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RESEARCH ARTICLE

ADHERENCE TO DIETARY GUIDELINES AND DIETARY PATTERNS OF TYPE 2 DIABETIC PATIENTS IN MOI TEACHING AND REFERRAL HOSPITAL, KENYA.

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Abstract

Background: Diabetes is a challenging disease to manage successfully. It is estimated that the prevalence of diabetes in Kenya is at 4.6% among adult patients. Although the care regimen is complex, patients with good diabetes self-care behaviors can attain excellent glycemic control. It is vital that patients adhere to their stipulated routines to minimize the burden of the disease on the health care systems. The purpose of this study was to determine adherence to dietary guidelines and dietary patterns among type 2 diabetic patients at Moi Teaching and Referral Hospital (MTRH), Kenya.

Methods: A cross sectional research design with mixed methods approach was used and included a total of 313 respondents with type 2DM at MTRH. Systematic random sampling was used to select type 2 diabetic patients from the outpatient clinic while purposive sampling was used to select key informants and patients for Focus Group Discussion. Descriptive and inferential statistics was used to analyze the quantitative data while qualitative data was analyzed thematically.

Results: Majority (80%) of the patients followed diet recommendations as per the counseling given by the hospital nutritionist. The patients had reduced sugar and alcohol intake, consumed foods rich in starch and had reduced intake of salt and processed food. Beef and fish was consumed at least once monthly by 31.3% and 34.2% of patients respectively. Fresh milk and fermented milk was consumed daily by 52% and 38% of patients respectively while chicken was consumed 1 to 3 times monthly by 54% of the respondents.

Fruits and nuts were rarely consumed. Fruits were the least frequently eaten. Bananas (5.1%), mangoes (5.8%), pawpaw (18.2%), avocado (8.3%) and oranges (5.8%) were eaten once a week.

However, there was increased intake of milk and meat products.

Conclusions: Type 2 diabetes mellitus patients had high levels of adherence to dietary guidelines. However, the patients had high intake of foods that are high in saturated fat that is not suitable for the management of diabetes. A more personalized dietary counselling is recommended to enhance adherence to dietary guidelines for type 2DM patients. We recommend a revision of the guidelines to inform patients of foods high in saturated fats.

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Introduction:-

Ensuring patients' adherence to diabetic medications and dietary modifications to prevent complications of diabetes remains a major challenge to public health in many developing countries. Diabetes mellitus (DM) is a disease of concern for both developed and developing countries [1]. In adults, the prevalence of DM worldwide was estimated to be 8.3% in 2011 and is expected to rise to 9.9% by the year 2030, largely due to lifestyle and other factors [2]. In sub-Saharan Africa, the prevalence of diabetes has not been well established and varies widely. For example, in Benin, the prevalence of diabetes is 3% [3], 10.2% in Zimbabwe [4], and 14.5% in the Democratic Republic of Congo [5]. Type 2 diabetes mellitus (type 2 DM) is the most common form of diabetes in sub-Saharan Africa, constituting 90-95% of all cases of diabetes [6]. About 6% of adults in Ghana are affected with type 2 DM [7].

It is estimated that the prevalence of diabetes in Kenya was at 3.6% in 2013 [8] and has risen to 4.6% in 2015 [9].

However, two-thirds of diabetic patients may be undiagnosed. Diabetes is a major public health concern as it increases the burden of communicable diseases [10] particularly in resource constrained environments where non communicable diseases (NCDs) continue to exert pressure on the Public Health systems. This intensifies the burden of the disease leading to worse clinical outcomes, frequent hospitalizations, increased health care needs and increased health care cost [11]. In Kenya, diabetes is among the leading cause of morbidity and mortality [12]. Over 50% of all hospital admissions and 55% of hospital deaths in Kenya are due to NCDs diabetes being among the leading according to the Ministry of Public Health of Kenya [13]. NCDs have significant social and economic implications in terms of health care needs, lost productivity and premature death. This poses a serious setback to attainment of Sustainable Development Goal (SDG) of ensuring healthy lives and promoting well-being for all at all ages [14].

Several studies have shown the advantage of healthy dietary customs and regular exercise in the prevention and management of type 2 diabetes mellitus [15] and [16]. The diet composition is one of the best known dietary patterns for its beneficial effects on individual health that may act beneficially against the development and progression of type-2 diabetes, including reduced oxidative stress and insulin resistance [17]. The American Diabetes Association [18], has identified beneficial effect of the dietary pattern on diabetes mellitus and glucose metabolism in general. Traditional food pattern is associated with a significant reduction in the risk of developing type-2 diabetes. The dietary pattern emphasizes a consumption of fat primarily from foods high in unsaturated fatty acids and encourages daily consumption of fruits, vegetables, low fat dairy products and whole grains, low consumption of fish, poultry, tree nuts, legumes and less consumption of red meat.

Adherence to lifestyle modification recommendations can lessen the disease burden and reduce the morbidity and mortality associated with type 2 diabetic complications. Poor commitment to self-management including adherence to diet and exercise recommendations of diabetic patients is more prevalent. Therefore primary prevention based on strict adherence to dietary patterns must be advocated in health policies worldwide to control diabetes mellitus, particularly in developing countries [19].

Adherence to dietary guidelines still remains a concern to health care providers in Kenya. Poor management and increasing prevalence of diabetic risk factors are critical hindrances to overcoming diabetes in Kenya [20]. This is revealed by patients presenting with complications, increased hospital admissions, unproductivity and long stay in hospital straining the limited resources in the healthcare system. Effective lifestyle modifications including counseling on adoption of a healthy dietary pattern together with physical activity are the cornerstone in the management of type-2 diabetes [21]. In this study we present the findings of levels of adherence to dietary guidelines and the dietary patterns for type 2 diabetic patients at a large referral hospital in Kenya.

Methods:-

The study was conducted at the Moi Teaching and Referral Hospital (MTRH), the second largest referral hospital in Kenya. A cross sectional study design with a mixed method approach was used. The study was carried out among diabetic type 2 patients in the diabetes clinic at the referral hospital.

The study involved 313 type 2 diabetic patients systematically sampled at the diabetes clinic who met the inclusion criteria. Approximately 90 patients were selected to participate in the study every week for a period of one month. A list of patients attending clinic on specific days was used as the sampling frame. From the list every 5th patient was selected at random. This method was applied systematically until 30 subjects were obtained daily. Key informants (nutritionist and a nurse) and type 2DM patients were purposively selected to participate in the qualitative aspects of the study. Data was analyzed by use of descriptive statistics with SPSS version 20.

Adherence to dietary intake was measured by use of a semi-quantitative Food Frequency Questionnaire and data was analyzed based on 5 food groups. The analysis of FFQ data was compared with the dietary guidelines to establish the levels of patients' adherence. Qualitative data was transcribed, and thematically analysed.

The study was approved by Moi University and MTRH Institutional Research and Ethics Committee (IREC) (0001406) and Informed consent obtained from the participants.

Results:-

The dietary guidelines at the diabetic clinic at MTRH states that patients should avoid ready-sugar carbohydrates (Table 1). Patients are also advised to reduce the salt intake and increase intake of vegetables and fruits.

Table 1:- All the 313 participants were type 2DM patients attending Diabetes clinic at MTRH. The mean age was 51.76 ±16.34 years. About half (54.6%) were females (54.6%), majority were married (70%) and 33.2% were farmers (Table 2).

Table 2:- Dietary patterns based on FFQ data was categories from daily, weekly or monthly intake of food items (Table 3). Milk and chicken were the most commonly consumed animal source foods. Fresh milk and fermented milk was consumed daily by 52% and 38% of patients respectively while chicken was consumed 1 to 3 times monthly by 54% of the respondents.

Table 3:- Beef and fish was consumed at least once month by 31.3% and 34.2% of patients respectively (Table 3). The most commonly consumed vegetables were kales, spinach, tomatoes and black night shade leaves (*managu*) taken at least 5-6 times per week by 35.5%, 35%, 41.9% 42.8% and 42.8% respectively (Table 3). Amaranthus and pumpkin leaves were taken at least 2-4 per week by 40% of the patients. Cowpea leaves, spider plant (*saga*), lettuce cucumber and eggplant were consumed rarely or not eaten at all. Fruits were the least frequently eaten. Bananas (5.1%), mangoes (5.8%), pawpaw (18.2%), avocado (8.3%) and oranges (5.8%) were eaten once a week (Table 3).

Common starches consumed were maize meal (*ugali*) and grain porridge from millet or sorghum which were eaten 1-3 times daily by 38.6% and 37.4% of the patients. Cassava and arrowroots were consumed 1-3 times per month (Table 3).

Similar to fruits, groundnuts were rarely consumed by these patients (26.8%); table 3). Green grams and peas were the most common consumed legumes two to four times of the week (32% and 28% respectively).

Water (49.6. %) and tea (69.5%) were taken by patients at least 1-3 times daily day while soda (76.7%), coffee (87.9%), soya (79.9%) cocoa (87.2%), commercial fruit juice (91.1%) and alcohol (93%) were taken less than once in a month by majority of the patients. Alcohol was not consumed by 93% of the patients and no one reported to have taken alcohol daily (Table 3).

Discussion:-

We found that type 2 diabetes mellitus patients at a large referral hospital in Kenya adhere to the dietary guidelines provided by the hospital health care team. However, the dietary guidelines did not inform patients on animal source foods high in saturated fats and we found a high intake animal source foods in the dietary patterns of type 2 DM patients. Dietary patterns have an important role against insulin resistance, prevention and management of type 2DM. Epidemiological studies have revealed that dietary patterns high in fiber-rich food items such as vegetables, fruits, whole grains and nuts, plus white meat sources like poultry and fish could have protective effects against the incidence of DM[22].

In this study, patients with type 2DM at MTRH reported a daily intake of milk, and a weekly and monthly intake of various meats (beef, fish, liver, fresh milk and fermented milk and chicken). Animal source foods are known sources of saturated fat [23]. Consumption of animal source foods is considered to increase intake of saturated fats and should therefore be reduced to a minimum and be replaced with vegetable oils [24]. An individual should aim at consuming not more than 2-3 grams of fat per serving of food. Saturated fat is a problem for people with diabetes. The more the fat in the diet, the longer the time insulin has in getting glucose into the cells. Conversely, minimizing fat intake and reducing body fat help insulin do its job much better [25]. Furthermore people with diabetes are at a greater risk of developing or have already high levels of fats in their heart and blood vessels [26].

In MTRH patients with type 2 diabetes are advised to ensure that their meals are nutritionally balanced including all the three food groups; energy giving, body building and protective food. They are also encouraged not to use sugar or sugary foods, reduce consumption of fried foods and food high in fat, increase physical activity, reduce intake of salt and processed food, increase intake of green leafy vegetables and fruits, take plenty of water (8-10 glasses per day), eat small but frequent meals per day, not to skip meals, to avoid smoking and alcohol consumption which is consistent with ADA 2016 guidelines[18]. In our study, a good number of type 2DM patients partly adhered to dietary guidelines. Good adherence to treatment including dietary modifications is effective in reducing diabetes complications while improving patients' quality of life and life expectancy [27]. Though this study reported a high adherence to dietary guidelines especially intake of complex carbohydrates and reduced alcohol intake, non-adherence has also been reported in some other studies [28].

We found that patients reduced alcohol intake and smoking as per the nutrition counseling guidelines at MTRH. Alcohol influences glucose metabolism in both diabetic non-diabetic patients [29]. And inhibits both gluconeogenesis and glycogenolysis. Acute alcohol intake without food may provoke hypoglycemia, especially in cases of depleted glycogen stores. Moderate consumption of alcohol is associated with a reduced risk of atherosclerotic disorders. Alcohol intake and smoking is associated with diabetic complications [30] like cardiovascular and renal diseases.

Dietary guidelines should emphasize on low consumption of saturated fats, daily consumption of fruits, vegetables, low fat dairy products and whole grains. This helps to reduce oxidative stress and insulin resistance. Oxidative stress has been implicated as a contributor to both the onset and the progression of diabetes. Some of the consequences of an oxidative environment are development of insulin resistance, β -cell dysfunction, impaired glucose tolerance, and mitochondrial dysfunction, which can lead ultimately to the diabetic disease progression. It can be reduced by controlling hyperglycemia and calorie intake. It's of concern that type 2DM patients at MTRH were consuming high levels of source of saturated fats and less vegetable and fruits. A diet consisting of lean meat, fish, fruits and vegetables, eggs and groundnuts, but not dairy products, salt or refined fats, and sugar has been associated with marked improvement of glucose tolerance [31]. Increased diversity in fruit and vegetable intake is linked to reduced incidence of chronic diseases such as diabetes while limited diversity is associated with negative health outcomes such as micronutrient deficiency [32]. Micronutrients help to improve insulin sensitivity. Many micronutrients exhibit anti-inflammatory or immuno-modulatory functions. The vitamins A, B6, B9, B12, C, D, and E as well as essential fatty acids and several trace elements for example zinc, iron and selenium are known to improve the overall function of the immune system hence reducing disease progression and diabetes related complications [33]. Seasonality of fruits and vegetables make the patients with diabetes suffer from difficulty of taking the recommended type and amount of fruits and vegetables leading to poor dietary practice [34]. In this study fruits and vegetables consumed was based on seasonal availability, which could lead to reduced diet diversity in fruits and vegetable intake. This could be attributed to the cost as fruits in season are inexpensive and may be affordable to the patients.

We found a high number of diabetes patients consumed foods rich in starch such as maize meal (*ugali*), which is a low glycemic index food. Consumption of foods rich in carbohydrates for example beans and maize has a strong inverse association with incidence of diabetes complications [35]. In addition high carbohydrate intake has been found to have adverse effects on lipid and glucose metabolism, and these changes would be expected to increase risk of diabetes complications like cardiovascular diseases [36]. Dietary glycemic index and glycemic load appear to have increased among type 2 DM patients because of increase in carbohydrate intake and changes in food processing [37]. This study findings were hospital based and may not be generalizable in the larger population.

Our findings are important in informing type 2DM patient care and management programs in similar contexts. The dietary counseling guidelines for T2DM ought to be routinely updated in outpatient care to incorporate new directions on patient care. A personalized look should be taken to ensure patients receive appropriate dietary guidance based on their own specific food availability and access at household level. Providing dietary guidance to patients in a timely manner is critical in increasing adherence to dietary guidelines. For increased adherence, we recommend that the dietary guidelines be disseminated through regular short message services (SMS) for type 2DM patients.

List of abbreviations:-

DM-Diabetes Mellitus
MTRH-Moi Teaching and Referral Hospital,
NCDS-None Communicable Diseases
SDG-Sustainable Development Goals
SMS- Short Message Service
WHO-World Health Organization

Authors' contributions:-

GJ, PK and JL contributed to the conceptualizing of the study, design and execution. GJ was in-charge of the data collection, cleaning analysis and interpretation. PK was a technical advisor and contributed to the writing of the manuscripts. JL reviewed the manuscript and provided technical guidance through the writing process. All authors approved the final version of the manuscript.

Ethics approval and consent to participate. The study received ethical approval from the Institute of Research and Ethics Committee (Approval number FAN: IREC 1406). **Informed consent was given by participants before data collection. The respondents' participation was voluntary and respondents were assured of privacy and confidentiality of the information obtained. Patients' names were not included in the questionnaires and the information from patients was only used for research purpose.**

Availability of data. Data used for this analysis can be availed by the corresponding author upon review of the request and signing of data use consent form.

Table 1:- Sample Guidelines for Diabetic Patients

General instructions	Foods to avoid
<ul style="list-style-type: none"> • Do not use Sugar or sugary food • Reduce consumption of fried food and food high in fat • Increase in physical activity • Reduce the intake of salt and processed food • Increase intake of green leafy vegetables and fruits • Eat small frequent feeds 6 times a day 93 meals and 3 snacks) • Do not skip meals • Avoid alcohol Intake • Do not smoke 	<ul style="list-style-type: none"> • Cakes • Sugarcane • Honey • Chocolates • Ice cream • Lucozade milo, drinking chocolate • Biscuits • Bottled/tinted/packed juice fruits with sugar added, • Commercial juices soda and Glucose

Table 2:- Demographic characteristics

Background Characteristics	Frequency	Percentage
Sex		
Female	171	54.6
Male	142	45.4
Marital Status		
Married	219	70.0
Single	48	15.3
Widowed	46	14.7

Age (years)		
<30	44	14.1
31-40	34	10.9
41-50	50	16.0
51-60	88	28.0
61-70	65	20.8
>70	32	10.2
Occupation		
Farmers	104	33.2
College Students	81	25.9
Businessmen/women	55	17.6
Employed	55	17.6
Farm Laborers	18	5.8
Total	313	100

Table 3:- Frequency of intake of Animal Source Foods

Meat type	Never or less than once per month	1-3 times per month	Once per week	2-4 times per week	5-6 times per week	1- 3 times daily
	%	%	%	%	%	%
Beef/goat meat/mutton	14.1	34.8	31.3	13.4	1.3	5.1
Fish (Tilapia, Omena)	16.3	44.4	34.2	3.5	0.7	0.9
Liver, kidney, tripe	20.8	41.9	33.2	3.8	0.3	0
Chicken	12.5	53.7	31.3	1.6	0.9	0
Fermented milk	15.7	11.5	5.1	14.1	15	38.6
Fresh milk	4.2	4.2	5.4	16.6	16.6	53.0
Eggs	10.9	21.7	19.8	36.1	4.5	7
Vegetables and Fruits						
Kales	6.7	8	11.5	23.3	35.5	15.0
Spinach	4.2	2.9	14.7	28.8	35.1	14.3
Tomatoes	2.2	1.3	8.9	6.4	41.9	39.3
Black night shade (managu)	1.9	2.6	12.5	15	42.8	19.8

Black night shade (managu)	1.9	2.6	12.5	15	42.8	19.8
Amaranthus (dodo)	15.3	16.6	7.7	18.8	31	10.6
Pumpkin leaves	11.8	8.3	31	19.8	19.5	9.6
Cowpeas	17.6	24.3	8.3	10.5	30	9.3
Spider plant (saga)	7.3	20.8	15	20.4	24	12.5
Lettuce	39.9	41.9	9.6	5.8	0.6	2.2
Cucumber	45.7	38.7	9.3	1	0.6	4.7
Eggplant	58.1	28.1	8.6	3.8	1	0.4
Pineapple (slices)	15.3	33.2	8.3	35.6	5.1	2.5
Bananas	5.1	5.8	30	27.8	20.4	10.9
Mangoes	6.7	10.2	26.5	25.9	24.6	6.1
Pawpaw	18.2	25.6	41.9	8.9	3.5	1.9
Watermelon	25.6	26.5	33.5	11.5	1.3	1.6
Passion	19.2	26.2	34.8	8.3	8.6	2.9
Avocado	8.3	19.2	31.3	15.3	19.8	6.1
Orange	5.8	12.5	27.6	37.1	10.2	6.8
Grapes	34.2	53.4	4.5	7.3	0.6	0
Apple	32.6	40.6	21.1	2.9	0.9	1.9

Starch						
Ugali	6.7	8.6	5.5	9.3	31.3	38.6
Githeri (beans and maize)	10.2	7.4	21.7	21.1	30.4	9.2
Sweet potatoes	18.2	26.5	22	29.1	4.2	0
Bread	6.5	20.4	22	25.6	8.6	16.9
Porridge (Millet/sorghum)	15	10.5	6.4	20.8	9.9	37.4
Chapati	10.2	7	33.6	27.8	8	13.4
Matooke	19.8	16.3	48.9	11.8	1.9	1.3
Spaghetti	28.8	45.7	15.3	8.3	1.3	0.6
Mandazi	45.8	15.3	18.5	11.5	6.7	2.2
Porridge (maize meal)	51.8	30	8.2	1.9	2.6	5.5
Roots and tubers						
Cassava	29.3	47.3	8.6	10.9	2.6	1.3
Arrow roots	21.7	43.5	26.2	5.1	1.9	1.6
Irish potatoes	15	31.9	31.6	12.5	5.8	3.2
Legumes						
Beans	6.4	4.2	22.3	23.3	31.3	12.5
Green grams	10.9	17.3	25.9	31.9	12.8	1.2
Peas	10.2	11.5	20.4	28.4	27.2	2.3
Ground nuts	26.8	29.1	31.9	6.4	4.2	1.6
Beverages						
Water	5.8	4.8	7.3	13.4	19.2	49.6
Tea	11.5	2.4	4.5	1.3	14.4	65.9
Soda	76.7	18.8	3.2	1.3	0	0
Soya	79.9	1.3	5.4	1.3	3.5	8.6
Cocoa	87.2	2.6	2.5	2.6	1.6	3.5
Coffee	87.9	1.8	0.3	2.6	1	6.4
Commercial fruit juice	91.1	6.1	1.6	0.6	0.6	0
Alcohol	93	3.8	0.6	1.9	0.7	0

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