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Glycemic Control in Patients with Type 2 Diabetes Mellitus in a Tertiary Hospital in Monrovia, Liberia

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Abstract:-

Background: Diabetes mellitus is now a common public health concern worldwide, with over 50% of diabetes population unable to achieve or maintain optimal glucose control. Butthe status of glycemic control among diabetic population in Liberia is uncertain

Aim: To assess glycemic control among patientswith type 2 diabetes mellitus attending clinic at the John F. Kennedy Memorial Hospital, Monrovia, Liberia

Methods: This was a prospective cross-sectional assessment of 128 patients with type 2 diabetes mellitus, attending clinic at the John F. Kennedy Memorial Hospital. Only adults (≥ 18 years of age), with up to 6 months consecutive clinic attendance and in stable conditions were included in the study, while patients with gestational diabetes and those suffering from advanced complications of diabetes were excluded. The socio-demographic characteristics of participants were obtained using a researcher-designed proforma for data collection, while data involving fasting blood glucose, blood pressure, height and weight were measured using Accu chek glucometer, digital blood pressure machine and stadiometer respectively.

The data obtained were analysed using Statistical Package for Social Sciences (SPSS) Version 26.0 and presented as frequencies and percentages

Results: A total of 128 type 2 diabetic patients participated in the study. The female patientswere more than the male (64.1% vs 35.9%) and 64.1% were married. The peak prevalence of diabetes in the studied population (39.8% & 29.7%) occurred at the sixth (6th) and seventh (7th) decade of life. Over 70% of the patients did not receive secondary or tertiary education and approximately 63% of them were civil servants or private business owners. Majority of the participants were obese/overweight (72.7%) and have had diabetes for not more than 5 years(83.6%) as well as engaged in low physical activity (70.3%). More than half (56.8%) of the patients had poor glycemic control, while over three quarters (76.6%) of them failed to attain good blood pressure control, with 52.4% of the patients having positive family history of diabetes

Conclusion: Poor glycemic control was highly prevalent in the studied population, thus enhanced management is advocated to ensure improved quality of life for the patients.

Keywords:- *Glycemic Control, Type 2 Diabetes, Tertiary Hospital, Liberia.*

I. INTRODUCTION

Glycemic control is a desired clinical outcome in the management of diabetes mellitus (DM), but this has remained a herculean task for healthcare professionals globally[1-3]. Landmark longitudinal clinical trials conducted among real-world diabetic populations in the 1990's and a 7-year post trial follow-up demonstrated the indispensable role of glycemic control in the management of diabetes[4-6]. One of the studies reported that each percentage-point reduction in glycated haemoglobin (A1C): being a 2 to 3 months measure of glycemic control, was associated with a 35% reduction in the risk of developing complications in persons with type 2 diabetes, while the follow-up study observed a steady reduction in microvascular complications among intervention participants 7 years after the trial was

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concluded[5,6]. Hoerger and colleagues examined the trends in A1C levels for adults with clinically diagnosed diabetes, using data from three consecutive waves of the National Health and Nutrition Examination Survey (NHANES) and found that A1C levels dropped from 7.82% in 1999–2000 to 7.47 and 7.18% in 2001–2002 and 2003-2004, respectively[4,5,7]. Despite the improvement in the proportion of participants with good glycemic control from 35.8% in 1999-2000 to 57.1% in 2003-2004, a substantial number of diabetic patients still experienced poor glycemic outcomes[7-9]. Persistently long-standing hyperglycaemia has been associated with increased risk of microvascular and macrovascular complications, accounting for over 40% deaths amongindividuals less than 70 years[10-12]. Given the available evidence associated with consistent hyperglycaemia and the increased risk of diabetes-related complications[12], it is essential for both patients and health care providers to concertedly strive towards achieving predetermined glycemic goals of between 6.5% and 7% A1C [13,11,14].

Many studies conducted in low- and middle- income countries (LMICs) have reported that more than half of patients with diabetes have poor glycemic control[15-18]. Furthermore, there are several published articles on glycemic control in different African countries[19-26], but literature search revealed that there is paucity of data regarding well-structured research to investigate glycemic control among patients with diabetes in Liberia. This study therefore aimed to assess the status of glycemic control among diabetic adults, attending clinic in a tertiary health institution in Liberia.

II. METHODS

Study Design, setting, participant's eligibility criteria, data collection and statistical analysis

This was a prospective cross-sectional assessment of 128 conveniently sampled patients with type 2 diabetes mellitus (T2DM), attending clinic at the John F. Kennedy Memorial Hospital (JFKMC), Monrovia, Liberia between October, 2020 and January, 2021. The hospital is the largest referral heath care institution and the major teaching hospital in Liberia, situated in the central part of the capital city, Monrovia. Only adult patients (≥ 18 years) who were clinically diagnosed T2DM, with greater than 6 months record of consistent clinic attendance and in a stable condition were enrolled into the study, while patients with gestational diabetes, suffering from complications of diabetes and those that did not sign the informed consent form were excluded. Socio-demographic characteristics (age, gender, marital status, educational status, employment status, level of alcohol consumption and smoking status) and clinical characteristics (physical activity status, body mass index, family history of diabetes, duration of diabetes, systolic and diastolic blood pressure) of eligible and consenting participants were collected using a researcher-designed proforma for data collection. Fasting blood glucose, blood pressure, height and weight were measured using ACCU CHEK® Active Glucometer, digital blood pressure machine and stadiometer respectively. Each subject was pricked using a fresh lancet by the research Pharmacist and less than 4µl sample of capillary blood was collected at the appropriate point on the glucometer. The glucose reading was recorded as soon as it was ready. The research assistants used the appropriate apparatus to measure the blood pressure, height and weight[27], the readings were recorded and computed for body mass index (BMI). The data obtained was entered into the statistical package for social sciences (SPSS) version 26.0 (IBM Corp, Armonk, New York, USA) and analysed. Results obtained were reported as frequencies and percentages (descriptive statistics).

Operational Definitions

- Alcohol consumption level was defined as non/occasional drinkers for patients who consume alcohol once in a long time, moderate drinker for those who consume atleast 3 bottles per week and heavy drinkers for patients that take an average of two bottles daily
- Physical activity was defined as low for patients who did not engage in exercise for more than 50 minutes per week, moderate activity was considered as between 50 to100 minutes weekly and above 150 minutes as regular physical activity
- Uncontrolled or poorly controlled blood glucose was defined as fasting blood glucose below 4mmol/L and greater than or equal to 7mmol/L
- Hypertension was defined as persistent blood pressure equal to or greater than140/90mmHg
- Overweight/Obesity was defined as BMI of equal to or greater than 25kg/m^2

Ethical Considerations

The study was approved by the Institutional Review Board Committee of the JFK Memorial Hospital, Liberia and all the subjects signed the informed consent form before participating in the research. Furthermore, subjects' information was coded using unique identification numbers to ensure confidentiality.

III. REULTS

A total of 128 T2DM Patients participated in thestudy. There were more females (64.1%) than males (35.9%) and 64.1% were married. It was observed that most of the participants were in their 6th (51-60 years; 39.8%) and 7th (61-70 years; 29.7%) decades of life and majority do not smoke (93%) or consume alcohol (83.1%). Over 70% do not have secondary or tertiary education and approximately 63% were civil servants or private business owners (Table 1). Most of the participants were obese/overweight (72.7%), have had DM for 5 years or less (83.6%) and engaged in low physical activities (70.3%). More than half of the population (56.8%) had poor glycemic control, with over three quarters (76.6%) not able to achieve good blood pressure control and 52.4% had familyhistory of DM (Table 2 & 3)

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Table 1: Socio-demographic Characteristics of T2DM patients attending clinic at JFK MemorialHospital, Liberia (n = 128)

Characteristics	Categories	Frequency (n)	Percentage (%)
Age (Years)	< 30	5	3.9
	31-40	7	5.5
	41-50	14	10.9
	51-60	51	39.8
	61-70	38	29.7
	71-80	12	9.4
	> 80	1	0.8
Gender	Male	46	35.9
	Female	82	64.1
Marital Status	Single	46	35.9
	Married	82	64.1
Alcohol Consumption	Non or occasional drinker	104	81.3
	Moderate drinker	11	8.6
	Heavy drinker	13	10.2
Smoking Status	Do not Smoke	119	93.0
	Smokes	9	7.0
Educational Status	No Formal Education	50	39.1
	Primary	41	32.0
	Secondary	20	15.6
	Tertiary	17	13.3
Occupational Status	Civil Servant	32	25.0
	Business/Private	49	38.3
	Students	34	26.6
	Unemployed	13	10.2

Table 2: Proportion of Cardiovascular Risk Factors in Patients with T2DM in JFK Memorial Hospital, Liberia

Cardiovascular Risk Factors	Frequency (n)	Percentage (%)
Smoking	9	7
Physical inactivity	90	70.3
Obesity	93	72.2
High blood pressure - systolic	98	76.6
High blood pressure - diastole	65	50.8
Diabetes	75	58.6
Family history	67	52.4

Table 3: Clinical Characteristics of T2DM patients attending clinic at JFK Memorial Hospital, Liberia (n = 128)

Characteristics	Categories	Frequency (n)	Percentage (%)
BMI status (Kg/m^2)	Normal weight	35	27.3
	Over weight/obesity	93	72.7
Family History	Not Present	61	47.6
	Present	67	52.4
Duration of Diabetes (Years)	1 - 5 yrs	107	83.6
	6 - 10 yrs	19	14.8
	> 10 yrs	2	1.6
Diabetes Control Status	Controlled	53	41.4
	Uncontrolled	75	58.6
Systolic Blood Pressure	Controlled	30	23.4
	Uncontrolled	98	76.6
Diastolic Blood Pressure	Controlled	63	49.2
	Uncontrolled	65	50.8
Physical Activity	Low	90	70.3
	Moderate	38	29.7

IV. DISCUSSION

Optimal glycemic control has been advocated as a primary indicator of an effective management of DM, to prevent complications and improve the quality of life in diabetic patients. This study was an attempt to provide for the first time the status of glycemic control among ambulatory T2DM patients attending clinic at the largest referral hospital in Liberia. The study revealed that diabetes was most prevalent in individuals within the age range of 40 and 60 years, with more than half of the participants being females and married. This is consistent with findings reported by other researchers in the United States (US) and Africa[7,18,26,28]. Hoerger and colleagues examined the NHANES wave of surveys conducted in 1999-2000, 2001-2002 and 2003-2004 respectively and found that the peak prevalence for diabetes occurred at age ranging from 45 to 64 years for all the three survey waves. Fiseha, Masilela, David and their associates also reported that most patients among their research population (53%, 58.5% and 82.5%) were within the same age range of 40 and 60 years. Similar to the outcome of this study, Kibirige and Masilela had more females (69.98% and 84.7%) than males in their studies, which also agrees with the result of a recent study conducted in Liberia[29]. Sorbor and colleagues found that T2DM was more prevalent among the female gender (56.8%) and affect more married individuals (65.9%) compared to the male participants[29]. Contrary to the assertions above, Hoerger and his associates found that there were more male than female participants in the NHANES surveys of 1999- 2000 and 2002-2003(51.6% vs 48.4% and 50.% vs 49.7%), which was corroborated by Fiseha and colleagues, with 52.3% female and 47.7% male[1,7,18]. Study

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design, demographic characteristics, research (selection) bias, sample size and sampling techniques could have informed the conflicting observations. The study revealed a high incidence of diabetic cases in the last five years and very few cases were reported 10 years or beyond. The observed pattern is worrisome, since it may indicate an upsurge in the disease, while survival rate appeared to be greatly low with increasing age of diagnosis. Although the reason for this observation may be unknown and would require further studies, evidence has shown that many diabetic patients could enjoy a life expectancy of up to 70 years or more [30]. It is however hoped that certain interventional measures would be provided to improve the quality of life as well as longevity and survival rate of patients in this region.

The prevalence of poor glycemic control in the studied population was 58.6%. This trend of poor glycemic control was reported in both large and small population surveys. Beginning with the US; Shaya and colleagues in a review titled: "US trends in glycemic control, treatment, and comorbidity burden in patients with Diabetes" observed that despite the improvement in glycemic control (A1C) in the NHANES surveys from 7.82% in 1999-2000 to 7.18% in 2004, approximately 63% fell short of the desired control target of A1C < 7.0% in 1999- 2000 and nearly half of the participants could not attain desired glycemic control at the end of 2003-2004 survey[7,9]. Prevalence of poor glycemic control observed in South Africa, Kenya, Ethiopia, Sudan and Ghana ranging from 60.0% to 86.4% were even more alarming compared to 58.6% in the current study[30-40]. Similarly, in a systematic review involving 24 studies, 16 assessed glycemic control using fasting plasma glucose (FPG), while 8 studies reported A1C measure. The final results of the analyses showed that approximately two-third ofthe studied population had poor glycemic control for both categories[12]. Studies have indicated that high prevalence of poor glycemic control was associated with young age, suboptimal care, low level of education, being married, duration of diabetes, polypharmacy and the complexity of medication[12,18,28,38,41]. This is corroborated by the current study, where most patients were young diabetics, had no formal education, with high comorbid existence of modifiable cardiovascular risk factors (physical inactivity, obesity, hypertension and family history). These factors potentially increase the risk of developing complications and mortality, as well as impede the achievement of desired glycemic control.

This study was a cross-sectional survey, which was susceptible to responder and interview bias. The study design, number of participants and duration of study could also be improved upon in future research. Despite the few limitations, this study is the first known to us to provide evidence on the status of glycemic control among diabetic patients in Liberia and will hopefully provide a basis for further discussions on the subject matter.

V. CONCLUSION

This cross-sectional prospective study revealed that more than half of the studied participants were unable to achieve good glycemic control, with an associated high prevalence of cardiovascular risk factors. This emphasizes the need for improved management of diabetic patients in the study site, to ensure achievement of treatment goals.

Conflict of Interest

This study received funding from West Africa Research Association/West African Research Centre (WARC) Travel. The fund was received by David, A. E, utilized for travels and research. The funders did not play any role in the study design, data collection, analysis, manuscript writing and decision to publish research findings.

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