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Original Research Article

Prevalence, patterns of clinical presentation, and the outcome of treatment of diabetes mellitus among paediatric patients in a tertiary care facility

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ABSTRACT

Background: Diabetes mellitus is a multi-systemic disease condition characterized by elevated blood glucose level which can be due to relative or absolute deficiency of insulin secretion or action or a combination of both in humans including paediatric patients which disproves the thought that it is a disease of adults alone.
Methods: The study was a retrospective descriptive cross-sectional full population study that involved getting the total population of 7880 paediatric patients that presented to the hospital facility within 3-years (from January 2019-December 2021) and from the total population getting the patients diagnosed with diabetes mellitus. A well-structured proforma was used to collect the relevant data needed from the case files of the patients. Statistical data analysis was done with SPSS version 25.
Results: The study showed that out of 7880 paediatric patients that presented to the facility, 20 of them were diagnosed and treated for diabetes mellitus giving a prevalence of 0.25 per 100 patients. The paediatric patients diagnosed with diabetes mellitus were aged 8-18years; 11 females and 9 males. This study showed that about 75.0% of the paediatric patients with DM fully recovered following treatment and was subsequently discharged; however about 95% of these patients were lost to follow-up.
Conclusions: Adequate measures needs to be put in place to ensure that the management of these patients are highly optimal and does not constitute much financial burden to the caregivers, in order to improve compliance to treatment and hence reducing morbidity and mortality associated with the condition.

Keywords: Clinical presentation, Diabetes mellitus, Paediatric patients, Prevalence, Tertiary care facility

INTRODUCTION

Diabetes mellitus (DM) is a group of multi-systemic metabolic endocrine disorder characterized by elevated blood glucose level due to relative or absolute deficiency in insulin secretion or due to deficiency in insulin secretion or action or both.[1] If the diagnosis and treatment of DM is not made early enough, it could have serious implications on health, lifestyle and economic status of the people at large.[2] Part of the contributions to the well

of knowledge on works on DM was its classification into types, some of which are; type 1 DM (T1DM) also called Insulin dependent type or Juvenile onset type, type 2 DM (T2DM) also called non-insulin dependent type, gestational DM and the very rare type of diabetes in children called malnutrition-related diabetes mellitus (MRDM) which is associated with long term malnutrition.[3,4]

Globally, DM is one of the most common chronic diseases that could affect children and of all the types, T1DM accounts for over 90% of the cases of diabetes.[5] In 2006, an estimate was put up from studies carried out by the International Federation of Diabetes (IDF) stating that the number of children with type 1 diabetes was about 440 000, with an annual increase of 3 % per annum and 70,000 newly diagnosed cases per year.[3,6] Overtime, studies have shown an observed gradual increase in cases of T2DM with the parallel increase in the incidence of childhood obesity as noticed in most western world notably United States of America.[7] DM can result in reduced life quality and expectancy, significant morbidity and burden of disease due to specific complications that could arise from it like diabetic ketoacidosis (DKA), micro vascular complications (nephropathy, retinopathy, neuropathy, foot disease) and macro vascular complications (ischemic heart disease, heart failure, stroke and peripheral vascular disease) amongst others.[2] DKA is one of the major complications of T1DM among others and is the most common medical emergency of childhood diabetes mellitus in developing countries and could be as a result of late presentation, late diagnosis and poor management of the condition.[6,8,9]

The mortality burden in developing countries especially Nigeria is high and this may be due to several factors some of which include; lack or low number of health care providers with the required knowledge, resources, expertise and experience in making diagnosis and caring for children with DM, inadequate routine screening services for DM because of lack of appropriate technology for the screening, diagnosis and monitoring of DM.[10] Despite the increasing prevalence of DM in most developing countries of the world including Nigeria, more emphasis has still remained on the control of communicable diseases.[11]Another problem is that most people with DM present late and at the point when there are complications already.[12] In USA, there was a marked increase in prevalence of T2DM by 30.5% between 2001-2009.[13]All these put together have shown that there is an increase in the incidence and prevalence of DM and much work is needed to be able to guide us rightly in prevention and management, to reduce to its barest minimum complications that are associated with it. Considering that studies have predicted that this condition will be on the rise and pose great burden on healthcare worldwide, not much has been done in developing countries like Nigeria compared to those done on several communicable diseases.[14,15]

Hence, this study will be helpful in determining the prevalence of the disease in our locality, common clinical presentations, and outcomes of treatments. Also, there has been no prevalence study of DM in children and adolescents conducted in this locality in recent times; hence this study will help in providing data in this setting for subsequent studies to build on.

METHODS

Study area

This study was carried out in Nnamdi Azikiwe University Teaching Hospital (NAUTH), a tertiary healthcare facility located in Nnewi North Local Government Area, Anambra state, Nigeria. Nnewi is the second largest city in Anambra state with a land area of over 200 square miles (520km^2) and population of 391,227 according to the Nigerian census of 2006 with a projected population of over 900,000 in 2022.[16] NAUTH was established in 1988 and being a tertiary training institution, it is the final referral point for the state and surrounding regions and it offers multidisciplinary approach to healthcare with about 440 bed spaces.

Study design

A descriptive cross-sectional retrospective study design was used for this study.

Study population

The study population were paediatric patients aged 0-18 years who presented to NAUTH for healthcare services from 1st of January 2019 to 31st of December 2021.

Inclusion criteria

Paediatric patients aged 0-18years who presented to NAUTH paediatric outpatient clinic and children emergency between 1st of January 2019 to 31st of December 2021 and whose medical records were available and complete for the study were included.

Exclusion criteria

Paediatric patients within the study period whose medical records were not available for study and analysis and paediatric patients within the study period with incomplete data for the research in their case files were excluded.

Sample size determination

A total population study of all the records of paediatric patients that presented to the facility within the study period and met the inclusion criteria were taken.

Research instrument

A well-structured data collection tool (proforma) was designed and used to collect relevant data from the patient's case files.

Training of research assistants

Two research assistants (clinical medical students of the institution) were recruited and trained on how to extract required information from patients' case files using the proforma checklist that was given to them.

Data collection

Permission were obtained from the Chairman Medical Advisory Committee (CMAC) and records department of the institution. Case files of the paediatric patients diagnosed with DM were identified, studied and the required information retrieved. The total number of paediatric admissions during the study period was obtained from the ward and clinic registers while the case files of children diagnosed with DM were retrieved from the medical records library.

Statistical analysis

The data obtained were arranged, inspected, cleaned, entered, coded and analysed using International Business Machines- Statistical Package for Social Sciences (IBM-SPSS) version 25. Frequency tables and chart distributions of all relevant variables were developed with mean and standard deviation calculated for continuous variables.

RESULTS

The prevalence of paediatric patients with DM was 0.25% out of the general paediatric patients. This implied that one (1) out of every 400 paediatric patients that presented to the facility within the study period had diabetes mellitus (Table 1).

T1DM was more than T2DM among paediatric patients diagnosed with DM (Table 2).

Table 1: Prevalence of diabetes mellitus among pediatrics patients recorded between 2019-2021 at Nnamdi Azikiwe University Teaching Hospital, Nnewi, Anambra state.

Year studied	Paediatric patients recorded (%)	Diabetes mellitus (%)	Prevalence (%)
2019	2731 (34.7)	6 (30.0)	0.22
2020	2478 (31.4)	5 (25.0)	0.20
2021	2671 (33.9)	9 (45.0)	0.34
Total	7880 (100.0)	20 (100.0)	0.25

Table 2: The distribution of the types of diabetes mellitus amongst paediatric patients in NAUTH, Nnewi, Anambra State.

Type of DM	Frequency	Percentage (%)
T1DM	18	90.00
T2DM	2	10.00
Total	20	100.00

Table 3: The socio-demographics of the study population.

Socio-demographics	Frequency (N=20)	Percentage (%)
Age group (years)		
8-10	2	10.00
11-13	4	20.00
14-16	9	45.00
>16	5	25.00
Mean±SD	14.4±2.83years	
Gender		
Female	11	55.00
Male	9	45.00
Tribe		
Igbo	18	90.00
Igala	1	5.00
Yoruba	1	5.00
Religion		
Christian	19	95.00
Muslim	1	5.00
BMI (Kg/M^2)		
Underweight	7	35.00
Normal	10	50.00
Overweight	2	10.00
Obese	1	5.00
Caregiver educational level		
FSLC	4	20.00
NCE	2	10.00
SSCE	14	70.00
Occupation of parent/caregiver		
Artisan	7	35.00
Farmers	1	5.00
Teachers	1	5.00
Trader	11	55.00
Family living condition		
Living with both parent	14	70.00
Living with one parent	2	10.00
Living with a relative	4	20.00
Family history of diabetes mellitus		
Yes	6	30.00
No	9	45.00
Unknown	5	25.00

*****Artisans= Plumbers, electricians and mechanics

Table 3 above summarizes the socio-demographics of the studied population. There were more patients within the

age range of 14-16 years, with mean age of 14.4±2.83years. There were more female (55.0%), Igbos (90.0%) and Christians (95.0%). About half had normal BMI (50.0%), however only one patient was obese (5.0%). Most of the patients' caregiver had completed secondary education and most were traders (55.0%). Most of the paediatric DM patient lives with both parents (70.0%) and only 30.0% had family history of DM.

Table 4: The distribution of the clinical presentations of the study population.

Clinical presentation	Frequency (%)	
	Yes	No
Vomiting	5 (25.00)	15 (75.00)
Polyuria	19 (95.00)	1 (5.00)
Polydipsia	18 (90.00)	2 (10.00)
Polyphagia	17 (85.00)	3 (15.00)
Weight loss	13 (65.00)	7 (35.00)
Weakness	16 (80.00)	4 (20.00)
Abdominal pain	5 (25.00)	15 (75.00)
Fever	5 (25.00)	15 (75.00)
Diabetic ketoacidosis	4 (20.00)	16 (80.00)

The commonest clinical presentations were polyuria (95.0%), polydipsia (90.0%), polyphagia (85.0%), weakness (80.0%) and weight loss (65.0%) (Table 4).

Table 5 above shows that all the patients had glucose in their urine/blood.

Table 5: Paediatric patients with DM in NAUTH that had glucose in their urine/blood.

Blood/urine glucose level on presentation	Frequency	Percentage (%)
Elevated	20	100.00
Total	20	100.00

Table 6 above showed that about 75.0% of the paediatric patients with DM fully recovered following treatment and was subsequently discharged, however 20.0% signed to be discharged against medical advice.

Table 6: The distribution of the treatment outcomes among the study population.

Treatment outcome	Frequency (%)	
	Yes	No
Fully recovered following treatment and was discharged	15 (75.00)	5 (25.0)
Signed to be discharged against medical advice	4 (20.00)	16 (80.0)
Died	1 (5.00)	19 (95.0)

Table 7 showed that majority of the paediatric patients with DM were lost to follow-up (95.0%).

Table 7: The distribution of the follow-up outcome of the study population.

Follow-up outcome	Frequency	Percentage (%)
Died	1	5.00
Lost to follow up	19	95.00
Total	20	100.0

DISCUSSION

This retrospective descriptive cross-sectional study was carried out to determine the prevalence of DM among paediatric patients within a 3 year period (January 2019-December 2021). The individual yearly prevalence were 0.22%, 0.20% and 0.34% for the three years respectively while the overall prevalence was found to be 0.25%. This low prevalence was in keeping with previous studies in various countries of the world but was lower than similar studies conducted in USA, Saudi Arabia, Iran, Cote D'Ivoire, and Kano state Nigeria, and this was possibly due to the higher total paediatric population in this study.[12,17-20] However, it was higher than studies conducted in Sokoto state Nigeria and another South-eastern state.[21,22]

Overall, the prevalence were higher in the western countries than the African countries and this could be attributed to their better knowledge of the condition and their higher healthcare-seeking behaviour which if probed further may be because of health insurance they enjoy unlike most parts of Africa including Nigeria, where they pay out of pocket.

This study also showed that paediatric patients can also come down with T2DM especially when they are overweight or obese and this was in keeping with a previously conducted study in Port Harcourt, Nigeria.[23,24] This study had T1DM higher than T2DM which was similar to a previous study conducted.[31] However, the study did not agree with studies conducted in western countries that said there was a tie in prevalence of paediatric patients who have T1DM and T2DM and this may be because of their high calorie dietary pattern and the lifestyle practices of western countries which increases the incidence of overweight and obese children which is a risk factor for T2DM.[25]

This study showed that the paediatric patients presented with polyuria, polydipsia, polyphagia, weakness, weight loss, abdominal pain, vomiting, diabetic ketoacidosis and fever with polyuria being the commonest clinical presentation and diabetic ketoacidosis being the least. This was similar with the study conducted in Nguru, Nigeria that found that all the patients presented with all the clinical features but the difference in both studies was that majority of the patients had fever which was probably because most of the patients were also diagnosed with malaria.[26] The presence of DKA from the study was in keeping with other studies conducted in Romania, Tanzania, and other parts of Nigeria.[14,19,27-32]

The study however showed that only 4 of the 20 children had DKA and this was low compared to study conducted in Sokoto state and Jigawa state both in Nigeria and this may be due to genetic/environmental factors alongside level of knowledge of the disease condition.[14,33] Also, the result showed that all the patients had elevated blood and urine glucose level and this was the same with similar studies in Abidjan, Cote D'Ivoire and Kano state, Nigeria that showed that all patients had elevated blood glucose.[12,29]

Those within the age group of 14-16 years had the highest number of paediatric patients with DM. This was similar to studies conducted in some parts of Nigeria and agreed with the study conducted in Saudi Arabia that showed that the condition occurred more among adolescents.[17,27,28,34] The mean and standard deviation were 14±2.83years and this was similar with studies conducted in Saudi Arabia and some parts of Nigeria.[17,28,22,29,35] There was no family history of DM in 45.0% of the study population while 30.0% had family members with DM. The prevalence of paediatric patients with DM who did not have family history of DM was in keeping with study conducted in Nguru, Nigeria.[26] The female gender was more affected than male from this study which was in keeping with studies carried in some parts of Nigeria, however it contrasted the findings of some studies in some other parts of Nigeria that showed that males were more than females.[19,32,36] The reason for the higher female prevalence may be explained by the fact that auto-immune diseases occur more in females and T1DM is an auto immune disease.[8,35] Majority of patients in this study had normal weight however only one patient was obese. The Body Mass Index(BMI) shown in a study conducted in Sokoto state, Nigeria showed that more children were underweight, some had normal weight however, there was no one that was overweight and obese. This study had all paediatric patients diagnosed with T1DM with none diagnosed with T2DM unlike this index study that showed 2 patients had T2DM which can be associated with being overweight and obese. [22,23,25]

Majority of the patients live with both of their parents which was in tandem with a similar study which showed that children who live with both parents have better glycaemic control than those who live with relatives and single- parent.[37,38] Caregivers' occupation were trading, artisan, farming and teaching; however the financial capacity of the family were not specified in the case files which could have helped clarify some issues regarding their management. A study conducted in Kano state, Nigeria showed that some of the patients who signed to be discharged against medical advice did so because of financial constraints.[29] This study showed that 15 of the patients recovered fully and were discharged following treatment, 4 signed to be discharged against medical advice while 1 died following complications of the condition and this was similar to previously conducted studies.[21,28,29] Also, nineteen of the twenty patients were lost to follow-up which was in tandem with the study conducted in Sokoko where similar findings were noted.[27] The problem with losing patients to follow-up meant that these patients will not benefit from more educative sessions on how to improve their health better and get adjustments in their medication if the need arises and this was seen in a study conducted in Cameroon.[37]

CONCLUSION

This study has shown that DM can also occur in paediatric patients, with the most common type being T1DM. Majority of the patients were discharged following treatment, few signed to be discharged against medical advice because of financial constraints and one patient died following complications of the condition. Modification of dietary and lifestyle practices will reduce the risk of coming down with complications associated with the condition. Also, socio-demographic factors like the financial and educational status of caregivers goes a long way in proper care of these children and since it is very demanding to manage DM, it is important that adequate measures are put in place so that the right practices and treatments are adhered to for these patients to get optimal care and support to reduce the mortality and morbidity associated with the disease.

Recommendations

Based on the findings from this study, the following recommendations are suggested: 1) Health care providers must increase efforts toward delivery of proper health education and promotion on the prevalence of DM in paediatric patients, with emphasis on the need for proper lifestyle modification, adherence to medication, glucose monitoring and follow up visits, 2) Counselling care givers of paediatric patients diagnosed with DM on how expensive it may be to properly manage the condition so they can make alternative financial plans to adequately support the patients, 3) Partnership between governmental bodies and non-governmental organizations (NGOs) in developing programmes that will promote awareness of DM and fund treatment of the patients. This will greatly improve health-seeking behaviour especially when they know they are going to be relieved of the financial burden of the treatment of the child, 4) More studies can be done especially in developing countries to determine association between the socio-demographic variables of paediatric patients and how they affect time of presentation to hospital facility and outcome of treatment.

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