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RESEARCH ARTICLE

ASSESSMENT OF THE RISK OF TYPE 2 DIABETES AMONG HEALTHY WITHOUT DIABETES IN SUDAN USING THE FINDRISC TOOL

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Abstract

Background and objective: Diabetes is increasingly recognized as a serious public health concern worldwide. The risk assessment of type 2 diabetes can be done through a risk questionnaire that provides an accurate, low-cost, educational and time-effective method for this. By early identification of people at risk of developing diabetes and if it is confirmed that they are in the pre-diabetes stage, adequate care is provided to them through lifestyle interventions or even hypoglycemic drugs if needed, thus delaying or preventing their progression to diabetes. Therefore, this study aimed to assess the risk of developing type 2 diabetes (T2DM) among healthy Sudanese without diabetes in Khartoum.
Methods: A cross-sectional study from Nov 2016-March 2017 comprising 122 adult participants, age (>20 yrs) visiting the garden yard located at airport street at Khartoum district without a diagnosis of T2DM was carried out. The risk of developing T2DM was assessed using the validated and widely used Finish diabetes risk score (FINDRISC) Total Risk Score of each participant was analysed and compared. Knowledge assessment tool and Anthropometric measurements were also used.
Results: 122 participated in the study, the mean age of the participants was 31.55±10.122, the mean BMI was 25.718±5.813 and the mean of waist circumstances 90.2±16.63. Estimated risk of developing T2DM in 10 years of study for participants according to FINDRISC, only 3.3% have a high risk. The risk factors for the participants in the study for developing DM type 2 were 66.4% has positive family history, 44.3% were overweight or obese, has 41.8% limited physical activity and 27.9% has central obesity. The pattern of vegetables and fruits daily intake according to FINDRISC only 36.1% from participants. Significant positive correlation (r= 0.395, *p*=0.000) High risk score of FINDRISC is >14, Estimated age: Y=24.1+(0.9x15)=37.9≈38years.Significant positive correlation (r=0.6, *p*=0.000) High risk score of FINDRISC is > 14, Estimated BMI: Y=19.24+ (0.8x15) = 31 Kg/ m^2.
Conclusion: The knowledge about diabetes risk factors, classical symptoms and common complication was not satisfactory. None of the "at high" risk had their risk further investigated. While 25% adapted health their lifestyle. Large scale studies to test the validity of FINDRISC in Sudanese population should be conducted. Development of Sudanese population specific risk score that take into count the local risk factors is warranted.
Keywords: Assessment, Finish diabetes risk score (FINDRISC), Sudanese, Type 2 DM.

INTRODUCTION

Diabetes is increasingly recognized as a serious, worldwide public health concern[1]. In 2010 it was estimated that 285 million people are living with diabetes[2], the number increased to 366 million in 2011[3], then escalated to 415 million in 2015[4]. Low-and middle-income countries have the highest proportion of people with diabetes[3]. International diabetes federation (IDF) estimates that by 2040 there will be 642 million people living with diabetes worldwide[4]. In Sudan, there were 3 million cases of diabetes in 2014[5]. One of the

most worrying characteristics of this rapid growth is that T2 DM is becoming more prevalent among children, adolescents, and young adults[6]; indeed Osman *et al.*, reported that prevalence of T2DM is now increasing among Sudanese children and adolescents[7]. This may be due to increasing prevalence of obesity, sedentary lifestyle and physical inactivity[8]. A primary concern about T2DM is that it remains clinical unapparent for long time[9]. The onset of T2DM may occur as early as 9-12 years before its clinical diagnosis[10]. Globally, 45.8% or 174.8 million people are estimated to be living with undiagnosed T2DM; about 83.8% of them live in low-and middle income countries[11]. Nevertheless even those undiagnosed people are placed at increased risk for developing diabetes complications. At time of diagnosis, complications are established in 20- 30% of the patients[12]. There is an intermediated stage between normoglycemia and diabetes which is pre-diabetes[13]. Approximately 5-10% of pre-diabetics per year will progress to diabetes[14]. T2DM can be delayed or even prevented in high risk subjects[15,16] which lead to delaying incidence of complications and co-morbidities[19]. Life style interventions targeting weight loss and increasing physical activity and improving diet has produced a 30-60% reduction in the risk of developing T2DM[17]. Pharmacotherapy has been also used; metformin, acarbose and troglitazone with 31, 36, and 56% risk reduction respectively[18].

Various risk scores are available, the Finnish diabetes risk score has been used in this study as it received the IDF Recommendation as a simple, fast, non-invasive, inexpensive, and reliable tool to identify individuals at high risk for T2DM[19], and it is validated in many countries with good performance[20]. This was concluded by Rowan P.C. and his colleagues after performing risk assessment followed by point of care glycosylated haemoglobin (HbA1C) test which showed positive correlation with the risk score as the risk increased the HbA1C value also increased[25]. Diabetes care represents a real challenge in Sudan for both healthcare system and patients[21-23]. According to the annual health report issued by the ministry of health for 2015, among the ten leading disease treated as out-patients diabetes was the fifth, and form the ten leading causes of hospital admissions it was the seventh[24]. Identification of individuals at high risk for developing diabetes has been a major concern worldwide, in Community-based settings, a study conducted in Libya by Abduelkarem *et al.*,[26], second study in Nigeria by Alebiosu *et al.*,[27] and third one in Saudi Arabia by Alzohairy M. and Hassan M.[28], all of these studies used the FINDRISC as a tool for risk assessment. Likewise two studies has been conducted in India using the Indian diabetes risk score by Subramani *et al.*,[29] in rural area of Sripuram and by Anjana *et al.*,[30] in urban slum of Hubli. Furthermore in rural West Virginia a study has been conducted by Misra *et al.*,[31-33]. There is a significant difference in the percent of individuals at high risk in rural areas compared to those in urban areas which is not surprising since urbanization leads to adapting more westernized lifestyle therefore increasing the risk of developing T2DM[34]. This study aims at assessing the risk of developing type 2 diabetes mellitus (T2DM) among healthy non-diabetic Sudanese in Khartoum city during the period from November 2016 to February 2017. The study was community based study divided into two phases:

Phase one: cross-sectional observational study, where all participants had their risk of developing diabetes assessed and provided with verbal counseling.

Phase two: educational interventional for those found at high/very high risk, their knowledge regarding diabetes was assessed, then they were provided with verbal education by feedback method with emphasis on importance of early testing for diabetes and contact information obtained, average interview time was 15-25 minutes. They were contacted after two weeks to check whether they went to investigate their risk status by doctor or not.

MATERIALS AND METHODS

The study conducted during the period from November 2016 to March 2017 for 122 Non-diabetic Sudanese adults visiting public gathering places mainly the Green yard Khartoum city, Sudan selected by convenient sampling technique. It has been selected as place for data collection as it represents a major destination for entertainment for families and individuals with average number of visitors approximately 10-15 thousand at weekends from all age groups and diverse areas of Khartoum city. To determine the percent of individuals at high risk of T2DM using the Finnish diabetes risk score. To determine the frequencies of most common risk factors predisposing individuals to develop T2DM. To assess the effect of perceived risk on those at high risk behavior to seek further medical care and intention to adopt healthy lifestyle.

The data were collected by three tools:

Finish diabetes risk score (FINDRISC):

Risk score form is a one-page questionnaire containing eight questions, with categorized answers, about age, body mass index (BMI, waist circumference, physical activity, daily consumption of fruits, berries or vegetables, history of antihypertensive drug treatment, history of high blood glucose, and family history of diabetes. The form was translated to Arabic language and layout has been adjusted.

Knowledge assessment tool:

Structured questionnaire to assess the high/ very high risk group perceptions regarding diabetes causes, signs and symptoms, risk factors, complications of diabetes, early screening attitude toward risk status also demographic information obtained as well as contact information.

Anthropometric measurements

Including body weight, height, waist circumference and Body Mass Index (BMI).

Ethical consideration:

Ethical approval was obtained from faculty of pharmacy, national university. Participation was completely voluntary and verbal consent was obtained from all participants after providing full explanation. SPSS version 21 (IBM SPSSInc., Chicago, IL) was

used for data entry and analysis. The variables (age, weight, BMI and WC) were expressed as mean± standard deviation. The frequencies of risk factors were expressed as number (%). Statistical association between nominal variables was estimated using the chi-square test. Linear regression was employed to estimate the correlation between age, BMI and risk score.

RESULTS

Total 122 participated in the study, 61.5% from them male while 38.5% were female, the mean age of the participants was 31.55±10, the mean BMI was 25.718±5.813 and the mean of waist circumstances 90.2±16.63 as stated in Table 1.

Table 1: Characteristics of study participants.

Study variable	Total (n=122)	Males(n=75)	Females(n=47)
Age	31.55±10.122	32.95±10.865	29.3±8.436
BMI	25.718±5.813	25.647±5.944	25.831±5.66
Waist circumstances	90.2±16.63	91.94±16.379	87.415±16.823

All (mean±standard deviation), Age in years, BMI in kg/m^2, Waist circumference in centimeters

The estimated risk of developing T2DM in 10 years of the study for the participants according to FINDRISC, only 3.3% has high risk, 19.9% moderate elevated risk, 34.9% slightly elevated risk and 41.9% has low risk for developing DM type 2 in the next 10 years as shown in Table 2.

Table 2: Estimated risk of developing T2DM in 10 years of the study participants according to FINDRISC.

Estimated risk of developing T2 DM in 10 years	Percent
Low	41.9
Slightly elevated	34.9
Moderate	19.9
High	3.3

66.4% has positive family history, 44.3% were overweight or obese, has 41.8% limited physical activity and 27.9% has central obesity as shown in Table 3. Only 36.1% from participant's daily take vegetables and fruits while 63.9% didn't take it daily as shown in Figure 1. The estimated age at which participants are at high risk according to FINDRISC: Y=24.1+ (0.9x15) = 37.9≈38 years. Significant positive correlation (r= 0.395, *p*=0.000), High risk score of FINDRISC is >14. The estimated body mass index at which participants are at high risk: Y= 19.24+(0.8x15)=31 Kg/m^2. Significant positive correlation (r= 0.6, *p*=0.000) High risk score of FINDRISC is > 14.

Table 3: Frequencies of risk factors among study participants.

Frequencies of risk factors among participants	Percent
Elder age	13.9
Over weight/ Obese	44.3
Central obesity	27.9
Limited physical activity	41.8
Anti hypertensive medication use	4.9
History of abnormal blood glucose level	15.6
Positive family history	66.4

DISCUSSION

Participants were predominantly aged less than 45 years. Males constituted a large portion because females showed a conservative behavior toward revealing their age and weight. Individuals found at high risk of developing DM type 2 constituted only small portion (3.3%) of the small sample size. Similarly Alebiosu *et al.*,[27], Alzohairy[28], Subramani *et al.*,[29] and Abduelkarem *et al.*,[26] reported a 5.05 %, 9.8 %, 12.1 % and 12.3% individual at high risk respectively. In contrast to studies of Anjana *et al.*,[30] and Misra *et al.*,[31] whereas 45% and 61.8% were at high risk respectively.

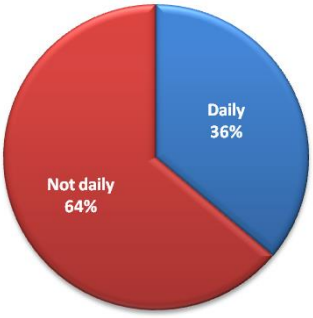

Figure 1: Patterns of vegetables and fruits intake among study participants.

Moderately risk was detected in 19.7% similar to Abduelkarem *et al.*, 20%[26], and 77% were at low/ slightly elevated risk similar proportion to findings of Alzohairy and Hassan 70.6%[28]. Majority of participants were aged less than forty five years old therefore they had less age associated risk. Additionally majority of them had neither family history nor personal history of abnormal blood glucose level, two components that are given high score in FINDRISC (5 points for each). First risk factor is the family history of diabetes either its type1 or 2. Positive family history it significantly associated with risk score, reported by 66.4% of the study participants and 4/ 4 of those found at high risk reported positive family history. Similar findings reported by Misra *et al.*,[31] 65% had family history of diabetes. About 44.3% had BMI ≥ 25kg/m^2 (24.6% were overweight and 19.7% were obese) contradictory to the study by Alzohairy and Hassan in Saudi Arabia[28] where 96.5% reported to have BMI ≥25kg/m^2. Although the sample size are not comparable as early

mentioned even though we compare in term of portion of sample. There was significant association between BMI and risk score (p=0.000). Limited physical activity (< 30 minutes of exercise) was reported by 41.8% of participants. Again Abduelkarem *et al.*, reported that 57.3% of their participants had limited physical activity[26]. According to FINDRISC the physical activity is measure in term of performing 30 minutes of exercise at work or during leisure time, it would have been more appropriate to specify the type of exercise such as brisk walking, intensity of exercise being aerobic or anaerobic. Central obesity detected in 27.9% of the study participants which increases the risk of developing T2 DM. Significant association with risk score was found (p=0.000). History of abnormal blood glucose level was reported by 15.6%, during a health examination or illness or gestational diabetes in females and significantly associated with the risk score (p=0.000). A total of 13.9% aged ≥ 45 years, the process of aging results in declining metabolic capacity of body and ability to secret or utilize the insulin to regulate blood sugar. Increasing age not only increases the risk developing T2DM but also other cardiovascular diseases. Irregular daily consumption of vegetables and fruit (component of FINDRISK component) was reported by majority of the participants, Similar to study by Naranjo *et al.*,[33]. In area of risk results and association with developing type 2 DM in each gender, there was no significant difference between males and females regarding risk score (p=0.076). Males risk results are associated with their BMI, WC (p=0.000 for both), history abnormal blood glucose level (p=0.005) and physical activity (p=0.004), while age and family history didn't show any association (p=0.157 and 0.196 respectively). Females risk of developing T2 DM was associated with their BMI and WC (p=0.00 for both), similar to findings reported by Alebiosu *et al.*,[26] and Misra *et al.*,[31]. In area of knowledge of high risk group about T 2 DM, family history and unhealthy diet were the most acknowledged risk factors of T2 DM. Regarding classical symptoms polyuria was the most acknowledged symptoms of diabetes, polydipsia and polyphagia were moderately known. Concerning common complications, nephropathy was well known; retinopathy and neuropathy were moderately known. One of the individuals had completely missing knowledge regarding all items assessed.

Study limitations

The small sample size that hindered the results incomparable with previous studies resulted from two factors: the first is time and resources constrain and the validity of Finnish diabetes risk score among Sudanese is not tested thus it may over or underestimate the actual risk status.

CONCLUSIONS AND RECOMMENDATIONS

Out of the 122 individuals had their risk assessed, 3.3% were found at high risk, 19.7% were at Moderate and 77% were at low/ slightly elevated risk. The most common risk factors encountered were positive family history of diabetes 66.4%, overweight/ obese status 44.3%, limited physical activity 41.8% and central obesity 27.9%. The knowledge about diabetes risk factors, classical symptoms and common complication was not satisfactory. None of the "at high" risk had their risk further investigated. While 25% adapted health their lifestyle.

Large scale studies to test the validity of FINDRISC in Sudanese population should be conducted, development of Sudanese population specific risk score that take into count the local risk factors is warranted and diabetes awareness programs should be commenced to raise awareness about seriousness of T2 DM and most important of all is preventability of T2 DM.

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AUTHOR'S CONTRIBUTION

Osman OA: data collection, writing original draft. **Saeed AA:** hypothesis of the work. **Mousnad MA:** writing original draft, editing, review. **Hamid A:** methodology, formal analysis. All authors revised the article and approved the final version.

DATA AVAILABILITY

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

CONFLICT OF INTEREST

No conflict of interest associated with this work.

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