	44.9 (61)	40.9 (18)	41.9 (13)	0.0 (0)	
	>30	2.1 (4)	15.4 (21)	20.5 (9)	38.7 (12)	0.0 (0)	
Daily activity	>30 min	72.2 (135)	52.9 (72)	47.7 (21)	45.2 (14)	0.0 (0)	0.000
	No	27.8 (52)	47.1 (64)	52.3 (23)	54.8 (17)	100 (2)	
History of HTN	Unknown	97.3 (182)	92.6 (126)	72.7 (32)	48.4 (15)	50.0 (1)	0.000
	Reg. AHM	0.5 (1)	5.1 (7)	15.9 (7)	32.3 (10)	50.0 (1)	
	Irreg. AHM	1.6 (3)	2.2 (3)	11.4 (5)	19.4 (6)	0.0 (0)	
History of hyperglycemia	Yes	4.8 (9)	2.9 (4)	13.6 (6)	56.7 (17)	100 (2)	0.000
	No	95.2 (178)	97.1 (132)	86.4 (38)	43.3 (13)	0.0 (0)	
Family history of DM	First relative	14.4 (27)	45.6 (62)	68.2 (30)	64.5 (20)	100 (2)	0.000
	Second relative	23.5 (44)	32.4 (44)	20.5 (9)	29.0 (9)	0.0 (0)	
	No	62.0 (116)	22.1 (30)	11.4 (5)	6.5 (2)	0.0 (0)	
	Total	46.8 (187)	34.0 (136)	11.0 (44)	7.8 (31)	0.5 (2)	

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