ECRONICON OPEN ACCESS

EC DIABETES AND METABOLIC RESEARCH

Research Article

Prevalence of Type II Diabetes Mellitus and Associated Risk Factors among Adult Population in Rural Bahri Administrative Unit, Khartoum State, Sudan

Rania Kamal Hussein[1], Mater Adam Abdalla[2], Abdalmajed MA[3]*, Bakheta ABA[3]

[1]*Master Student, AlzaiemAlazhari University, Sudan*

[2]*Associate Professor, AlzaiemAlazhari University, Sudan*

[3]*Senior Public Health Specialists, Khartoum State, Ministry of Health, Sudan*

***Corresponding Author:** Abdalmajed MA, Senior Public Health Specialists, Khartoum State, Ministry of Health, Sudan.

Received: March 25, 2021; **Published:** April 26, 2021

Abstract

Type 2 Diabetes Mellitus is the predominant form of human diabetes. It is worldwide increasing rapidly. The goal of this study was to determine the prevalence of T2DM and associated risk factors among adult population in Rural Bahri Administrative Unit. A cross-sectional study community based was applied, among 162 adult. Data were collected through structured questionnaires. Anthropometric measurements were taken. Subjects were also screened for random blood sugar sample was drawn from every participant and measured using glucometer strips following the Reference Scale for Normal Random Blood Sugar. The overall preavlence of T2DM was found 11.1%. Socio-demographic factors such gender, age, education level, occupation, residence and relation to member of family with diabetes type 2 were not significantly associated with diabetes type 2 ($P > 0.05$). Analysis of association of lifestyle factors and other factors and prevalence of diabetes mellitus type 2 revealed that infected with any chronic health problems (94.4%), nutritional status (overweight adult (25 - 29.9) kg/body weight) (77.8%), types of chronic health problems, previous infection of one of family members with any chronic health problems (family history) of diabetes and hypertension (44.4%), diabetes (38.9%) and hypertension (5.6%), frequency of meals intake per day (three meals) (61.1%) followed by 2 meals (38.9%), types of intake any types of tobacco and alcohol mainly intake cigarette (11.1%), practiced of periodic medical check-up, type of practiced of periodic medical check-up mainly blood sugar check-up (50%) were significantly associated with diabetes mellitus type 2 ($P < 0.05$). Control efforts should be directed on screening and public nutrition programmes. .

Keywords: *Type II Diabetes Mellitus; Rural Bahri Administrative Unit; Khartoum; Sudan*

Introduction

According to International Diabetic Federation [1], diabetes is the most common serious chronic metabolic disease causing morbidity and mortality among the affected individuals with an estimated 5 million deaths globally in 2015 [2]. In fact, diabetes is one of the fastest rising non-communicable disease (NCD) globally, although the preventable diabetes type 2 is the most common form of diabetes reported accounting for 90% of all cases [3]. Owing to numerous blockades of accessing diagnosis and treatment, diabetic patients are often undiagnosed whereas individuals on diabetic treatment were mismanaged [3].

The mismanagement would arise because of non-adherence to non-pharmacological measures such as physical exercise, and healthy life style such as weight control, regular medical check-ups, routine monitoring of blood sugar, and enough rest [1].

The numbers of people affected by the disease has continued to rise and this has been attributed to lifestyle factors of which 75% are from low income countries [1].

Diabetes is among the most prevalent chronic illness on the rise, universally affecting 415 million people and more [1]. It has emerged as global epidemic due to a fast upsurge in overweight, obesity, in addition to physical inactivity. The world health organization (WHO) established that, the number people are living with diabetes mellitus is on the increase and its prevalence is growing in all regions of the world [4]. In 2014, four hundred twenty two adults people (or 8.5% of the population) were diabetic, equated to 108 (4.7%) in 1980 [4]. WHO predicted diabetes to be the seventh primary cause of death universally by 2030 but then again approximately 50% -80% of all type 2 diabetic patient die of cardiovascular disorders and stroke, and furthermore end up with renal failure [5].

The combined impact of poor awareness, insufficient access and limited services on diabetic information is closely accompanying the occurrence of type 2 diabetes mellitus. These, together with inadequate resources makes diabetic patients end up in heart attack, stroke, blindness, kidney failure and leg amputation (WHO, 2016). Furthermore, the frequency of leg amputation in diabetes mellitus is 15 times greater than for non-diabetic individuals [4].

In terms of costs, it is estimated that global health care expenditure is 673 billion dollars, 12% of the global expenditure on diabetes [1].

In Sub Saharan Africa, the actual number of diabetic patients remains uncertain, although the International Diabetes Foundation (IDF) estimated 14.2 million in 2016 and the figure is projected to double to about 28 million by the year 2040 [1]. More than two thirds (66.7%) of people living with diabetes are undiagnosed in Africa (IDF, 2016). According to IDF [1], most populous African countries have the highest number of people with diabetes, these include South Africa (2.3 million), Democratic Republic Of Congo (1.8 million), Nigeria (1.6 million) and Ethiopia (1.3 million) [1].

A recent study in Khartoum in Jabra area showed that the prevalence of diabetes mellitus among adults was 18.6% [6]. For these reasons there is an urgent need to assess current prevalence and factors associated with type 2 diabetes mellitus in Rural Bahri Administrative Unit.

Materials and Methods

Study design

This study was cross sectional community based study conducted during the period from March t June 2016.

Study area

Rural Bahri administrative unit is considered as one of Bahri locality administrative units which subdivided into three administrative units, namely, Bahri, North Bahri and Rural Bahri. The Rural Bahri administrative unit has population of 199401 and also divided into two units: North rural Bahri (Elgaili) which has population of 104485 inhabitants' and South rural Bahri (Elseleit) with a population of 94916 inhabitants'.

Study population

The study population includes all adult population aged 40 years old and more already or newly diagnosed with diabetes mellitus who live in Rural Bahri administrative Unit.

Inclusion criteria

This study included all participants aged 40 years and more who meet the above requirements and have consented to get involved in the research.

Exclusion criteria:

- Participants who did not accept to consent and those who were found to have communication hindrances such as the deaf and mute as well as those too sick to communicate were excluded from the study.
- Participants aged less than 40 years were excluded from the study.

Sample size

The sample size was calculated by using the following equation:

$n = Z^2PQ / (e)^2$

Where n is the minimum sample size, P is the prevalence of diabetes mellitus which taken as 3.8% among adult in rural communities in Sudan [7].

P is estimated to be 3.8% and Z value is at α/2. The value Z α/2 is equal to 1.96 (approximately to 2) and e is the precision with value of 0.1.by substitution in this formula. e = Desired margin of error, expressed as decimal.

$$n = (1.96)^2 \times .038 \times 0.962 / (0.1)^2 = 141$$

considering the account for non-responds (15%) was 21, and then the total sample size was 141+ 21 = 162.

Sampling technique

The sampling technique was stratified sampling technique. Sampling frame was taken as a proportion in accordance to the number of population of Elseleit and Elgeili administrative units. The researchers divided a population into homogeneous subpopulations (2 stratums) the first stratus was Algaili administrative unit and the second stratum was Alselaite administrative unit. Every member of the population should be in exactly one stratum. Each stratum is then sampled using simple random sampling. The sample size for the first stratum was (87) and for the second stratum was (75) to collectively give a sample size of 162.

Study variables

Dependent variables

Diabetes mellitus disease.

Independent variables

Personal characteristics that includes: age, sex, level of education, marital status, occupation, monthly income and residence. The main dependent variable in this study is diabetes mellitus. The independent variables are chronic diseases, types of chronic diseases, any one of the family members infected with chronic health problems, frequency, intake any type of tobacco or alcohol of meals intake and make a periodic medical check-up.

Data collection tools

Interview

Interview using pretested structured questionnaires was use to collect the data. Illiterate candidates were interviewed verbally by the researcher and their responses were written in the questionnaire. There were two trained persons to help the researcher in collection of the data. The questionnaire was adopted from different previous literature and modified. The questionnaire was pretested and the validity and reliability of the questionnaire was measured. The questionnaire includes socio-demographic information which consists of 11 variables and diabetes mellitus risk factors contain 5 variables.

Anthropometric measurements

Weight was measured in kilograms (kg) using calibrated weighing scales with participants lightly clothed. Height was measured in meters using standard height meter by participants standing upright on the height meter, BMI was computed using a Reference Scale BMI: Below 18 = underweight, 18 - 24.9 = normal weight, 25 - 29.9 = overweight, 30 and above (obesity) [8].

Blood samples

Blood samples were taken and checks by using diabetes pen. Random blood sugar sample was drawn from every participant and measured using glucometer strips following the Reference Scale for Normal Random Blood Sugar. A blood sugar level less than 140 mg/dL (7.8 mmol/L) is normal. A reading of 200 mg/dL (11.1 mmol/L) or higher after two hours suggests diabetes [8].

Results

Table 1 below indicates that there was no association between age and diabetes infection, $p > 0.05$. The age group over 50 years old (66.6%) was not significantly high infected by diabetes. Female was not significantly high infected by diabetes compared to male (83.3 vs.16.7%) as shown in table 2. Table 3 show that diabetes was not significantly high among adult population of Alselaite administrative unit (55.6%). In table 4 diabetes infection was not influence by level of education, $p > 0.05$. Non educated adults were not significantly high infected with diabetes (38.9%) compared to other levels of education. Also marital status had no effect on diabetes infection. Married adults were not significantly have high diabetes infection (66.7%), $p = .557$ (Table 5). Families who had members more than 5 were not significantly have high infected adults' population diabetes (94.4%) (Table 6). Diabetes infection was not influence by adults' occupation, $p > 0.05$. Adults' housewives were not significantly having high diabetes infection (66.7%), $p > 0.05$ as shown in table 7. Significant association was found between adult population diabetes infection and nutritional status, $p = .003$. Those who were overweight (25 - 29.9) kg/ body weight significantly having high diabetes infection (77.8%) (Table 8). Table 9 shows that the overall prevalence of diabetes among adults population was found to be 11.1%. There was association between diabetes mellitus infection and infected with any chronic disease, $p < 0.05$. Those adults who having any chronic diseases were significantly having high infection with diabetes mellitus (94.4%) as displayed in table 10. Table 11 indicates that there was association between diabetes mellitus infection among adults population and type of infection of family members with any chronic health problems, $p = .044$. The high infection with diabetes was significantly found among adults who have a family members infected by diabetes and hypertension (44.4%), diabetes (38.9%) and hypertension (5.6%). Table 12 illustrates that the frequency of meals intake per day associated with diabetes infection, $p < 0.05$. Those who having 3 meals per day were significantly having high infection of diabetes (61.1%) followed by 2 meals per day (38.9%). Association was found between diabetes mellitus and intake any types of tobacco and alcohol, $p = .004$ (Table 13). The most diabetes adults were intake cigarette (11.1%) compared to those who intake snuff and drink alcohol as shown in table 14. Table 15 shows that there was association between diabetes mellitus infection and type of practiced of periodic medical check-up, $p = .000$. The most diabetes mellitus infection was significantly found among adult who practiced periodic medical check-up of blood sugar (50%) followed by adults practiced Blood sugar, renal function and blood periodic check-up (5.6%) and adults practiced blood sugar and hypertension of periodic medical check-up.

Category	Diabetes		Total	χ^2	P-value
	Yes	No			
40 - 49	6 (3.3%)	73 (50.7)	79 (48.8%)	2.523	.283
50 - 59	6 (33.3%)	28 (19.4%)	34 (21.0%)		
≥ 60	6 (33.3%)	43 (29.9%)	49 (30.2%)		
Total	18 (100%)	144 (100%)	162 (100%)		

Table 1: *Prevalence of type 2 diabetes mellitus according to age group in rural Bahri administrative unit, 2016. P-value significant at Less than 0.05 Levels (Not significant).*

Category	Diabetes		Total	χ^2	P-value
	Yes	No			
Male	3 (16.7%)	34 (23.6%)	37 (22.8%)	.438	.373
Female	15 (83.3%)	110 (76.4%)	125 (77.2%)		
Total	18 (100%)	144 (100%)	162 (100%)		

Table 2: *Prevalence of type 2 diabetes mellitus according to sex in rural Bahri administrative unit, 2016. P-value significant at less than 0.05 levels (Not significant).*

Category	Diabetes		Total	χ^2	P-value
	Yes	No			
Algaili administrative unit	8 (44.4%)	79 (54.9%)	87 (53.7%)	.698	.279
Alselaite administrative unit	10 (55.6%)	65 (45.1%)	75 (46.3%)		
Total	18 (100%)	144 (100%)	162 (100%)		

Table 3: *Prevalence of type 2 diabetes mellitus according to place of residence in rural Bahri administrative unit, 2016. P-value significant at less than 0.05 levels (Not significant).*

Category	Diabetes		Total	χ^2	P-value
	Yes	No			
Non- educated	7 (38.9%)	45 (31.3%)	52 (32.1%)	5.404	.369
Khalwa	2 (11.1%)	4 (2.8%)	6 (3.7%)		
Basic	5 (27.8%)	32 (22.2%)	37 (22.8%)		
Secondary	2 (11.1%)	34 (23.6%)	36 (22.2%)		
University	2 (11.1%)	27 (18.8%)	29 (17.9%)		
Post University	0 (0.0%)	2 (1.4%)	2 (1.2%)		
Total	18 (100%)	144 (100%)	162 (100%)		

Table 4: *Prevalence of type 2 diabetes mellitus according to level of education in rural Bahri administrative unit, 2016. P-value significant at less than 0.05 levels (Not significant).*

Category	Diabetes		Total	χ^2	P-value
	Yes	No			
Married	12 (66.7%)	108 (75%)	120 (74.1%)	2.075	.557
Single	0 (0.0%)	6 (4.2%)	6 (3.7%)		
Widowed	5 (27.8%)	24 (16.7%)	29 (17.9%)		
Divorce	1 (5.6%)	6 (4.2%)	7 (4.3%)		
Total	18 (100%)	144 (100%)	162 (100%)		

Table 5: *Prevalence of type 2 diabetes mellitus according to marital status in rural Bahri administrative unit, 2016 P-value significant at less than 0.05 levels (Not significant).*

Category	Diabetes		Total	χ^2	P-value
	Yes	No			
< 2	0 (0.0%)	7 (4.9%)	7 (4.3%)	3.152	.207
2-4	1 (5.6%)	27 (18.8%)	28 (17.3%)		
≥ 5	17 (94.4%)	110 (76.4%)	127 (78.4%)		
Total	18 (100%)	144 (100%)	162 (100%)		

Table 6: *Prevalence of type 2 diabetes mellitus according to number of family in rural Bahri administrative unit, 2016. P-value significant at less than 0.05 levels (Not significant).*

Category	Diabetes		Total	χ^2	P-value
	Yes	No			
Employee	1 (5.6%)	24 (16.7%)	25 (15.4%)	3.338	.503
Free work	3 (16.7%)	25 (17.4%)	28 (17.3%)		
Retired	2 (11.1%)	19 (13.2%)	21 (13%)		
Housewife	12 (66.7%)	69 (47.9%)	81 (50%)		
Not work	0 (0.0%)	7 (4.9%)	7 (4.3%)		
Total	18 (100%)	144 (100%)	162 (100%)		

Table 7: *Prevalence of type 2 diabetes mellitus according to occupation in rural Bahri administrative unit, 2016. P-value significant at less than 0.05 levels (Not significant).*

Category	Diabetes		Total	χ^2	P-value
	Yes	No			
Underweight (≤18) kg/ body weight	0 (0.0%)	1 (0.7%)	1 (0.6%)	1.561	.003**
Normal (18.5-24.9) kg/ body weight	3 (16.7%)	37 (25.7%)	40 (24.7%)		
Overweight (25-29.9) kg/ body weight	14 (77.8%)	91 (63.2%)	105 (64.8%)		
Obese (≥ 30) kg/ body weight	1 (5.6%)	15 (10.44%)	16 (9.9%)		
Total	18 (100%)	144 (100%)	162 (100%)		

Table 8: *Association between nutritional status and type 2 diabetes mellitus among adult population in rural Bahri administrative unit, 2016. **: P-value significant at less than 0.05 levels (Significant).*

Category	No.	%
Yes	18	11.1
No	144	88.9
Total	162	100.0

Table 9: *Overall prevalence of type 2 diabetes mellitus among adult population in rural Bahri administrative unit, 2016.*

Category	Diabetes		Total	χ^2	P-value
	Yes	No			
Yes	17 (94.4%)	57 (39.6%)	74 (45.7%)	19.407	.000**
No	1 (5.6%)	87 (60.4%)	88 (54.3%)		
Total	18 (100%)	144 (100%)	162 (100%)		

Table 10: *Association between type 2 diabetes mellitus and infected with any chronic health problems in rural Bahri administrative unit, 2016. **: P-value significant at less than 0.05 levels (Significant).*

Category	Diabetes		Total	χ2	P-value
	Yes	No			
Diabetes	7 (38.9%)	31 (21.5%)	38 (23.5%)	8.090	.044*
Hypertension	1 (5.6%)	31 (21.5%)	32 (19.8%)		
Diabetes and hypertension	8 (44.4%)	38 (26.4%)	46 (28.4%)		
No chronic health problems	2 (11.1%)	44 (30.6%)	46 (28.4%)		
Total	18 (100%)	144 (100%)	162 (100%)		

Table 11: *Association between type 2 diabetes mellitus and types of infection of one of family members with any chronic health problems in rural Bahri administrative unit, 2016. **: P-value significant at less than 0.05 levels (Significant).*

Category	Diabetes		Total	χ^2	P-value
	Yes	No			
One meal	0 (0.0%)	3 (2.1%)	3 (1.9%)	4.625	.009**
Two meals	7 (38.9%)	90 (62.5%)	97 (59.9%)		
Three meals	11 (61.1%)	51 (35.4%)	62 (38.3%)		
Total	18 (100%)	144 (100%)	162 (100%)		

*Table 12: Association between type 2 diabetes mellitus and frequency of meals intake per day in rural Bahri administrative unit, 2016. **: P-value significant at less than 0.05 levels (Significant).*

Category	Diabetes		Total	χ^2	P-value
	Yes	No			
Cigarette	2 (11.1%)	4 (2.8%)	6 (3.7%)	4.014	.004**
Snuff	0 (0.0%)	6 (4.2%)	6 (3.7%)		
Drink alcohol	0 (0.0%)	1 (0.7%)	1 (0.6%)		
Cigarette and snuff	0 (0.0%)	1 (0.7%)	1 (0.6%)		
No intake	16 (88.9%)	132 (91.7%)	148 (91.4%)		
Total	18 (100%)	144 (100%)	162 (100%)		

Table 13: *Association between type 2 diabetes mellitus and types of intake any types of tobacco and alcohol in rural Bahri administrative unit, 2016. **: P-value significant at less than 0.05 levels (Significant).*

Category	Diabetes		Total	χ^2	P-value
	Yes	No			
Yes	11 (61.1%)	27 (18.8%)	38 (23.5%)	15.99	.000**
No	7 (38.9%)	117 (81.3%)	124 (76.5%)		
Total	18 (100%)	144 (100%)	162 (100%)		

Table 14: *Association between type 2 diabetes mellitus and practiced of periodic medical check-up in rural Bahri administrative unit, 2016. **P-value significant at less than 0.05 levels (Significant).*

Category	Diabetes		Total	χ^2	P-value
	Yes	No			
Blood sugar	9 (50%)	5 (3.5%)	14 (8.6%)	46.550	.000**
Hypertension	0 (0.0%)	8 (5.6%)	8 (4.9%)		
Asthma	0 (0.0%)	1 (0.7%)	1 (0.6%)		
General examination	0 (0.0%)	1 (0.7%)	1 (0.6%)		
Eyes	0 (0.0%)	3 (2.1%)	3 (1.9%)		
Anemia	0 (0.0%)	1 (0.7%)	1 (0.6%)		
Blood sugar, renal function and blood	1 (5.6%)	5 (3.5%)	6 (3.7%)		
Blood sugar and hypertension	1 (5.6%)	3 (2.1%)	4 (2.5%)		
No medical check-up	7 (38.9%)	117 (81.3%)	124 (76.5%)		
Total	18 (100%)	144 (100%)	162 (100%)		

Table 15: *Association between type 2 diabetes mellitus and type of practiced of periodic medical check-up in rural Bahri administrative unit, 2016. **: P-value significant at less than 0.05 levels (Significant).*

Discussion

This study established the overall prevalence of type 2 diabetes mellitus among adult populations of Rural Bahri as 11.1%, this finding is not much different from 15% prevalence in Nepal among according to Nepal Diabetes Association (NDA) [9]. In contrast however, cross-sectional studies previously done around towns close to Kampala city showed a low prevalence of 8.1% [10] and 9% from studies on foot hills of Rwenzori Mountains in western Uganda [11].

The prevalence of T2DM in this study was found to lower than the national prevalence of 9.1% as reported in Tanzania STEPS Survey 2012 [12]. A recent study by Ruhembe., *et al*. [13] conducted in Mwanza urban reported higher prevalence of 11.9% and observed that, public education on diet-related diseases should be emphasized and routine check-up of blood glucose levels be undertaken among adults. A study conducted by Prem-Kumar., *et al*. [14] on the prevalence of T2DM and its associated factors in Selangor, Malaysia revealed a bit higher prevalence of 12.8%. These differences could be as a result of heterogeneity of diabetes across population structures and difference in life styles and also may be attributed to socio-economic status, differences in obesity and geographical location of the population.

Moreover, the study revealed that diabetes mellitus was not significantly more prevalent among adult aged 50 - 59 years old (33.3%) and aged ≥ 60 years old (33.3%). The finding in line with the statements that elderly individuals are at a higher risk of developing metabolic abnormalities, such as T2DM, than other younger adults [15]. Also other study agree with study finding that people aged 45 to 64 were the group most frequently diagnosed with T2DM [16].

In addition, the current study showed that type 2 Diabetes mellitus was not significantly higher among female (83.3%) compared to male (16.7%), p = .373. However, the risk of developed diabetes mellitus was not significantly increased .647 folds among female compared to male sex. This results matched to the statement that being female is related to poorer glycemic control in people with T2DM [17]. Also females who have had children tend to have higher adiposity and prevalence of T2DM than males as a result of the increased weight during pregnancy and the subsequent inability to shed that weight [18]. The risk of developing T2DM and the prevalence of this condition are associated with gender-related differences in lifestyle [19]. On the other hand the study showed that Alselaite administrative unit was not significantly have a higher prevalence of diabetes mellitus (55.6%) compared to Algaili administrative unit (44.4%). The differences between two areas to some extent not greater because all the areas located in countryside. However, the group of residents of the countryside was characterized by a lower income and education level and a higher number of persons with disability pension [20]. Also, the finding was consistent with reports from studies done in Bangladeshi which stated that the prevalence of prediabetes was significantly increased with advanced age [21] and Southern Ethiopia, Sidama [22]. This could be because aging is often accompanied by an increased in body fat, which may contribute to the development of insulin resistance. In addition, the aging process is also associated with a decrease of βcell proliferative capacity and enhances sensitivity to apoptosis [23].

This study showed that the prevalence of diabetes mellitus was not significantly high among non-educated adult (38.9%) compared to other levels of education. This may be because knowledgeable people were more about the disease and how to avoid. The results matched several results such as Sacerdote., *et al*. [24] showed that, lower education level is associated with the high prevalence of T2DM in men and women in western European countries; even though it does not have a direct biological effect on disease, its effects are mediated by other risk factors that are biologically related to disease such as smoking, high BMI and physical inactivity. Similar results by Ross., *et al*. [25] reveal that there is association between educational level and T2DM incidence.

In this study the prevalence of type 2 diabetes mellitus was not significantly more prevalent among married adult (66.7%). The finding in contrast with other study that showed single was associated with diabetes and this was supported by the previous study in Brazilian population [26]. This may be due to the fact that a single person has been more stressed than a married person because a married person has the advantage of managing his or her economy, controlling unhealthful habits and adopting favorable lifestyles. There are increased levels of certain hormones such as cortisol during stress, which affects the action of insulin and causes insulin resistance [27].

The present study indicated that adult population who have family members more or equal 5 was not significantly have high diabetes mellitus (94.4%). This may be because the family with large members could affect the nutritional situation of the family and have greater chance to be genetically infected with DT2M.

Moreover, the study showed that housewives were not significantly having high prevalence of type 2 diabetes mellitus (66.7%). This may be because housewives always being inactive and rarely practiced sport. Similar finding that states diabetic housewives who are unemployed and largely inactive are more likely to develop obesity [28,29].

In addition the study showed that those who have monthly income ranged between 2000-2999 SDG were not significantly having high prevalence of type 2 diabetes mellitus (72.2%). This finding not in line with other study that showed People with low income have a higher prevalence of diabetes [30,31]. Food insecurity is often linked to a low income and therefore poverty [32,33].

Furthermore, the study revealed that those who were overweight and obese 15 (83.4%) were significantly having high prevalence of diabetes mellitus. This because obesity signifies excess adipose tissue. The fining in line with Pearson., *et al*. [34] report that, the risk of T2DM increases tenfold in people with a BMI over 30 kg/m^2. Again, Alberti., *et al*. [35] asserts that, interventional measures directed at reducing obesity had positive effects on reducing the incidence of T2DM.

In this study there was strong association was found between diabetes mellitus and adult who any chronic health problems. This may be because diabetes leads to excess risk for cardiovascular disease, and diabetic retinopathy is the leading cause of preventable sight loss among people of working age. The finding of the study matched other study that stated that people with diabetes are at a greater risk of a range of chronic health conditions including cardiovascular disease, blindness, amputation, kidney disease and depression than people without diabetes [36].

On the other hand the study showed that adult who having one of their family members having any chronic health problems (88.9%) was highly statistically significant with diabetes mellitus. However, the risk of developed type 2 diabetes mellitus was statistically significantly increased 3.520 times compared to family members who have-not any chronic health problems. This result indicated that presence of family history of T2DM is well established risk factor for developing the disease. Many studies proved this association such as a study conducted by Ramachandran., *et al*. [37] who stated that diabetes is a disease which has a strong clustering in families and has a genetic component. While other studies agree with the study finding showed that the risk of developing T2DM increases approximately two to four fold when one or both parents are affected [38], Alcolado and Alcolado [39]. Also, if either father or mother have diabetes in the family, it increases the risk by 15%, if both the parents are affected the risk increases by 75% [40] and having a first degree relative with type 2 diabetes increases the chance of developing diabetes by 40% [41]. While other study showed that maternal and paternal familial histories are associated with an earlier age of onset and poor glycemic control [42,43]. However, family history of diabetes may be a useful tool to identify the individuals at increased risk of developing the disease and target behaviour modifications that could potentially delay disease onset and improve health outcomes [44].

There was strong association between diabetes mellitus and number of meals intake per day in the current study. Also, adult who having three meals per day were significantly having high prevalence of diabetes (61.1%). In addition, the study found that the main dietary for the adult in the study area were carbohydrates. The prevalence of diabetes mellitus in this study may be due to intake of carbohydrates dietary that may influence the development of type 2 (non-insulin-dependent) diabetes, for example, through effects on blood glucose and insulin concentrations. Other international in line with the study finding showed that, the three meals were consumed at breakfast, lunch, and dinner, while in the one meal plan all foods were eaten during a four-hour time period in the early evening hours. During the one meal dietary regimen, morning plasma glucose concentrations were significantly increased [45].

Strong association was found between diabetes mellitus and practiced of periodic medical check-up. This may be because patients have symptoms of T2DM but not diagnosed. Therefore, knowledge of conducted of periodic medical check-up is very important for detection of DT2M. However, routine medical checkup is a form of preventive measures involving thorough history, physical examination and screening of asymptomatic persons by physicians on a regular basis as part of a routine health care process (WHO, 2010).

Conclusion

The prevalence of diabetes mellitus type 2 among the respondents aged 40 years old and above who took part in the study was 11.1%. This implies there is a higher proportion of a person living with DT2M in Rural Bahri Administrative Unit. Socio-demographic factors such gender, age, education level, occupation, residence, relation to member of family with diabetes type 2, and average monthly income were not significantly associated with diabetes type 2 ($P > 0.05$). Analysis of association of lifestyle factors and other factors and Prevalence of diabetes mellitus type 2 revealed that infected with any chronic health problems, types of chronic health problems, previous infection of one of family members with any chronic health problems (family history), types of infection of one of family members with any chronic health problems, frequency of meals intake per day, Types of intake any types of tobacco and alcohol, practiced of periodic medical check-up, type of practiced of periodic medical check-up and obesity were significantly associated with diabetes mellitus type 2 ($P < 0.05$).

Several limitations should be considered. First, our research enrolled the adult population only, which cannot reflect the rest of population in Rural Bahri Area. Second, variables such as dietary habits and practiced physical activity are not available in the data, which are considered as potential risk factors of diabetes.

Recommendations

As diabetes is a disease is prevalent in the study area, proper therapy methods with special emphasis on diet should be given by the healthcare providers in a way to control the disease, reduce the symptoms, and prevent the appearance of the complications. Ministry of health in Khartoum with assistance from academic institutes, should ensure that local diabetes prevalence and incidence data are collected for example through the recurring demographic and health survey (DHS) to increase the availability of information on current epidemiological trends of diabetes type 2. Active and effective dietary education may prevent the onset of diabetes and its complications. Further researches are urgently required to be implemented such as risk factors and prevention of diabetic complication among type 2 diabetic patients and relationship between type 2 diabetes mellitus and other co-morbidities such as hypertension and kidney disorders.

Bibliography

1. International Diabetes Federation, IDF; Diabetes atlas, 7th Edition (2016).

2. International Diabetes Federation. Diabetes: Facts and figures (2015).

3. Bagonza J., *et al*. "Adherence to anti diabetic medication among patients with diabetes in eastern Uganda; a cross sectional study". *BMC Health Services Research* 15.1 (2015): 168.

4. World Health Organization (WHO); Global Report on Diabetes (2016).

5. Einstein AJ., *et al*. "Patient-centered imaging: shared decision making for cardiac imaging procedures with exposure to ionizing radiation". *Journal of the American College of Cardiology* 63.15 (2014): 1480-1489.

6. Abdalla E and Ahmed R. "Epidemiology of diabetes among adults in Jabra area "block 14" in Khartoum state–Sudan: community based study". *The International Journal of Community Medicine and Public Health* 4.6 (2017): 1863-1869.

7. Noor SKM., *et al*. "Undiagnosed diabetes mellitus in rural communities in Sudan: prevalence and risk factors 21 (2015): 3.

8. Amanyire J., *et al*. "Prevalence and Risk Factors for Hypertension, Diabetes and Obesity among Lecturers and Support Staff of Bishop Stuart University in Mbarara, Uganda*". Open Journal of Applied Sciences* 9.03 (2019): 126.

9. Paudel VP. "Prevalence of Hypertension and Diabetes Mellitus in Political Cadres of Nepal". *Journal of College of Medical Sciences Nepal* 13 (2017): 345-349.

10. Lasky D., *et al*. "Obesity and Gender Differences in the Risk of Type 2 Diabetes Mellitus in Uganda". *Nutrition* 18 (2002): 417-421.

11. Mondo CK., *et al*. "The prevalence and distribution of non-communicable diseases and their risk factors in Kasese district, Uganda". *Cardiovascular Journal of Africa* 3 (2013): 52.

12. WHO STEPS. "STEPS Survey Country Reports". *World Health Organisation* (2012).

13. Ruhembe CC., *et al*. "Prevalence and awareness of type 2 diabetes mellitus among adult population in Mwanza city, Tanzania". *Tanzania Journal of Health Research* 16.2 (2014).

14. Premkumar D., *et al*. "The Role of Obesity in Producing Type 2 Diabetes by Insulin Resistance". *Diabetes and Obesity International Journal* 5.2 (2020): 000227.

15. Kirkman MS., *et al*. "Diabetes in older adults". *Diabetes Care* 35.12 (2012): 2650-2664.

16. CDC, smoking and diabetes (2014).

17. Stadlmayr A., *et al*. "Relations of vitamin D status, gender and type 2 diabetes in middle-aged Caucasians". *Acta Diabetologica* 52.1 (2015): 39-46.

18. Ekpenyong CE., *et al*. "Gender and age specific prevalence and associated risk factors of type 2 diabetes mellitus in Uyo Metropolis, south eastern Nigeria". *Diabetologia Croatica* 41.1 (2012): 17.

19. Kaminsky LA. "ACSM's health-related physical fitness assessment manual (4edition.). Philadelphia, PA:, Wolters Kluwer Health/Lippincott Williams and Wilkins (2014).

20. Dudzinska M., *et al*. "Type 2 diabetes mellitus in relation to place of residence: evaluation of selected aspects of socio-demographic status, course of diabetes and quality of life–a cross-sectional study". *Annals of Agricultural and Environmental Medicine* 20.4 (2013).

21. Akter S., *et al*. "Prevalence of diabetes and prediabetes and their risk factors among Bangladeshi adults: a nationwide survey". *Bulletin of the World Health Organization* 92 (2014): 204-213.

22. Zekewos A., *et al*. "Prevalence of diabetes mellitus and associated factors in Southern Ethiopia: a community based study". *Ethiopian Journal of Health Sciences* 28 (2018): 4.

23. Maedler K., *et al*. "Aging correlates with decreased β-cell proliferative capacity and enhanced sensitivity to apoptosis: a potential role for fas and pancreatic duodenal homeobox-1". *Diabetes* 55.9 (2006): 2455-2462.

24. Sacerdote C., *et al*. "Lower educational level is a predictor of incident type 2 diabetes in european countries: The EPIC-InterAct study". *International Journal of Epidemiology* 41.4 (2012): 1162-1173.

25. Ross SA and Ekoé JM. "Incretin agents in type 2 diabetes". *Canadian Family Physician* 56.7 (2010): 639-648.

26. Flor LS and Campos MR. "The prevalence of diabetes mellitus and its associated factors in the Brazilian adult population: evidence from a population-based survey". *Revista Brasileira de Epidemiologia* 20 (2017): 16-29.

27. Dallman MF. "Stress-induced obesity and the emotional nervous system". *Trends in Endocrinology and Metabolism* 21.3 (2010): 159-165.

28. AL-Shammari SA., *et al*. "Blood lipid concentrations and other cardiovascular risk factors among Saudis". *Family Practice* 11.2 (1994): 153-158.

29. Al-Malki JS., *et al*. "Overweight and obesity in Saudi females of childbearing age". *International Journal of Obesity* 27.1 (2003): 134-139.

30. Kim SH. "Maturity-onset diabetes of the young: what do clinicians need to know?" *Diabetes and Metabolism Journal* 39.6 (2015): 468.

31. Sims M., *et al*. "The socioeconomic gradient of diabetes prevalence, awareness, treatment, and control among African Americans in the Jackson Heart Study". *Annals of Epidemiology* 21.12 (2011): 892-898.

32. Levine JA. "Poverty and obesity in the US (2011).

33. Hamman RF., *et al*. "The SEARCH for Diabetes in Youth study: rationale, findings, and future directions". *Diabetes Care* 37.12 (2014): 3336-3344.

34. Pearson E. "Zinc transport and diabetes risk". *Nature Genetics* 46.4 (2014): 323-324.

35. Alberti L., *et al*. "Type 2 diabetes and metabolic syndrome are associated with increased expression of 11 β-hydroxysteroid dehydrogenase 1 in obese subjects". *International Journal of Obesity* 31.12 (2007): 1826-1831.

36. Gatineau M., *et al*. "Adult obesity and type 2 diabetes (2014): 5-14.

37. Ramachandran A., *et al*. "Burden of type 2 diabetes and its complications–The Indian scenario". *Current Science* 25 (2002): 1471-1476.

38. Klein BE., *et al*. "Components of the metabolic syndrome and risk of cardiovascular disease and diabetes in Beaver Dam". *Diabetes Care* 25.10 (2002): 1790-1794.

39. Alcolado JC and Alcolado R. "Importance of maternal history of non-insulin dependent diabetic patients". *British Medical Journal* 302.6786 (1991): 1178-1180.

40. Diabetes.co.k Diabetes and genetics (2017).

41. Viswanathan M., *et al*. "Familial aggregation of type 2 (non-insulin-dependent) diabetes mellitus in South India; absence of excess maternal transmission". *Diabetic Medicine* 13.3 (1996): 232-237.

42. Molyneaux L., *et al*. "Strong family history predicts a younger age of onset for subjects diagnosed with type 2 diabetes". *Diabetes, Obesity and Metabolism* 6.3 (2004): 187-194.

43. Bo S., *et al*. "Low birthweight and metabolic abnormalities in twins with increased susceptibility to Type 2 diabetes mellitus". *Diabetic Medicine* 17.5 (2000): 365-370.

44. Baptiste-Roberts K., *et al*. "Family history of diabetes, awareness of risk factors, and health behaviors among African Americans". *American Journal of Public Health* 97.5 (2007): 907-912.

45. Ahola-Olli AV., *et al*. "Circulating metabolites and the risk of type 2 diabetes: a prospective study of 11,896 young adults from four Finnish cohorts". *Diabetologia* 62.12 (2019): 2298-309.

46. World Health Organisation. Towards a strategy for Cancer Control in the Eastern Mediterranean Region.1st Edition". *Cairo, World Health Organization Regional office for the Mediterranean* (2010).

Volume 5 Issue 4 April 2021