



Type 2 Diabetes Mellitus in Ambulatory Adult Nigerians: Prevalence and Associated Family Biosocial Factors in a Primary Care Clinic in Eastern Nigeria: A Cross-sectional Study

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Authors' contributions

This work was carried out in collaboration between all authors. Author GUPI designed the study, wrote the protocol, performed the statistical analysis and wrote the first draft of the manuscript. Authors ANA and CICE managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background: Type 2 diabetes mellitus is a multi-factoral medical condition that aggregates in the family and has implications for family health. Research analyses of determinants of type 2 diabetes mellitus have demonstrated the interactions and clustering of family biosocial factors in its epidemiology.

Aim: To determine the prevalence of type 2 diabetes mellitus and describe the associated family biosocial factors in ambulatory adult type 2 diabetic Nigerians in a primary care clinic in South-eastern Nigeria.

Study Design: This was a cross-sectional study. Seven hundred and fifty patients were screened

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for diabetes mellitus and thirty five of them who had diabetes mellitus were age and sex matched with thirty five non-diabetic, non-hypertensive patients for the determination of the association with family biosocial factors.

Place and Duration of Study: The study was carried out at a primary care clinic in Umuahia, South-eastern Nigeria in May 2011.

Methodology: Data on family biosocial factors were obtained using pretested, structured and interviewer-administered questionnaire. Diabetes mellitus was defined using American Diabetes Association criterion.

Results: The prevalence of type 2 diabetes mellitus was 4.7%. Eleven (1.5%) of the diabetic patients were newly diagnosed in the hospital. There were fourteen (40.0%) males and twenty one (60.0%) females with sex ratio of 1:1.5. The age ranged from 28-82 years with mean age of 47 ± 11.2 years. The middle aged adults were predominantly affected. Family biosocial factors significantly associated with type 2 diabetes were family history of hypertension ($P=.006$) and diabetes mellitus ($P=.048$). A significantly higher proportion of the diabetic patients had family history of hypertension compared to the non-diabetic and non-hypertensive subjects. The diabetic patients were one and half times more likely to have family history of hypertension compared to their non-diabetic and non-hypertensive counterparts.

Conclusion: The study has shown the prevalence of type 2 diabetes mellitus with predilection for middle aged adult Nigerians. The associated family biosocial factors were family history of hypertension and diabetes mellitus. Screening adult Nigerians with family history of hypertension and diabetes mellitus for diabetes mellitus is recommended in primary care setting for family-centred preventive care.

Keywords: Adult Nigerians; family biosocial factors; prevalence; primary care; type 2 diabetes.

1. INTRODUCTION

Diabetes mellitus (DM) is a global clinical and family health problem [1-3]. The increasing burden of type 2 diabetes mellitus (T2DM) is gaining a worldwide attention as an important risk factor for premature death from non-communicable disease in families [2,4,5]. It is a multi-dimensional medical condition that requires significant participation of patients and members of family in the process of care [2,6,7] and impacts on every facets of quality of life of the affected persons and their families and places huge burden on personal, family and national economies [8-10].

The prevalence of T2DM has been reported to vary between different populations [11,12]. Research studies have demonstrated that T2DM is relentlessly increasing worldwide affecting economically affluent nations and is gradually creeping and afflicting developing countries [13-16]. The global burden of DM in 2013 by International Diabetic Federation was estimated at 382 million with predicted rise to 592 million in 2035 compared to world prevalence of 366 million in 2011 and predicted increase to 540 million in 2035 with predilection for developing countries [13]. In sub-Saharan Africa, T2DM constitutes an important clinical and public health

problem and affected 19 million people with predicted rise to 41.5 million by 2035 [13]. In a systematic review of prevalence of T2DM in sub-Saharan Africa from 1999-2011, the reported prevalence ranged from 1% in rural Uganda to 12% in urban Kenya [14]. In Northern Africa, systematic review of prevalence of T2DM reported prevalence range of 2.6% in rural Sudan to 20.0% in urban Egypt [15].

In Nigerian Africa, the national prevalence of T2DM was estimated at 2.2% by the Expert Committee on non-communicable diseases in 1997 with highest prevalence of 7% in Lagos Island and 0.5% in Mangu, Plateau state [16]. However, the International Diabetes Federation reported a prevalence of 4.99 in 2013 diabetic atlas with recorded 3921500 cases of DM in Nigeria [13]. In a systematic review of literature on the prevalence of DM in Nigeria, Abubakari *et al.* reported the prevalence of T2DM of 1.65% in 1985 and increased to 6.8% in the year 2000 [17]. The regional prevalence of T2DM in Nigeria has been reportedly variable across different parts of the country which could be a reflection of cultural, tribal and food values and lifestyles. The prevalence of T2DM of 2% was reported in semi-urban community in Zaria, northern Nigeria,[18] 7% was reported in Port Harcourt, South-south, Nigeria, [19] 5% was reported in family practice

setting in South-west, Nigeria, [2] 6.5% was reported in Calabar, South-south, Nigeria, [20] 4.6% was reported in a multicenter study by Diabcare Nigerian Study Group, [10] and 3.6% was reported in Abia state non-communicable diseases survey [21]. The prevalence of T2DM has been reported in cross sections of Nigerians: Among the obese patients in rural, semi-urban and urban adult Nigerians, the reported prevalence values of T2DM were 3.9%, [22] 3.4% [23] and 15.1% [24] respectively. The prevalence of T2DM of 7.1% was reported among abdominally obese adult Nigerians in a rural hospital in South-east, Nigeria [25] 23.6% [26] was reported among geriatric Nigerians with essential hypertension in a primary care clinic in Umuahia, South-east Nigeria and 8.7% was reported among geriatric Nigerians in a rural hospital in Imo state, South-east Nigeria [27]. More so, T2DM constituted 7.4% of emergency hospitalizations in a rural hospital in South-east Nigeria [28] and risk factors of T2DM have also been reported in Nigeria and among pre-diabetic Nigerians with essential hypertension in primary care clinic in south-east Nigeria [29,30] and 20.9% of T2DM reportedly co-occurred with hypertension in rural communities of South-east Nigeria [31].

It has been documented that every year new cases of T2DM are added to the global burden of diabetes mellitus with the figure rising annually [13]. However, the consequences of alarming epidemics of T2DM and its attendant burden on the lean resources of Nigerian families need to be addressed urgently in order to reduce the emergence of diabetes mellitus among members of the family. The significance of family biosocial risk factors as important tool for diagnosis in medical genetics is a critical element in risk assessment for many genetic conditions such as T2DM [3,32]. Research studies on the association between T2DM and family bio-social factors in primary care settings in Nigeria are nonexistent. Identification of family bio-social factors associated with T2DM avails great opportunity for health promotion and maintenance particularly in primary care settings in resource-poor environment where health care seeking behaviour and utilization are largely driven by the need for curative services rather than the imperative for preventive care [33,34]. It is against this premise that the authors were motivated to study the prevalence and associated family biosocial factors of T2DM in a cross section of ambulatory adult Nigerians in a primary care clinic in South-eastern Nigeria.

2. MATERIALS AND METHODS

2.1 Study Design

This was a cross sectional study carried out in May 2011 at the primary care clinic of Federal Medical Centre, Umuahia, Nigeria. Seven hundred and fifty adult patients were screened for T2DM using American Diabetes Association criterion, [35] thirty-five(35) patients who had fasting plasma glucose ≥ 126 mg/dL or documented use of antidiabetic medications in a previously diagnosed person with T2DM were age and sex matched with 35 non-diabetic patients. The age group frequency matching was used. The study didn't employ *apriori* separate control group. However, authors controlled for the participants with family biosocial factors of T2DM using those who were non-diabetic within the study population. The researchers adopted this study design to describe the associated family biosocial factors.

2.2 Study Setting

The study was carried out at Federal Medical Centre, Umuahia which is located in the capital of Abia state, South-east Nigeria. Abia state is endowed with luxuriant agricultural and mineral resources with supply of professional, skilled, semi-skilled and unskilled manpower. Until recently, Umuahia, the capital city has witnessed an upsurge in the number of junk food restaurants, banks, hotels, schools, markets, and industries, in addition to the changing demographic geography, nutritional and social lifestyles.

2.3 Inclusion and Exclusion Criteria

The inclusion criteria were adult Nigerian patients who gave consent for the study and were aged ≥ 18 years. The exclusion criteria were critically ill patients, pregnant diabetics (gestational diabetes) and patients with type 1 diabetes mellitus.

2.4 Sample Size Estimation and Sampling Technique

Sample size estimation was determined using the formula [36] $N = Z^2 pq/d^2$ where N=Minimum sample size, Z=Standard normal deviation usually set at 1.96 which corresponds to 95% confidence interval, P=Proportion of the population estimated to have a particular

characteristic. Proportion was taken from the prevalence of T2DM in a family practice population in Ife, Western Nigeria [2] = 5.0% (0.05). $q=1.0 - p=1.0 - 0.05=0.95$, $d=\text{degree of accuracy set at } 0.05$. Hence $N= (1.96)^2 \times 0.05 \times 0.95 / (0.05)^2$. This gave $N=73$. However, 750 adult patients were screened for diabetes mellitus and 35 patients who had diabetes mellitus were age and sex matched with 35 non-diabetic and non-hypertensive patients in order to study associated family biosocial factors.

Every adult patient who registered to see the clinicians on each consulting day during the study period and who met the inclusion criteria was consecutively recruited. This sampling technique was conveniently chosen by the authors and those participants selected were likely to be representative of the study population.

2.5 Diagnostic Procedure for Diabetes Mellitus

The plasma glucose was determined after an overnight fast between 8.00 hours to 10.00 hours using venous plasma by glucose oxidase method [37]. A repeat fasting plasma glucose was done for those who had abnormal fasting plasma glucose test result on the next scheduled clinic visit.

2.6 Diagnostic Criterion for Diabetes Mellitus

Diabetes mellitus was defined based on fasting venous plasma glucose of ≥ 126 mg/dL which was confirmed by a repeat test on second clinic visit or current use of anti-diabetic medications [35,38].

2.7 Methods

The research tool was adapted from the generic WHO-STEPwise instrument approach for chronic non-communicable diseases risk factors [39] and was modified to suit Nigerian environment through robust review of relevant literature [2,3,6,7,17,19,21,40]. The family biosocial variables studied were type of marriage, family size, type of household family and family histories of cardiovascular and metabolic conditions such as hypertension, diabetes mellitus and stroke; family dietary salt, fruits and vegetables consumptions during meal times and type of oils used in household meal

preparations [40]. The family history of hypertension, diabetes mellitus and stroke was coded as yes or no for the presence or absence of hypertension, diabetes mellitus and stroke in any of the first, second or third degree generation family members respectively [40].

The family dietary factors of fruits and vegetables consumption were evaluated by asking how many days in the previous 7 days did the family eat fruits and vegetables [34,37,40]. The dietary responses were graded into: never/rarely (<3 servings/ week) and oftentimes (≥ 3 servings/ week). Those who had ≥ 3 servings/week had adequate dietary fruits intake while those who had <3 servings/ week had inadequate dietary fruits and vegetables consumption respectively. The question on dietary salt was evaluated by inquiring whether the family added raw table salt in addition to the one used to cook meals during meal times. The dietary salt consumption responses were coded yes or no. The question on family dietary use of oils was got by inquiring in the previous 7 days the type of oils used in household meal preparations. The information on family dietary measurements was based on previous 7 days dietary recall method. This method was expected to give required information on family dietary assessment based on the feasibility in Nigerian socio-family context [34,37,40,41].

2.8 Operational Definitions

Bio-social risk factors of type 2 diabetes mellitus refer to antecedent condition(s) whose presence is(are) positively associated with an increased probability that diabetes mellitus will develop later [37,40]. Family history of primary cardio-metabolic diseases such as hypertension, diabetes mellitus, and stroke refers to previous information on the occurrence of hypertension, diabetes mellitus, and stroke events in any of the first, second or third degree generation family members who were dead or alive made by a health professional.

The bio-social risk factors studied were the traditional non-constitutional dietary factors of consumption of dietary salt, fruits, vegetables and type of household cooking oils and constitutional factors of family history of hypertension, diabetes mellitus and stroke events. Family refers to two parents and their child(ren) or single parent family made of either parent or their child(ren). Household family in Nigerian family demographic geography refers to

a number of persons eating from the same pot. Primary care refers to the care provided by physicians specifically trained for comprehensive first contact and continuing care for undifferentiated patients including early detection, management of the patient, health promotion and maintenance. Proband or consultand refers to the index patient who presented in the clinic for family case study and investigations [40].

2.9 Statistics

Analysis of the data was done using software Statistical Package for Social Sciences (SPSS) version 13.0, Microsoft Coporation Inc. Chicago, IL, USA. Univariate frequency table distributions were employed where appropriate and bivariate cross tabulations to identify important associations between variables were done using Chi-square statistics. Odds ratio(OR) and measure of risk analysis using logistic regression at 95% confidence limit was restricted to the variables that were statistically significant at bivariate Chi-square analyses. A *P-value* of <.05 was considered statistically significant.

3. RESULTS

Seven hundred and fifty adult patients were screened for diabetes mellitus; thirty five of them

had diabetes mellitus with prevalence of 4.7%. The age of the patients who had diabetes mellitus ranged from 28 years to 82 years with mean age of 47±11.2 years. There were fourteen (40.0%) males and twenty one (60.0%) females with male to female ratio of 1:1.5 Table 1.

Bivariate analysis of the family biosocial factors as related to T2DM showed that family history of hypertension ($\chi^2=6.77$, $P= .006$) and diabetes mellitus ($\chi^2=4.62$, $P=.048$) were statistically significant while other family biosocial variables were not statistically significant Table 2.

Bivariate analysis of family dietary factors as related to T2DM showed that none of the family dietary factors was statistically significant Table 3.

On logistic regression analysis of the statistically significant family variables at bivariate Chi-square analysis, family history of hypertension remained statistically significant Table 4. A significantly higher proportion of the T2DM patients had family history of hypertension compared to the non-diabetic and non-hypertensive subjects (OR=1.92, CI=0.365 - 1.801, $P-value=.041$). The T2DM patients were one and half times more likely to have family history of hypertension compared to the non-diabetic and non-hypertensive counterparts.

Table 1. Distribution of the study participants who had T2DM by age and sex

| Age (group) (years) | Parameter | |
|---------------------|-----------------|-------------------|
| | Male number (%) | Female number (%) |
| 18 – 39 | 2(14.3) | 4(19.0) |
| 40 - 60 | 7(50.0) | 10(47.7) |
| >60 | 5(35.7) | 7(33.3) |
| Total | 14(100.0) | 21(100.0) |

Table 2. Family biosocial factors as related to T2DM among the study participants

| Variables | Type 2 diabetes mellitus | | χ^2 | P-value |
|---------------------------------------|--------------------------|---------------|----------|---------|
| | Yes number (%) | No number (%) | | |
| Type of marriage | | | | |
| Monogamous | 29(82.9) | 26(74.3) | 2.06 | .491 |
| Polygamous | 6(17.1) | 9(25.7) | | |
| Type of household family | | | | |
| Nuclear household family | 33(94.3) | 31(88.6) | 4.13 | .705 |
| Extended household family | 2(5.7) | 4(11.4) | | |
| Family size | | | | |
| 1 - 4 | 28(80.0) | 30(85.7) | 3.15 | .097 |
| >4 | 7(20.0) | 5(14.3) | | |
| Family history of hypertension | | | | |
| Yes | 28(80.0) | 17(48.6) | 6.77 | .006* |
| No | 7(20.0) | 18(51.4) | | |

| Variables | Type 2 diabetes mellitus | | x ² | P-value |
|--|--------------------------|---------------|----------------|---------|
| | Yes number (%) | No number (%) | | |
| Family history of diabetes mellitus | | | | |
| No | | | | |
| Yes | 19(54.3) | 11(31.4) | 5.62 | .048* |
| No | 16(45.7) | 24(68.6) | | |
| Family history of stroke | | | | |
| Yes | 9(25.7) | 4(11.4) | 3.33 | .120 |
| No | 26(74.3) | 31(88.6) | | |

Table 3. Family dietary factors as related to T2DM among the study participants

| Variables | Type 2 diabetes mellitus | | x ² | P-value |
|---|--------------------------|---------------|----------------|---------|
| | Yes number (%) | No number (%) | | |
| Family dietary consumption of vegetables | | | | |
| Adequate | 33 (94.3) | 30(85.7) | 2.09 | .303 |
| Inadequate | 2(5.7) | 5(14.3) | | |
| Family dietary consumption of fruits | | | | |
| Adequate | 11(31.4) | 8(22.9) | 3.11 | .085 |
| Inadequate | 24(68.6) | 27(77.1) | | |
| Family dietary use of raw salt | | | | |
| Yes | 9(25.7) | 13(37.1) | 4.08 | .394 |
| No | 26(74.3) | 22(62.9) | | |
| Family dietary consumption of oils | | | | |
| Saturated | 27(77.1) | 32(91.4) | 4.69 | .290 |
| Unsaturated | 8(22.9) | 3(8.6) | | |

Table 4. Logistic regression analysis of significant family variables

| Family variables | Odds ratio | Confidence intervals (95%) | P-value |
|--|------------|----------------------------|---------|
| Family history of hypertension | | | |
| No | 1.0 | | |
| Yes | 1.92 | 0.365 – 1.801 | 0.041* |
| Family history of diabetes mellitus | | | |
| No | 1.0 | | |
| Yes | 1.07 | 0.219 – 2.130 | 0.053 |

Remark: *Significant

4. DISCUSSION

The prevalence of T2DM in this study of 4.7% is more than national prevalence of 2.2% reported in 1997 non-communicable disease survey in Nigeria [16], 3.6% reported in Abia state non-communicable diseases survey [21] and 4.6% reported in a multicentre study by Diabcare Nigeria Study Group [10] but is within 1-12% reported in systematic review of published studies on T2DM for sub-Saharan Africa [14], 2.6 - 20.0% reported in Northern Africa [15] and 1.65-6.8% reported for Nigerian Africa [17]. However, the prevalence in this study is lower than 4.99% estimated for Nigeria by International

Diabetes Federation in 2013 [13], 5.0% reported in a family practice clinic in Ife, South-west Nigeria, 7% reported in Port Harcourt, South-south Nigeria, 6.5% reported in Calabar, South-south Nigeria and reports from other countries such as 23.7% in Saudi Arabia [42] and 57.4% in India [43]. The findings of this study has corroborated the reports in Nigeria and other parts of the world on the burden of T2DM with implications for family health [3,10,13,19]. The prevalence of T2DM in this study could be attributed to cardio-metabolic variables in the family particularly in urban Nigerian setting with rapidly changing family ecology and dynamics [40,44,45]. This is related to lifestyle changes

characterized by physical inactivity, overweight, obesity in addition to socio-technological and environmental factors which predispose to type 2 diabetes mellitus [25,34,37]. With diverse family structure and function in Nigeria [44,45] combined with varying family health challenges, the family factors that promote the emergence of T2DM has implications for family oriented care which has been acclaimed as the cornerstone for patient centred care [33,46]. This study has highlighted the need and opportunity for stakeholders in Nigerian health delivery system to develop an integrated family centred approaches and responses for early detection of diabetes mellitus among family members since prevention of diabetes in the family is better and cheaper than its treatment.

Eleven (1.5%) of diabetic patients in this study were newly diagnosed. This finding is lower than the prevalence of newly diagnosed T2DM of 2.8% reported in Port Harcourt South-south Nigeria, [19] 7% reported in Calabar, South-south Nigeria [20] and reports from other parts of the world like United States of America (3%) [47]. Despite the varied family and transitional factors in the epidemiology of T2DM in Nigeria, dedicated action from committed individuals and groups are required for the conducive interplay of relevant factors to prevent and control diabetes mellitus in the family. This study therefore provide an additional evidence of the burden of newly diagnosed T2DM and is a reflection of inadequate preventive health seeking behaviour and poor performing health system particularly in primary care delivery system in the resource-constrained environment of the sub-region.

The age group that had the greatest burden of T2DM in this study was the middle age adults. This finding is in accordance with the report by International Diabetes Federation that in low and middle income countries (LMIC), more persons under the age of 60 years have T2DM compared to the high income countries where a growing population of persons over the age of 60 years makes up the largest proportion of diabetes mellitus [13]. Although T2DM was previously described as the disease of the elderly but recent evidence showed that young adult and middle age group are affected especially in high risk populations [48] and onset time of T2DM can occur up to 4-7 years before clinical diagnoses are made even in high income countries [49]. However, because of the limited and strained health resources in low and middle income countries like Nigeria, most of the patients were diagnosed with T2DM only after they have overt

symptoms and complications. Primary care clinicians in the study area should therefore be aware of this subtlety and strived to detect high risk persons for T2DM through optimal use of clinical methods for appropriate family-oriented health information, education, and counselling and health promotion. This is one of the ways that middle age Nigerians will benefits from longevity devoid of diabetes morbidities reported in advanced nations of the world.

This study has shown that family history of hypertension was associated with type 2 diabetes mellitus. The finding of this study has buttressed the reports from previous studies in Nigeria [19,50-52] and other parts of the world [53,54]. This could be a reflection of the fact that hypertension is the principal risk factor for cardio-metabolic disease and a gateway to cardiovascular disease which is the most common non-communicable disease in Nigeria [16,21,40]. In addition, hypertension and T2DM are component defining criteria of the umbrella syndrome called metabolic syndrome [51,52]. It is therefore possible that the expression of each cardio-metabolic risk factor is under genetic control and influence with intersection and interjection of different socio-behavioural and environmental exposures that predispose to dysmetabolic conditions. The family history of hypertension therefore points to a common predisposition and promotional socio-behavioural and genetic factors which are shared by hypertension and T2DM [53,54]. Exploring family history of hypertension during clinical encounter is therefore a primary care imperative especially in resource-poor setting where there are limited options for healthy living. Although family history of hypertension is a relatively simple tool for targeted screening and interventions for people at risk of metabolic decompensation but family history determination is underutilized particularly in primary care practice in resource-poor environment. However, control of hypertension in the family can be achieved successfully through primary and secondary prevention but the ultimate goal in general is primary prevention aimed at reducing the onset of T2DM through high risk interventions to avert the attainment of blood pressure at which institution of medication would be considered and co-occurrence of T2DM inevitable.

This study has demonstrated the relevance of family history of diabetes mellitus. The finding of this study is in consonance with previous studies in Nigeria [19,50] and other parts of the world like Ethiopia, [55] Spain, [56] Greece, [57] Turkey,

[58] and United States of America [3,47]. Research studies have shown the relevance of genetics and lifestyle factors in the development of T2DM [59-61]. These lifestyle practices that predispose to T2DM tend to develop in the family [62,63]. The clustering and maintenance of the risk factors of T2DM in the family is inevitable especially in family setting where members of the family share similar lifestyle practices like unhealthy diet, physical inactivity, alcohol consumption among others. The family history of T2DM is therefore relevant for identifying persons at increased risk of diabetes mellitus with the risk predilection varying with having one or two parents or relatives with diabetes mellitus [64,65]. Although, not every person with family history of T2DM develops type 2 diabetes but their chances of developing T2DM are high [19,66]. Screening adult Nigerians with immutable family history of T2DM during clinical encounter is very pertinent in primary care practice as the metabolic derangement and damage even starts before the diagnosis is made. This research study therefore informs the need for primary care based screening for family history of diabetes mellitus as part of bio-socio-environmental risk factor evaluation of adult Nigerians for preliminary determination of the need for prophylactic or therapeutic lifestyle practices that will help to establish a culture of healthy living in the family.

A significantly higher proportion of the T2DM patients had family history of hypertension compared to the non-diabetic and non-hypertensive subjects. This finding is in agreement with other reports on the relevance of family history of hypertension as a significant risk factor for emergence of T2DM [19,42,43,51,52, 60]. This relationship could be due to the influence of heredity [66] and the genetic contribution involves multiple genes with variable familial penetrance and expressions. However, apart from genetic predilection, other family socio-behavioural factors are contributory. Although not every patient with family history of hypertension develops T2DM but their chances are high. Thus, as the burden of hypertension increases globally so will the family history of hypertension and invariably T2DM. With the changing lifestyle in the family particularly in the study area, the presence of family history of hypertension during clinical encounter should provide a guide for screening for T2DM and can help tailor health education messages to family lifestyle modifications and health promotion.

4.1 Study Implications

Type 2 diabetes mellitus is a polyfactoral metabolic condition that tends to aggregate in families and cluster in persons with constitutional and non-constitutional cardio-metabolic risk factors. As the lifestyle of Nigerian families continues to change as a result of socio-economic transition and demographic geography, the prevalence of T2DM is expected to increase with implications for family health. Family health is a reflection of family lifestyle practices and unhealthy family lifestyle is a risk factor for cardio-metabolic disease such as T2DM. With the rising prevalence of T2DM in Nigeria, a feasible primary care approach on early detection of T2DM in the families which will ensure effective family-centred healthcare delivery at effective and efficient cost. Since families are important recipients of health-related information and messages on diabetes mellitus and sources of motivation for family members concerning health promotion practices for T2DM, the role of family factors on the epidemiology of T2DM need to be explored in resource-poor Nigerian family environment. Research analyses of determinants of T2DM have shown that targeting family factors is one of the cornerstones for the prevention of T2DM and that family with favourable bio-social advantage have a greater health awareness culminating in better risk reduction practices that could predispose to T2DM. Screening vulnerable families for T2DM is an important health care challenge that should be embraced particularly in primary care practice in Nigeria.

4.2 Limitations of the Study

The authors recognized the following limitations of the study. The information was collected from the consultant result findings of this study are subject to information bias. Obtaining information from the consult and also made it difficult to study other family variables such as family physical activity, body mass index among others. The limitation imposed by the cross sectional study design is also recognized and this limitation didn't allow for the evaluation of the direct effects of predictor family biosocial variables on type 2 diabetes mellitus and vice versa. The cross sectional design allowed only establishment of an association between dependent and independent variables. Further longitudinal studies to explore the interactions as well as studies to unravel the clinical relevance of

family biosocial variables in the study area are advocated.

5. CONCLUSION

The study has shown the prevalence of T2DM with predilection for middle age adult Nigerians. The associated family biosocial factors were family history of hypertension and diabetes mellitus. Screening adult Nigerians with family history of hypertension and diabetes mellitus for diabetes mellitus is recommended in primary care practice for early commencement of family centred preventive care.

CONSENT

All authors declare that 'written informed consent was also obtained from respondents included in the study.

ETHICAL APPROVAL

Ethical certificate was obtained from the Ethics Committee of the hospital.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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