Food Consumption Frequency as Risk-Factor to The Onset of Type 1 Diabetes Mellitus Among Middle Childhood Children and Adolescents in Owerri Municipal and West LGA, Imo State

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Abstract- The exact underlying trigger of T1DM is a complicated interaction of genetic and environmental factors that is still not fully understood. Although, consumption pattern has shown to be a risk factor. However, this study investigated to food consumption frequency as risk factor to the onset of type 1 diabetes among middle childhood children and adolescents in facilities in Owerri Metropolis. Using a cross-sectional study design, eighty (80) were purposively recruited from Federal University Teaching Hospital (FUTH) and Imo State Specialist Hospital, Owerri, Imo State. Structured questionnaire was the tool used in gathering the information needed for the study. Data were subjected to descriptive statistics and Chi-square using SPSS statistics version 23. The respondents were insignificantly dominated by female 44(55%) and were within the age bracket of 11-18 years 57(71%). Most of them were in secondary school 45(56%) with their caregivers achieving Tertiary education as highest qualification 45(56%). Majority was diagnosed with type 1 diabetes at the age bracket of 11-14 years 41(51%). Furthermore, consumption of different classes of food varied significantly. Among the carbohydrate-based foods, cocoyam 48(60%) was mostly consumed once a month, milk 45(56%) was mostly consumed within 2-3 per day while fats and oil in form of palm oil 38(48%) was mostly once a day. All the respondents 80(100%) practiced healthy eating and insulin therapy.

I. INTRODUCTION

Diabetes is a chronic metabolic disease, in which the body's ability to produce or utilize insulin is impaired (WHO, 2017). It is caused by a deficiency in the production or function of insulin or both, which can occur because of different reasons, resulting in protein and lipid metabolic disorders (ADA, 2010). There are different forms of DM which include Type 1 (insulin-dependent), Type 2 (non-insulin-dependent), and gestational diabetes (GDM) (ADA, 2015a; Craig *et al.*, 2014). There are also rarer forms of diabetes such as monogenic diabetes, neonatal diabetes, mitochondrial diabetes, and diabetes associated with cystic fibrosis, hemochromatosis, toxins, and drugs as well as diabetes during pregnancy (Mayer-Davis *et al.*, 2018). Type 1 Diabetes Mellitus (T1DM) is the major type of diabetes in children and adolescents (Maahs *et al.*, 2010; Klaprat*et al.*, 2019) accounting for more than 85% of all diabetes cases in Adolescents and Young Adults (AYAs) under the age of 20 worldwide (Maahs *et al.*, 2010). Additionally, it has been suggested that the current increase of type 1 diabetes incidence is a multi-factorial process that cannot be explained by one single factor, rather it is an interaction between genetics and environmental factors (Atkinson *et al.*, 2014; Butalia *et al.*, 2016).

Furthermore, given the poor health seeking behavior in developing countries and lack of quality health care, most children present late resulting in a majority of children dying early due to complications (Majaliwa *et al.*, 2008). However, proper nutrition is essential for growth and energy with close adherence to dietary recommendations playing a significant role in improving glucose control in children and adolescents (Patton *et al.*, 2007). More so, the risk factors of T1DM and its related complications among children and adolescents have not been reliably evaluated in Nigeria. In absence of such reliable data, the

effectiveness of interventions cannot be determined or foretold (Ngwiri, 2008). However, modifiable risk factors like dietary practices remains a risk factor associated with type 1 diabetes mellitus among children and adolescents, thus this study investigated to determine the food consumption frequency of children and adolescents in facilities in Owerri municipal and west LGA Imo state. This study is an excerpt from a component of a larger study.

II. METHODS

Study area
The study location is Owerri which is the capital of Imo State. It lies within latitudes 4°45'N and 7°15'N, and longitude 6°50'E and 7°25'E, occupying an area of about 5,100 square kilometers Owerri is also the state's largest city, followed by Orlu and Okigwe. Owerri Metropolis consists of three local government area namely; Owerri municipal, Owerri north, and Owerri west with a combined population estimate of 983,352 (NPC, 2023). Federal University Teaching Hospital (FUTH), and Imo State specialist hospital Umuguma in Owerri municipal, and Owerri west respectively, served as the study area. Federal University Teaching Hospital, Owerri is the foremost tertiary health institution in Imo State, located in the capital city Owerri. The hospital serves as a referral center for primary and secondary public and private health care facilities in Imo State and neighboring parts of Abia, Anambra, Enugu and Rivers States. The FUTH Owerri has a General Outpatient Clinic (GOPC) and other Specialist clinics such as General Surgery, Urology, Cardiology, Neurology, Dermatology, Orthopedics, Pediatrics etc. It also has in patient services in the various specialties with a 700-bed capacity (cots and incubators inclusive). On the other hand, Imo State Specialist Hospital, Umuguma in Owerri west Local Government Area is also a tertiary health institution which serves as a center for curative and preventive health services as well as a research center. It is located at Umuguma Road, New Owerri, Owerri, Imo State. It was established on the 2nd of June, 1960. It offers medical services (cardiology, neurology, infectious diseases), surgical, pediatrics, special clinical, obstetrics & gynecology and dental services. It has a 200-bed capacity (cots and incubators inclusive) for in patients. The choice of these hospitals is because:

The Federal University Teaching Hospital Owerri, being one of the referral centers for Type 1 Diabetes Mellitus (T1DM) patients across the entire Southeastern Nigeria, ensures a representative inclusion of individuals seeking specialized care for T1DM. Also, the Imo State Specialist Hospital was selected due to its recognized standard pediatric section, which will increase the likelihood of encountering children with T1DM.

Study design and sampling
A Quantitative study design was employed for the study and included patients aged 5-10 and 11-18 years respectively who are receiving treatment at the pediatric and outpatient clinic of the two selected hospitals (Federal University Teaching Hospital (FUTH), and Imo State specialist hospital (IMSSH), Umuguma) and also a control group of non-diabetic patients aged 5-10 and 11-18 years respectively who are receiving treatment at the pediatric and outpatient clinic of the two selected hospitals. The population was based on the availability of patients and the time span of the study. A sample size of 80 was estimated using the Cochran's formula. A purposive sampling method was employed to deliberately select participants from two key hospitals in Owerri, namely the Federal University Teaching Hospital Owerri and Imo State Specialist Hospital. Every child and adolescent (participants) who registered to see the clinicians on each consulting day during the study period and who met the inclusion criteria were consecutively recruited. Every week an average of 4 respondents in IMSSH and an average of 6 participants at FUTH were conveniently. This selection method continued until the desired sample size was achieved, facilitating the inclusion of a diverse range of T1DM patients from these selected hospitals, which gave a total of 32 respondents in IMSSH and 48 respondents in FUTH and a sum total of 80 respondents in both facilities.

Data collection
A structured questionnaire was adapted for this study and patients' weight were measured using a weighing scale and height were measured using a tape rule. The questionnaire was pre tested by administering it to 10 type 1 diabetic patients from another health facility which was not part of the selected study population but shared similar characteristics with the selected study

population. After one week, the same but fresh copies of questionnaire were re-administered to the same set of respondents. The questionnaire was validated using face and contents validation by an endocrinologist. The questionnaire was tested for reliability using Crombach Alpha test and a reliability coefficient of 0.83 was obtained. Data was collected within the period of January till Febuary 2024 and at each facility, potential respondents were approached and were given the questionnaire and asked to fill and return it at the end of the clinic. Also, weight and height were measured using standard procedures. Weight was measured in kilograms using a pre-calibrated weighing scale to the nearest 0.5 kg on a flat surface with the subject wearing light clothing. Height was measured to the nearest 0.5cm in meters with a tape ruler with subject not wearing shoes.

Data Analysis

The data obtained in this study were analyzed using IBM-SPSS version 21 and EXCEL 2019 software. A descriptive method was employed to summarize the data characteristics. Frequency distribution tables were constructed for all variables and were expressed as the percentage of the distribution. BMI was calculated and interpreted in respect to the BMI-for-age weight percentiles. The Chi-square test was used to examine association, comparisons, and proportions of different potential risk factors, for each variable, the p value was assessed with $p \leq 0.05$ being statistically significant.

III. RESULTS

Socio demographic characteristics

Socio-demographic characteristics of the respondents are summarized in Table 1 where all the variables differed significantly ($p \leq 0.017$) except for gender. It was shown that out of the 80 respondents used for the study, age bracket of majority of them was 11-18 years 57 (71%) followed by those within 5-19 years 23 (29%). Most of the participants were female 44 (55%) compared to their male counterpart 36 (45%). Most of them were patients in Federal University Teaching Hospital Owerri 48 (60%) followed by those attending Imo State Specialist Hospital 32 (40%). On religion, the Table showed that almost all the participants were Christians 69 (86%) whereas 9(11%) of them were Muslims and 2(3%) were Traditionist. Besides, out of the 80 participants, a greater proportion of them were from Igbo tribe 58(72%) followed by Yoruba 12(15%) and Hausa 10(13%) and none was from Fulani. Child's educational level was represented as four categories: nursery with 15 participants or 19%, primary with 19 or 24%, Secondary with 45 or 56% and 1(1%) of them is not yet in school. Equally, caregiver's educational level was represented as four categories: Primary with 20 participants or 25%, secondary with 15 or 19%, tertiary with 45 or 56% and none of them was attending any education. Age(years) at diagnosis of the child/adolescent variable for the participants ranged from <5-8, 9-10, 11-14 and 15-18 years. Age of participants categorized from 5-8 was 12 (15%), 9-10 was 18 (23%), 11-14 was 41 (51%) and 15-18 was 9 (11%).

Table 1: Socio demographic characteristics

Variables	Frequency	Percentage
Child's age bracket		
5-10 years	23	29
11-18 years	57	71
Total	80	100
Gender		

Male	36	45
Female	44	55
Total	80	100
Healthcare Institution		
FUTH	48	60
Imo State Specialist Hospital	32	40
Total	80	100
Religion		
Christianity	69	86
Muslim	9	11
Traditional	2	3
Total	80	100
Ethnicity		
Igbo	58	72
Hausa	10	13
Yoruba	12	15
Fulani	0	0
Total	80	100
Child's educational level		
Nursery	15	19
Primary	19	24
Secondary	45	56
Not yet in school	1	1
Total	80	100
Caregiver's educational level		
Primary	20	25
Secondary	15	19

Tertiary	45	56
None	0	0
Age (years) at diagnosis of the child/adolescent		
Total	80	100
5-8	12	15
9-10	18	23
11-14	41	51
15-18	9	11
Total	80	100

Food consumption frequency of the participants

Table 2 displayed the food consumption frequency of the participants grouped into never or < 1month, once a month, 2-4 per week, once a day and 2-3 per day and all of them exhibited significant association (p < 0.001). As shown, among the carbohydrate-based foods, it was only cocoyam 48(69%) and yam 36(51%) that was mostly consumed once a month and 2-4 per week, respectively. However, fufu/ garri 36(51%), noodles/ spaghetti 30(43%), potatoes 41(59%), cereals 42(60%) and bread 46(66%) were mainly consumed once a day whereas rice 30(43%), agidi 42(60%) and Biscuits 41(59%) were mostly consumed 2-3 per day. Across the consumption intervals, it was shown that once every month higher proportion 32(46%) of the respondents consumed more of protein-rich foods, in form of liver. Also, among the protein-rich foods, beans 45(64%), moi-moi 30(43%) and chicken 40(57%) were mostly consumed by majority of the participants within the interval of 2-4 per week. While soya beans 38(54%), groundnut 40(57%) and fish 39(56%) were mostly consumed once a day, beef meat 35(50%), egg 38(54%) and milk 45(64%) were mostly consumed within 2-3 per day. The consumption of minerals and vitamins including fruits 36(51%), vegetables 38(54%) and soft drinks 45(64%) were mainly done once a day by the majority of the participants. as regards the consumption of fats and oil, greater proportions of them were able to consume palm oil 38(54%) and vegetable oil 37(53%) at the interval of once a day and 2-3 per day respectively with significant association (p < 0.001).

Table 2: Food consumption frequency of the participants

Food/frequency	Never or less than a month	Once a month	2-4 per week	Once a day	2-3 per day	Total	X^2	p-value
Carbohydrate								
Rice	0(0%)	0(0%)	17(21%)	33(41%)	30(38%)	80(100%)	52.71	p < 0.001
Fufu/ Garri	2(2%)	4(5%)	28(35%)	36(45%)	10(13%)	80(100%)	80	p < 0.001
Noodles/ Spaghetti	1(1%)	13(16%)	11(14%)	30(38%)	25(31%)	80(100 %)	48.29	p < 0.002
Yam	10(13%)	26(33%)	36(45%)	5(6%)	3(3%)	80(100%)	73.29	p < 0.003
Potatoes	0(0%)	11(14%)	14(18%)	41(51%)	14(18%)	80(100%)	73.86	p < 0.004
Cereals	0(0%)	8(10%)	10(13%)	42(53%)	20(25%)	80(100%)	87.43	p < 0.006
Cocoyam	5(6%)	48(60%)	7(9%)	10(13%)	10(13%)	80(100%)	107	p < 0.008
Agidi	13(16%)	5(6%)	8(10%)	12(15%)	42(53%)	80(100%)	73.29	p < 0.009
Bread	0(0%)	3(3%)	14(18%)	46(58%)	17(21%)	80(100%)	103.57	p < 0.021
Biscuits	0(0%)	2(2%)	12(15%)	25(31%)	41(51%)	80(100%)	95.29	p < 0.022
Protein								
Beans	4(5%)	27(34%)	45(56%)	4(5%)	0(0%)	80(100%)	97.57	p < 0.001
Moi-moi	6(9%)	18(23%)	30(38%)	11(15%)	15(19%)	80(100%)	30.43	p < 0.005
Soyabeans	12(15%)	6(8%)	24(30%)	38(48%)	0(0%)	80(100%)	60	p < 0.007
Groundnut	15(21%)	4(5%)	6(8%)	40(50%)	15(19%)	80(100%)	65.86	p < 0.010
Beef meat	0(0%)	5(6%)	15(19%)	25(31%)	35(44%)	80(100%)	65.71	p < 0.013
Chicken	1(1%)	7(9%)	40(50%)	20(25%)	12(15%)	70(100%)	76.71	p < 0.014

Fish	13(16%)	10(13%)	8(10%)	39(49%)	10(13%)	80(100%)	58.14	$p < 0.015$
Liver	15(19%)	32(40%)	20(25%)	3(3%)	10)13%)	80(100%)	58.14	$p < 0.016$
Egg	10(13%)	4(5%)	2(2%)	26(33%)	38(48%)	80(100%)	48.43	$p < 0.017$
Milk	0(0%)	2(2%)	14(18%)	22(28%)	45(56%)	80(100%)	109.57	$p < 0.018$
Minerals and Vitamins								
Fruits	0(0%)	1(1%)	13(16%)	36(45%)	30(38%)	80(100%)	63.29	$p < 0.011$
Vegetables	0(0%)	6(8%)	24(30%)	38(48%)	12(15%)	80(100%)	77.14	$p < 0.012$
Soft drinks	0(0%)	2(2%)	3(3%)	45(56%)	30(38%)	80(100%)	104.14	$p < 0.023$
Fats and oil								
Palm oil	0(0%)	5(6%)	26(33%)	38(48%)	11(14%)	80(100%)	83.29	$p < 0.019$
Vegetable oil	0(0%)	3(3%)	16(20%)	24(30%)	37(46)	80(100%)	72.14	$p < 0.020$

IV. DISCUSSION

The respondents were insignificantly dominated by female (55%) Christians (86%) from Igbo tribe (72%) and were within the age bracket of 11-18 years (71%). Most of them were in secondary school (56%) and their caregivers achieved Tertiary education as their highest level of education (56%). In addition, majority of them were diagnosed of type 1 diabetes at the age bracket of 11-14 years (51%). In similar study conducted in Aswan University Hospital, Ismail *et al.* (2020) reported lower population of adolescents (26%) and female respondents (44%). In the present study also, greater proportion (80%) of the respondents belonged to the normal weight category of body mass index (BMI) with significant association. A BMI value that is less than 18.5 is considered underweight; 18.5 and 24.9 is considered normal; 25.0 and 29.9 is considered overweight; a BMI value that is 30 and above is considered obese (CDC, 2015). According to Bang (2018), as the body mass index (BMI) of adolescents increase, the likelihood of developing metabolic syndrome also increases. Previous studies have affirmed that a variety and balance of foods from all food groups and moderate consumption of all food items is very important in order to maintain a healthy diet (Nnakwe and Onyemaobi, 2013). In the present study, consumption of different classes of food varied significantly. Among the carbohydrate-based foods, cocoyam (60%) and yam (33%) were mostly consumed once a month. Fufu/ garri (45%), noodles/ spaghetti (38%), potatoes (51%), cereals (53%) as well as bread (58%) were mainly consumed once a day whereas rice (38%), agidi (53%) and biscuits (51%) were mostly consumed 2-3 per day. Once every month, higher proportion (40%) of the respondents consumed more of protein-rich food in form of liver. Also, among the protein-rich foods, beans (56%), moi-moi (38%) and chicken (50%) were mostly consumed by majority of the participants within the interval of 2-4 per week. The consumption of minerals and vitamins including fruits (45%), vegetables (48%) and soft drinks (56%) were mainly done once a day by the majority of the participants. Consumption of fats and oil in form of palm oil (48%) and vegetable oil (30%) were mostly once a day and 2-3 per day respectively. When the food deficit is very high, people's diet tends to be deficient in protein, vitamins and carbohydrate-rich staple foods such as rice, cassava and maize that provide energy (Iyabo, 2020).

CONCLUSION

Conclusively, consumption of different classes of food varied significantly. Among the carbohydrate-based foods, cocoyam 48(69%) was mostly consumed once a month. Milk was the most protein-rich food consumed within 2-3 per day. The consumption of soft drinks was mainly once a day by most of the participants. Consumption of fats and oil in form of palm oil and vegetable oil were mostly once a day and 2-3 per day respectively.

RECOMMENDATIONS

Based on the findings of this research work the following recommendations were made

1. Regular physical activity ≥3 times per week for ≥60 minutes each time should be encouraged for all children and adolescents with diabetes.

2. There is necessity to develop an intervention program for the early prevention of diabetes centered on children and adolescent diabetes high-risk groups. Equally, interventions that aim to minimize exposure to those risk factors are recommended in genetically susceptible patients.

3. Future research should be aimed at examining wider samples and to design health promotion interventions for Type 1 diabetes mellitus (T1DM) adolescents.

4. Future research needs to focus on whether culture, language and other socio-demographic attributes has an impact on the correlation between T1DM and its management measures among children and adolescents as this has the potential to widen our knowledge on such psychosocial factors and their role for patients' coping and treatment results. Furthermore, studies using instruments that target more specific psychosocial factors like eating disorders, fear of hypoglycemia, problem areas in diabetes and family related factors in association to children and adolescents with T1DM is recommended.

A nutritional food menu should be put in place to help manage blood sugar levels of children and adolescents living diabetes and avoid some of its complication.

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