

Original Research Article

Nutritional status and Food consumption Pattern of Type 2 Diabetic Patients in Aboudah Health Center, Kerri Locality, Khartoum State, Sudan

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Abstract: The study thus aimed at determining the nutritional status and food consumption pattern among diabetes type 2 patients in Aboudah Health Center, Khartoum, Sudan. The study was conducted with the participation of 100 type 2 diabetic patients (38 males and 62 females) receiving treatment Aboudah Health Center, Kerri Locality, Sudan. Data were collected using pretested, structured questionnaire to elicit information on the socio- demographic data, anthropometric measurement such as height and weight was measured to determine the nutritional status while 24 hour recall and food frequency questionnaire was used to assess the intake pattern of food. Data were analyzed using SPSS statistical package (version 21) and level of significance was set at $P < 0.05$. Majority (62%) were female, 31% illiterate and 90% had family history of diabetes while diabetes was diagnosed during the course of other disease (30%). Anthropometry assessment shows that the prevalence of overweight and obesity among the female respondents is higher (10% , 20% respectively) than male (15%,10%) , there was no significant difference ($P < 0.05$) between males and females . While fasting blood glucose, 2hrs postprandial blood glucose and HbA1C of diabetics were slightly higher than that normal range of 100-125mg/dL, 140 -200mg/dl and 4- 5.5 % respectively. The 24 –hour dietary recall shows that the mean of dietary fiber and energy intake/day of the respondents were below the dietary goals (1800 Kcal) (38g/day for male, 25g/day for women) respectively , also fat intake/ day was slightly above the dietary guideline (30g/day). Subjects of this study were mostly obesity and overweight. They had low intake of fiber and high intake of fat compared to recommended levels of type 2 diabetic patients. Non starchy vegetables, fruits and fish consumption pattern of the respondents were low, and diabetes was poorly controlled and can be contributed to lack of a appropriate level of physical activity. Study revealed the importance of educating patients with type 2 diabetes on dietary changes and more importantly the involvement in regular physical exercises.

Keywords: The nutritional status and food consumption pattern among diabetes type 2 patients in Aboudah Health Center, Khartoum, Sudan.

INTRODUCTION

Diabetes mellitus is a metabolic disorder characterized by chronic hyperglycaemia and disturbed carbohydrate, fat and protein metabolism and caused by defective insulin secretion, action, or both (Mohammed *et al.*, 2017, WHO 2018, WHO, 2015, Wahome & Kiboi 2016, Mohamed, 2018). Type 2 Diabetes (Non-Insulin Depended Diabetes Mellitus (NIDDM) is as a result of insulin resistance of the body cells which may be combined with relatively reduced insulin secretion. It is the most common type (Ansari *et al.*, 2019, Zanetti 2017, Firouzi *et al.*, 2015). Insulin may be present often in normally large amount. The pancreas becomes less able to produce insulin. People with type 2 Diabetes

must take insulin to supplement their own insulin (Wahome & Kiboi 2016).

Diabetes mellitus is a major public health concern, statistical estimations revealed that the total number of diabetic individuals would be 65% in the world (380 million) by 2025 (Ansari *et al.*, 2019). In 2014, The middle East and North Africa had the highest age-adjusted global prevalence of diabetes (about 11%) and the prevalence in Sudan was about 18% (IDF, 2014). The WHO estimated the prevalence of type 2 diabetes in Sudan to be 3.5% among males and 3.4% among females (WHO, 2016). In addition World Health Organization (WHO, 2016) estimated Prevalence of

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diabetes and related risk factors as shown below: diabetes, Overweight, and Obesity 6.6%, 25.0%, and 6.6% respectively (Mohamed, 2018).

Hyperglycaemia might lead to chronic, irreversible tissue damage. Long-term complications include nephropathy, retinopathy, neuropathy, cardiovascular diseases, peripheral vascular diseases delayed healing, periodontal diseases, Stroke and blindness (Tunrayi, 2013). (Sima &Glogauer, 2013)

Nutritional status is the conditioned of health of individuals as influenced by the utilization of the nutrient. It can be determined only by the correlation of information through a medical and dietary history, although physical examination and appropriate laboratory investigations (Singh *et al.*, 2015). In Sudan, several factors, such as changes in dietary pattern and socio-economic status, have contributed to the increased prevalence of non-communicable diseases, include diabetes (mohammed *et al.*, 2017).

Nutritional investigation is an integral part of diabetes management and self-care education aiming at the attainment and maintenance of optimal metabolic outcomes. However, cross-sectional studies in Africa indicate

Low adherence to dietary recommendation for macronutrients intake and fruits and vegetables consumption among diabetic patients (WHO/FAO, 2004, Oladapo *et al.*, 2013, Wahome &Kiboi 2016). Fruits and vegetables consumption has been found to be associated with decreased incidence of diabetes and mortality from a variety of health outcomes including obesity, hypertension and cardiovascular diseases (Thomas *et al.*, 2015, Mohamed, 2018).

Diabetics were less devoted to the Mediterranean diet, which is rich in vegetables, fruits, fish, cereals, and olive oil (Pomerleau &Knai,2005), they encounter troubles following food-revised strategies that would incorporate appropriate education on how to make healthy food choices (Fadupin *et al.*, 2000, Oladapo *et al.*, 2013). Therefore, the study aims at assessing the nutritional status and food consumption pattern of type 2 diabetics in Kerri locality, Khartoum State, Sudan.

MATERIALS AND METHODS

The study was a descriptive cross-sectional survey of type 2 diabetes attending Aboudh Medical Center, Kerri Locality, Khartoum State between April and June 2018. All procedures will be subjected to ethical approval prior to commencement of the study objectives, steps and expected outcome of the research will be explained to the participants. Handeret (100) respondents with type 2 diabetics were systematically selected based on the admission list. Structured questionnaire was used to collect information on the

socio-demographic characteristics, anthropometric, medical history and dietary consumption pattern. Data on fasting blood glucose level(FBG), 2hrs postprandial blood glucose (2hppBG), and HbA1C(%) of the Respondents were also collected. Salter scale and stadiometer were used to take weight and the height of the respondents respectively. Body mass index (BMI); was used to determine the nutritional status, it calculated as the weight in kilograms divided by the square of the height in meters. It is classified according to the (WHO 2000,AL-Rethaiaa *et al.*, 2010) classification criteria for adults as underweight(BMI less than 18.5) normal (18.5- 24.9), overweight (25-30), and obese (BMI above 30) { WHO 2012}.

The dietary information's were investigated with a 24-hour diet recall (based on three consecutive days), and food frequency questionnaire {Hall *et al.*, 2009, Delvarianzadeh *et al.*, 2016, shaneshin *et al.*, 2013}. In the 24-hour diet recall questionnaire, the participants were asked to recall and report their consume food material during the previous 24 hour including drinks and dietary complements.

None of the participants female were pregnant or breast feeding at the time of the study. The statistical analysis was performed using SPSS version 21. Chi-squared and t-tests were used to determine significance difference between male and female respondents. The data collected was also analyzed using simple description analysis such as percentages and frequency counts. The significance level was set at P<0.05.

RESULT

The socio demographic characteristics are given in table 1. Majority of the respondents (62%) was female while 38% were male; 40% were within the age range of 41-50 years. Majority (86%) were married while 31% illiterate and 17% of them were unemployed. A medical record of the patients shows that 90% had family history of diabetes; diabetes was diagnosed in the hospital during medical check up (60%). duration of illness for 38% was more than 10 yrs while 16% of them was 1-5yre. Patients were diagnosed to have other complications such as Hypertension (41%), Leg ulcer (14%), Kidney disease (12%), and (15%) had no any complications. Majority of the respondents (94%) had regular blood glucose check-up. Majority of the respondents (81%) were on hypoglycemic drugs and diet therapy while remaining 19% are on drugs treatment alone. Lifestyle of patients reveals that high percentage (64%) have no regular activity pattern (Table 2).

Nutrition status of the respondents is presented in table 3. 45% of the respondents had a normal nutritional status, while 30% of them were obese, 15% were overweight and 10% were underweight. In this study. The prevalence of overweight and obesity among the female respondents is higher (10%, 20%

respectively) than male (15%,10%) , there was no value > 0. 05.
 significant difference between males and females p-

Table 1- Socio- demographic characteristics of respondents

Characteristics	Frequency	Percentage (%)
Sex		
Male	38	38.00
Female	62	62.00
Total	100	100.00
Age (yrs)		
31-40	6	6.00
41-50	40	40.00
51-60	24	24.00
61-70	7	7.00
71-80	19	19.00
81-90	4	4.00
Total	100	100.00
Marital Status		
Single	8	8.00
Married	86	86.00
Widow	3	3.00
Divorced	3	3.00
Total	100	100.00
Education Level		
Illiteracy	31	31.00
Khulwa	11	11.00
Primary	19	19.00
Secondary	23	23.00
University /post	16	16.00
Total	100	100.00
Occupation		
Unemployed	17	17.00
Retired	3	3.00
Worker	3	3.00
Officer	16	16.00
Business	7	7.00
House Wife	54	54.00
Total	100	100.00

Table 2- Medical History of the respondents

Medical History	Frequency	Percentage (%)
Family history of diabetes		
Yes	90	90.00
No	10	10.00
Other diseases part from diabetes		
Hypertension	41	41.00
Heart Failure	5	5.00
Kidney problems	12	12.00
Visual problems	7	7.00
Leg ulcer	14	14.00
No	15	15.00
Regular blood glucose check-up		
Yes	94	94.00
No	6	6.00
Total	100	100.00
Duration of illness		
<1 yrs	20	20.00
1-5yrs	16	16.00
6-10yrs	31	31.00
>10 yrs	38	38.00

Total	100	100.00
First Knowledge of diabetes		
Before coming to clinic	10	10.00
During routing medicalcheckup	60	60.00
During treatment of a disease	30	30.00
Total	100	100.00
Regular physical activity pattern		
Yes	36	36.00
No	64	64.00
Total	100	100.00
Type of treatment		
Drug only	19	19.00
Drug and Diet	81	81.00
Total	100	100.00

Table- 3 Nutritional status of the respondents according to sex

Nutritional status	Male (38)	Female (62)	Total	P-value
Under weight(BMI<18.5kg/m ²)	6(6.00%)	4(4.00%)	10(10.00%)	0.083
Normal weight(BMI 18.5-24.9 kg/m ²)	17(44.74%)	28(45.16%)	45(45.00%)	
Over weight (BMI 25-29.9kg/m ²)	5(5.00%)	10 (10.00%)	15(15.00%)	
Obese (BMI 30kg/m ² and above)	10(10.00%)	20 (20.00%)	30(30.00%)	

The mean fasting glucose levels \pm SD, 2hrs postprandial blood glucose (2hppBG), and HbA1C of the Respondents were 215.60 \pm 63.58 (mg/d), 297.92 \pm 71.21 (mg/d), and 12.09 \pm 1.64 (%) respectively. There was significant difference (P< 0.05)

between the fasting blood glucose levels of the respondents. The men had a mean blood glucose level of 12.09 mg /dL, while the women had mean blood glucose level of 216.00 mg/dL (Table4).

Table (4) Fasting blood glucose, 2hrs postprandial blood glucose and HbA1C of the Respondents according to sex

Parameter	Male Mean \pm SD	Female Mean \pm SD	Total Mean \pm SD	Normal	P-value
Fasting blood glucose level (FBG) (mg/dL)	12.09 \pm 1.64 \pm 62.0	216.00 \pm 65.05	215.60 \pm 63.58	100-125 mg /dL (5.6- 6.9) mmol/	0.030
2hrs postprandial blood glucose(2hppBG) (mg/dL)	299.72 \pm 72.27	296.04 \pm 70.04	297.92 \pm 71.21	140 -200mg/dl (7.8-11.1mmol/L)	0.076
HbA1C(%)	10.30 \pm 1.44	13.79 \pm 1.73	12.09 \pm 1.64	4- 5.5 %	0.097

The food consumption pattern of respondents is given in table 5. Majority (60%) consumed cereals once per day while 6%, 9%, and 10% consumed poultry/ egg, fish, and meat respectively once per day . Half (50%) of the respondents consumed non- starchy vegetable once per day while 39%, 20% of them consumed fruit rarely or don't eat it respectively. Fried foods were consumed by 38% twice per week while milk and milk products was consumed by 30% of the respondents once per day. Table 6- shows the

macronutrients intake of the respondents. The mean energy intake was 1722 \pm 163.1 Kcal and 1520 \pm 170 Kcal for male and female respectively while carbohydrates intake was 216 \pm 12.8 (g) and 288 \pm 19(g) for male and female respectively. The mean protein intake was 93.2 \pm 8.2 (g) and 76.8 \pm 8.6 (g) for male and female respectively while the mean dietary fiber intake was 14.8 \pm 1.3 (g) and 12.9 \pm 2.9 (g) for male and female diabetics.

Table 5 Respondents frequency of food consumption

Food groups	No of time/day				No of time/week				Never	Occasional
	1	2	3	4	1	2	3	4		
Cereals	60(60.00)	15(15.00%)	3(3.00%)	-	-	-	4(4.00%)	13(13.00%)	-	5(5.00%)
Meat	10(10.00%)	4(4.00%)	5(5.00%)	-	9(9.00%)	15(15.00%)	7(7.00%)	5 (5.00%)	26(26.00%)	19(19.00%)
Poultry/egg	6(6.00%)	-	-	-	-	-	-	-	92(92.00%)	2 (2.00%)
Fish	9(9.00%)	-	-	-	26(26.00%)	10(10.00%)	-	-	14(14.00%)	41 (41.00%)
Non-starchy										
Vegetables	50(50.00%)	36(36.00%)	-	-	2(2.00%)	5 (5.00%)	-	-	7(7.00%)	-
Legumes/ Nuts	25(25.00%)	20(20.00%)	19(19.00%)	11(11.00%)	8(8.00%)	-	-	-	14(14.00%)	2(2.00%)
Fruit	15(15.00%)	-	-	-	15(15.00%)	11(11.00%)	-	-	39(39.00%)	20 (20.00%)
Fried foods	5(5.00%)	-	-	-	23 (23.00%)	11(11.00%)	-	-	39(39.00%)	20(20.00%)
Milk and milk Products	30(30.00%)	15(15.00%)	4(4.00%)	-	13(13.00%)	10(10.00%)	8(8.00%)	6(6.00%)	8(8.00%)	6(6.00%)

Occasional= once in two month or less

Table 6- Mean macronutrients intake of the respondents

Nutrients	Male Mean± SD	Female Mean± SD	Total Mean± SD	P-value	Reference
Energy(Kcal)	1722±163.1	1520 ±170	1596±243.55	0.060	1800 Kcal
Protein (g)	93.2±8.2	76.8 ±8.6	84.9 ±9.05	0.876	-
Carbohydrate(g)	216±12.8	288 ± 19	284 ±19.95	0.091	-
Fat(g)	65.8±5.0	52.6±12	59.05±7.77	0.130	30g/ day
Fiber (g)	Fiber (g)	6.3±2.9	6.75±2.83	0.081	25- 38g/ day

DISCUSSION

The aim of this study is to assess the nutritional status and food consumption pattern of diabetics in Karari locality, Khartoum state, Sudan. The study shows that majority of the respondents were 41 to 50 year and quarter of them (24%) were 51to 60% , this is similar to finding of Ansari *et al.*, 2019, Mwann *et al.*, 2018, Wahome &Kibi 2016 and Tunrayo, 2013. WHO reported that majority of people with diabetes are 41year and above, it means that diabetes type 2 mostly occurs in mid-year of life. According to WHO (2003) majority of diabetes type 2 cases are above 45years of age. This may be attributed to glucose intolerance associated with increase in age. As the age increase cell sensitivity to insulin also reduces. This insensitivity could be due to physical inactivity associated with advancing age. Additionally, highest frequency of diabetic respondents was observed in females (62%) as compared to males (38%). The increased prevalence of diabetes among female could be possible since most women lead a sedentary life , are more obese and engage in less strenuous activities as compared to the men. Similar finding have also been reported in other studies (Ansari *et al.*, 2019, Mwann 2018, Wahome &Kibi 2016 , Ahmad *et al.*, 2011, Oladapo 2013).

Majority (86%) of the respondents were Married , this finding lower than that reported in their counterparts in Saudi Arabia (73.5%)(Ansari *et al.*, 2019), and Lebanon(81.9%)(Naja *et al.*, 2012), Sudan (60%) (Mohamed *et al.*, 2017) Ethiopia (81.2%) (Kassahu 2016). One third of the respondents (31%)

were illiterate . Establishing that patient's education can lead to better over this disease. There was strong association between education level and nutrition knowledge of the respondents. This could be attributed to the fact that when one is educated , they are exposed to diversified sources of dietary information which would impact positively on their nutritional knowledge and is able to choose health food and maintain optimal weight (Wahome &kiboi 2016). American Diabetes Association (ADA) has also stressed the importance of patients education in the management and prevention of chronic complications of such a community health problem(ADA 2003) , this percentage is lower than that finding conducted by Tunrayo, 2013 (35%) but higher than that found by Wahome &Kibi 2016 (15.6%).

Lifestyle of patients reveals that majority of the respondents (64%) has no regular activity pattern. This percentage is one- fold higher than that reported by Oladapo *et al.*, 2013 who found that 70%of the respondents did not exercise regularly, and also Firouzi *et al.*, 2015 found 59% of the subjects rarely or never exercised.

Similar data from diabetic patients in Sudan which conducted by Mohammed 2013, and Mohammed 2013 they found that the majority of diabetic patients do not perform physical activity regularly (64%), (63,6%) respectively, in Kelantan also showed that the majority of diabetic patients do not perform physical activity regularly (Abougambou *et al.*, 2010), in Malaysia

(59.6%) (Firouzi 2015), and in Sri Lanka (69%) (Senadheera *et al.*, 2016). The association between increasing physical activity levels and improvements in glycemic control has been demonstrated by several studies (Zanett 2017, Aylin *et al.*, 2009). Diet and drug therapy is vital to ensure the successful outcome of diabetes management. In this study, majority (81%) of diabetes were on oral hypoglycemic drugs and diet, the use of diet in the treatment of adult onset diabetes and the combination of drugs and diet in the treatment of juvenile onset diabetes has been recommended (Krause & Mahon 1984). However, my findings is different from the finding of Oladapo *et al.*, 2013, they found out that about 60% diabetics were in both drug and diet. In regard to nutritional status, about one third (30%) of the respondents were obese and 15% were overweight. This could explain the occurrence of diabetes since overweight and obesity have been linked to diabetes. Obesity is one of the predisposing factors to diabetes type 2. It results from poor feeding habits and lack of physical activity. Notably, one in three of the world's adult are overweight and one in ten is obese (Wahome & Kibi 2016).

Overweight and obesity are associated with increased resistance of the cells to the insulin activity. My result could be because of low level of physical activities among the diabetics.

The prevalence of obesity in this study is slightly lower than that reported in their counterparts in Kenya (50.9%) (Wahome & Kibi 2016), but higher than that in Nigeria (11.67%) (Oladapo *et al.*, 2013), Ethiopia (9.4%) (Kassahun 2016) and India (15%) (Singh *et al.*, 2015). Similar finding have reported in other studies (31.11% Tunrayo 2013, (32.8%) (Mohammed, 2013).

This prevalence of overweight is considered lower than that reported in their counterparts in Sudan (43.9%), (41.8%) (Mohammed, 2013 and Mohammed, 2013 respectively) and Ethiopia (33%) (Kassahu 2016), Nigeria (21.67%) (Oladapo *et al.*, 2013), Nigeria (48.89%) (Tunrayo 2013),

Similar finding have also been reported in other studies (Wahome & Kibi 2016, Singh *et al.*, 2015). The fasting blood glucose, 2hrs postprandial blood glucose and HbA1C of diabetics in this study was slightly higher than that normal range of 100-125mg/dL, 140-200mg/dl and 4-5.5% respectively. This indicates that diabetes was poorly controlled. This could be because of non-compliance to the stipulated dietary guidelines for diabetics, this finding slightly higher than that reported in their counterparts in Nigeria (Oladapo *et al.*, 2013) who reported that fasting blood glucose was 6.84 ± 1.30 mmol/L, and Malaysia (Firouzi *et al.*, 2015) he found that fasting blood glucose was 7.2 ± 2.0 mmol/L, Northeast Ethiopia (Fiseha 2018) above 130 mg/dl (>7.22 mmol/L) and HbA1c was $7.6 \pm$

1.4%. But lower than that finding have also been reported in Sudan by Mohammed 2018 he found that FBG was 229.18 ± 66.17 mg/dL, 2hrs postprandial blood glucose was 313.09 ± 61.14 mg/d, and HbA1c was lower (10.40 ± 2.27 %) than in this current study. Statistically significant difference regarding mean present fasting blood glucose level was observed between male and female diabetic patients even at 5% level of significance. This difference might be occurred due to performing exercise, restricted diet and taking proper medicine.

Such levels of are a concern as tight glycemic control is important to prevent or minimize the development of diabetes-related complications in patients with type 2 diabetes (Abougalambou *et al.*, 2010, Firouzi *et al.*, 2015).

Fruit and vegetables are important component of a healthy diet and their sufficient daily consumption could help prevent and manage diseases such as cardiovascular diseases, diabetes mellitus and certain cancers (Mohammed *et al.*, 2017, WHO/FAO 2004, Oladapo 20013). This study shows that non-starchy vegetables were consumed by 50% of the respondents once a day and 39% of them consumed it twice per day. This below the minimum recommended consumption of five serving per day, (WHO 2003, Oladapo 2013). These results were compared to the food pyramid published by the World Health organization (WHO) (Ansari 2019, and found that there was a poor intake of non-starchy in these patients.

A majority of patients (39%) did not consumed fruit at all and 20% of them consumed it occasionally. Comparing these results to the food pyramid, they should at least take 2-4 serving per day (Ansari 2019), so there was a poor intake of fruits in the majority of patients studied. The low intake of fruits and vegetables among the diabetics could be because of low level of awareness on the importance of fruits and vegetables to diabetes management as vegetables contain fiber, which helps reducing cholesterol thereby controlling blood glucose, or this can be attributed to insufficient income, high prices and unavailability of these food items. Similar finding have also been reported in other studies (Mohammed *et al.*, 2017, Bakr 2015, Oladapo 2013).

Some types of fatty fish contain unique polyunsaturated fats called omega-3 fatty acids. The omega-3 is recommended for individuals with diabetes because of its beneficial effects on lipoproteins, prevention of heart diseases, and association with positive health outcomes in observational studies. In this study majority of the respondents (41%) consumed fish occasionally and 14% of them do not consumed it, Comparing these results to the food pyramid, they should at least take 2-3 serving per day (Ansari 2019), so there was a poor intake of fish in the majority of

patients studied . The recommendation for people with diabetes to eat fish (particularly fatty fish) at least two times (two servings) per week (Gray 2015). This result disagree with Ansari 2019 .

Despite the high prevalence of overweight and obesity in this population, the 24 –hour dietary recall shows that the mean of energy intake of the respondents was below the dietary goals (1800 Kcal), but the fat intake was above it (30g/day) this might explain why some respondents were overweight and obese. The effect of dietary fiber on glycaemic control is modest, however may improve serum cholesterol and cardiovascular risk factors(Zanetti 2017). In this study shows that the mean of dietary fiber intake is slightly lower than recommended (25g/day for women and 38g/day for men). This finding indicated low adherence to dietary recommendation for macronutrient intake on fruits and vegetables consumption among diabetics. Also diabetics were less devoted to the Mediterranean diet, which is rich in vegetables, fruits, fish, cereals and olive oils. This is similar to Firouzi *et al.*, (2015), and Mohammed (2013).

My limitation was in the collecting of the data from the outpatients as there was lack of cooperation from many of the patients as they think it is a waste of time or will not help them or make a change in their life. Despite these inherent limitations, data from this study can be used as a baseline for further research in this area.

CONCLUSION

Subjects of this study were mostly obesity and overweight. They had low intake of fiber and high intake of fat compared to recommended levels of type 2 diabetic patients. Non starchy vegetables, fruits and fish consumption pattern of the respondents were low and diabetes was poorly controlled and can be contributed to lack of a appropriate level of physical activity. This could be attributed to low level of awareness on the importance and benefit of vegetable, fruits, fish and physical activity in the management of diabetes. Study revealed the importance of educating patients with type 2 diabetes on dietary changes and more importantly the involvement in regular physical exercises.

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