Association of Socioeconomic Characteristics, Knowledge, Attitudes, and Practices towards Dietary Management with Anthropometric Indices of Type 2 Diabetics in Federal Medical Centre, Umuahia Nigeria

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Abstract—

Background: *Increasing prevalence of poorly controlled diabetes with huge health complications necessitated the evaluation of the association of socioeconomic characteristics, knowledge, attitude, and practices (KAP) towards dietary management with anthropometric indices of type 2 diabetics Federal Medical Center, Nigeria.*

Objective*: The study examined the associations between socio-economic characteristics, KAP towards dietary management, and anthropometric indices of diabetics.*

Methodology: *The cross-sectional study assessed 50 diabetics purposively selected from the hospital's outpatient clinic. Socioeconomic characteristics, KAP towards dietary management were obtained with a validated structured interviewer-administered questionnaire. Anthropometric indices (body mass index BMI and waist circumference WC) were assessed using standard methods. Data were analyzed with IBM Statistical Product for Service Solution (SPSS) version 21.0, and presented with descriptive statistics, Chi-square, and Pearson correlation.*

Results*: The patients were mainly rural (52%), female (62%), ≥ 40 years (88%), married (96%), and monogamous (84%). Sixty-two percent had below primary education status, 94% were employed, and 56% earned below ₦20,000/month. BMI and WC were high in 50% and 54% respectively; many (68%, 53%, and 67%) had good KAP towards dietary management respectively. Positive correlations exist between occupation and WC (r^2=0.537; p=0.000); education attained with BMI (r^2=0.293; p=0.039), and WC (r^2=0.676; p=0.000), income level and BMI (r^2=0.453; p=0.001), nutrition knowledge and WC (r^2 = 0.517; p=0.000); and KAP and BMI (r^2=0.355; p=0.012) of the diabetics. Negative relationships exist between knowledge of dietary management and BMI (r^2=-0.328; p= 0.020) and WC (r^2=-0.485; p=0.000).*

Conclusion*: Waist circumference had significant positive associations with education attained, occupation, and nutrition knowledge; nutrition knowledge correlated significantly with education attained.*

Keywords— Socioeconomic, knowledge, attitude, practice, anthropometry, diabetics.

I. INTRODUCTION

Diabetes mellitus is a metabolic disorder of chronic high blood sugar levels associated with disturbances in macronutrient metabolism resulting from absolute or relative insulin deficiency with dysfunction in organ systems [1]. It is globally associated with a high disease burden and has been described as one of the global leading causes of death [2, 3]. The world's prevalence of diabetes is on a steady increase, 10.5% of adults (20 – 79 years) about 537 million people are currently with diabetes, almost 50% are unaware of the condition and 90% have type 2 diabetes [3]. In Africa, the prevalence is 4.5% an estimate of 24 million adults (20 – 79 years) with diabetes, and it is predicted to increase to 129% (55 million people) by 2045 [2]. Mortality increases every second, and legs/arms are being amputated continually due to diabetes complications [4, 5]. Initially, Nigeria had about 3.2 million cases especially type 2 diabetes [6]. This prevalence is alarming, because the earlier rate in Nigeria was 1-7% of the population [7], but onward the prevalence of diabetes came up to 5.77% [8]. The increase in the incidence of diabetes

especially type 2 in developing countries has been attributed to urbanization, the aging population, lifestyle changes resulting in decreasing physical activity, and increasing overweight and obesity prevalence [3]. This upsurge in the prevalence of diabetes is known to be accompanied by tremendous losses in national income and livelihood [9]. In Nigeria, the blood glucose level of known diabetics continues to rise due to poor management resulting from poorly functioning National Health Insurance Scheme (NHIS) and health bills fully funded by individuals [10]. The situation is complicated and predisposes the patients to organ damage, dreadful chronic diseases like hyperlipidemia, hypercholesterolemia, cardiovascular diseases, kidney problems, and a host of other complications, leading to amputations and eventually death. The huge health cost attributed to this condition is regrettable considering that dietary modification apart from being the clinically recommended primary therapy for diabetes mellitus [11], is also the simplest and cheapest form of diabetes treatment. Diet has since been proven to be the best long-term therapy in the management of diabetes [12]. This global high prevalence of diabetes which is compounded with many undiagnosed diabetes and improper or unsatisfactory management and control of blood glucose of known diabetics, raises questions like what is the problem, why is there poor control of blood glucose in diabetics despite the existing dietary modifications?

As a chronic illness, diabetes requires sound knowledge of self-care and informed decisions by the patients for effective management. Patients with increased BMI are at higher risk of diabetes, and increased WC means that excessive fat have been deposited around the internal organs (liver and pancreas) which will result in insulin resistance. Both indices are associated with incidence of heart failure and other chronic diseases in diabetics [13]. The current increase in poorly controlled diabetes coupled with a dearth of research on the knowledge, attitude, and practices of dietary management of diabetic patients in Nigeria, calls for immediate investigation on the associations of socio-economic characteristics, knowledge, attitude, and practices towards the dietary management of diabetic patients with their anthropometric indices (BMI and WC) as these concepts could impact on the disease outcome.

II. MATERIALS AND METHODS

2.1 Study design:

A cross-sectional survey design was used for the study.

- **Survey area:** The survey was carried out in the outpatient clinic of Federal Medical Center (FMC), Umuahia, Abia State Nigeria. The Hospital is a tertiary health facility located in the state capital Umuahia [14]. The facility caters to patients in the state capital as well as referrals from within and outside the state and has an accredited Dietetic Center.
- **Population of the study:** The study population is composed of out-patients diabetics attending the Special clinic of the Federal Medical Centre Umuahia, Nigeria.

2.2 Sample size and Sampling technique:

The sample size was obtained using the prevalence of diabetes (4.3%) in Africa for adults (20-79) years [15] to calculate with the sample size formula - sample size (n) $=Z^2xP\ (100\text{-}P)/x^2$ where p= prevalence rate of diabetes (4.3%), z = confidence interval taken at 95% probability (1.69) and approximately 2%, x = width of confidence interval at 5% probability. Thus, sample size (n) $= 1.69^2$ x 4.3 (100-4.3)/5^2 = 12.28123 x 95.7/25 = 47.013 which was approximated to 50

2.3 Sampling techniques:

The Federal Medical Centre Umuahia has no clinic days for diabetic patients only, thus any diabetic patients that were available on each visit to the specialist clinic and willing to participate were purposively selected and used for the study.

2.4 Ethical approval and Informed consent:

A written proposal was submitted for approval to the Health Research Ethics Committee (HREC) of the Federal Medical Centre Umuahia. The proposal was thoroughly reviewed, scrutinized, and approved, and the ethical certificate was issued (FMC/OEH/G.596/Vol.10/039). The study respondents were duly informed of the study, and only those who gave their consent were used for the study.

2.5 Data collection:

- **Questionnaire**: A validated interviewer-administered structured questionnaire was used to obtain information on the socioeconomic characteristics, knowledge, attitude, and practice of diabetics toward dietary management.
- **Anthropometry**: Anthropometric indices weight, height, and waist circumference were obtained using standard procedure [16]. The weight of each respondent barefooted and with minimum clothing was measured with a

mechanical scale (M1206 Body weight Szt-120 with stadiometer) to the nearest 0.1kg. The height of each respondent standing erect on a platform without shoes looking straight ahead with hands on the sides, and the moveable headplate on the crown of the head was measured to the nearest 0.1cm with a stadiometer (M1206 Body weight Szt-120 with stadiometer). BMI was calculated with the equation Weight (kg) / Height (m^2), where Wt. (kg) = weight of the patient in kilogram, and Ht.(m^2) = height of the patients in meter square.

The waist circumference of the respondents was obtained with a flexible non-stretchable fiber tape. The respondents were made to stand at ease with their weight evenly distributed on both feet, with the feet placed about 25 to 30 cm apart. The waist circumference was taken midway between the upper hip bone and the uppermost border of the right iliac crest. The tape was placed around the abdomen at the level of the midway point, and readings were taken with the tape snug to the skin to the nearest 0.1 cm.

2.6 Statistical analysis:

Data generated from the study were analyzed with IBM Statistical Product for Service Solution (SPSS) version 21.0 software and results were presented with descriptive statistics (frequencies, and percentages). BMI and WC were obtained, graded, and compared with standards. BMI <18.5kg/m^2= underweight, 18.5 to 24.9 = normal weight, 25 to 29.9 overweight/pre-obesity, 30.0 to 34.9 = obesity class 1 (WHO). Healthy WC = ≤ 35 inches for women, ≤ 40 inches for men (National Heart, lung, and Blood Institute, American Heart Institute, International Diabetes Federation). Chi-square and Pearson's correlation were used to determine the associations between socio-economic characteristics, knowledge, attitudes, and practice of diet therapy of patients with BMI and WC.

III. RESULTS

More than half (52%) of the patients were Abia indigenes, residing in rural areas (table 1). Many (88%) were equal to or above 40years of age, more (62%) females than males (32%) and 100% Christians. Sixty-two percent were married and 84% were monogamous. Almost half (46%) attained primary education status, 28% in civil service and more than half (56%) earned less than ₦20,000/month.

TABLE 1
PERSONAL AND SOCIOECONOMIC STATUS OF TYPE 2 DIABETIC PATIENTS

Characteristics	Variables	Frequency (%)	Characteristics	Variables	Frequency (%)
State of origin	Abia	26(52)	Religion	Christianity	50(100)
	Anambra	4(8)		Others	0(0)
	Delta	1(2)		**Total**	**50(100)**
	Cross River	1(2)	Type of family	Polygamous	8(16)
	Ebonyi	1(2)		Monogamous	42(84)
	Imo	17(34)		**Total**	**50(100)**
	Total	**50(100)**	Education level	No formal education	8(16)
Area of residence	Urban	24(48)		Primary	23(46)
	Rural	26(52)		Secondary	11(22)
	Total	**50(100)**		Tertiary	8(16)
Age	20-29 years	1(2)		**Total**	**50(100)**
	30-39 years	5(10)	Occupation	Civil servants	14(28)
	≥40	44(88)		Business	15(30)
	Total	**50(100)**		Students	3(6)
Sex	Male	19(38)		Artisans	7(14)
	Female	31(62)		Farmers	7(14)
	Total	**50(100)**		Self-employed	4(8)
Marital status	Married	31(62)		**Total**	**50(100)**
	Single	2(4)	Monthly income	Less than ₦ 20,000	28(56)
	Divorced	1(2)		₦20,000-50,000	15(30)
	Widowed	16(32)		₦60,000-500,000	7(14)
	Total	**50(100)**		Above ₦ 500,000	0(0)

Most of the patients (96%) were diagnosed by doctors (table 2). Many (72%) have had diabetes for over two years, 52% had different complications with as much as 20% having diabetic retinopathy only. Many (62%, 44%) had chronic diseases and diabetes running in their families respectively, and up to 40% had family members (1 to 3) with (20% siblings) diabetes.

TABLE 2
DISEASE HISTORY OF TYPE 2 DIABETIC PATIENTS IN THE STUDY AREA

Parameters	Variables	Frequency (%)	Parameters	Variables	Frequency (%)
Type of diabetes	Type 1	2 (4)	**Diseases in family**	None	19(38)
	Type 2	48 (96)		Hypertension	6(12)
	Gestational	0 (0)		CVD	1(2)
	Total	**50(100)**		Diabetes	19(38)
Diagnosed by	Doctors	48(96)		Hypertension & diabetes	3(6)
	Nurses	0(0)		Hypertension & CVD	1(2)
	Dietitians	0(0)		Kidney problem	1(2)
	Family members	2(4)		**Total**	**50(100%)**
	Total	**50(100%)**	**Diabetic members**	None	9(18)
Diabetes duration	< 6month	4(8)		1 to 3	20(40)
	6months	2(4)		4 to 6	3(6)
	One year	4(8)		Above 6	2(4)
	Two years	4(8)		Uncertain	16(32)
	> 2 years	36(72)		**Total**	**50(100%)**
	Total	**50(100%)**	**Persons affected**	Father	5(10)
Complications	None	24(48)		Mother	1(2)
	Retinopathy	10(20)		Siblings	10(20)
	Nephropathy	1(2)		Father + others	4(8)
	Neuropathy	2(4)		Mother + siblings	3(6)
	Weight loss	2(4)		Father & mother	1(2)
	Foot ulcer	4(8)		Uncertain	26(52)
	Multiple complications	7(14)		**Total**	**50(100%)**
	Total	**50(100%)**			

Almost half (46%) of the patients had good nutrition knowledge, 68% had good dietary management knowledge, 52.8%, and 67% had good attitudes, and practice of dietary management respectively (table 3). Dietary care was mainly (38%) from doctors, 68% were on diet therapy with 36% over five years.

TABLE 3
KNOWLEDGE, ATTITUDE, AND PRACTICES OF THE TYPE 2 DIABETIC PATIENTS

Parameter	Variables	Frequency (%)	Parameter	Variables	Frequency (%)
Nutrition knowledge	Good	23(46)	Diet care	Doctors	19(38)
	Poor	16(32)		Nurses	2(4)
	Very poor	11(22)		Dietitians	13(26)
	Total	**50(100%)**		Self	16(32)
Dietary management. Knowledge	Good	34(68)		**Total**	**50(100%)**
	Poor	11(22)	Diet therapy	Yes	34(68)
	Very poor	5(10)		No	16(32)
	Total	**50(100%)**		**Total**	**50(100%)**
Attitude	Good	26.4(52.8)	Diet duration	0-6months	6(12)
	Poor	5(10)		6-1 year	1(2)
	Very poor	18.6(37.2)		1-3 years	6(12)
	Total	**50(100%)**		3-5 years	3(6)
Practice	Good	33.5(67.0)		> 5 years	18(36)
	Poor	10(20)		Uncertain	16(32)
	Very poor	6.5(13.0)		**Total**	**50(100%)**
	Total	**50(100%)**			

Most (80%) patients did not indicate quitting dietary regimen, 42% had inconsistent dietary regimen due to poverty, and 62% had no response for challenges encountered (table 4). Health was the main (32%) motivation for good attitude and practice of dietary management.

TABLE 4
FACTORS INFLUENCING TYPE 2 DIABETICS' ATTITUDES AND PRACTICES TO DIETARY MANAGEMENT

Parameters	Factors	Frequency (%)	Parameters	Factors	Frequency (%)
Quitting of diet regimen	Social	4(8)	**Challenges**	Expensive	15(30)
	Economic	4(8)		Lifestyle	2(4)
	Stress	2(4)		Religion	2(4)
	None	40(80)		No response	31(62)
	Total	**50 (100.0)**		**Total**	**50 (100.0)**
Inconsistent diet regimen	Friends& Family	2(4)	**Motivation**	Health	16(32)
	Limited time	1(2)		Advice	13(26)
	Poor food preparation skill	1(2)		Availability of resources	1(2)
	Lack kitchen facility	2(4)		Health and advice	1(2)
	Lack of money	21(42)		Nothing	19(38)
	Preference	2(4)		**Total**	**50 (100.0)**
	None	22(44)			
	Total	**50 (100.0)**			

Many (44%) had normal BMI while 38%, 12%, and 6% were overweight, obese, and underweight respectively, with no significant (x^2=5.453; p=0.141) difference in the BMI of the male and female patients (table 5). More than half of the population (54%) had abnormal waist circumference with significant (x^2=6.202; p=0.013) difference in the waist circumference of the male and female outpatients.

TABLE 5
BODY MASS INDEX AND WAIST CIRCUMFERENCE OF TYPE 2 DIABETICS

Parameters	Classification	Male Freq	%	Female Freq	%	Total Freq	%	X^2	p-value
Body Mass Index	Underweight (<18.5)	1	5.3	2	6.5	3	6	**5.45**	**0.141^{ns}**
	Normal weight (18.5-24.99)	5	26	17	55	22	44		
	Overweight (25-29.99)	11	58	8	26	19	38		
	Class I obesity (30-34.99)	2	11	4	13	6	12		
	Total	19	100	31	100	50	100		
Waist circumference									
Normal	Female (<88); Male (<102)	13	68	10	32	23	46	**6.2**	**0.013***
Abnormal	Female (>88); Male (>102)	6	32	21	68	27	54		
	Total	19	100	31	100	50	100		

Positive correlation coefficients $r^2 = 0.355$ at $p = 0.012$, and $r^2 = 0.517$ at $p = 0.000$ exist between KAP and BMI; and waist circumference and knowledge of nutrition respectively; and negative correlation coefficients ($r^2 = -0.328$ at $p = 0.020$; $r^2 = -0.485$ at $p=0.000$) between knowledge of dietary management of the respondents on their BMI and waist circumference respectively (table 6). There was also a positive correlation coefficient ($r^2=0.405$ at $p = 0.004$) between the attitudes of the respondents toward diabetes management and their waist circumference. The dietary practices of the respondents negatively correlated ($r^2= 0.328$ at $p=0.020$) with their BMI.

TABLE 6
RELATIONSHIP OF TYPE 2 DIABETICS' KNOWLEDGE, ATTITUDES, AND PRACTICES WITH BMI AND WC

Correlation Parameters		Nutrition knowledge	Dietary mgt	Attitude	Practice	BMI	WC
Nutrition knowledge	Pearson Correlation	1	-.485**	.405**	-.485**	.355*	.517**
	Sig. (2-tailed)		0	0.004	0	0.012	0
	N	50	50	50	50	50	50
Dietary mgt	Pearson Correlation	-.485**	1	-0.058	.357*	-.328*	-.485**
	Sig. (2-tailed)	0		0.687	0.011	0.02	0
	N	50	50	50	50	50	50
Attitude	Pearson Correlation	.405**	-0.058	1	-.659**	0.08	.405**
	Sig. (2-tailed)	0.004	0.687		0	0.58	0.004
	N	50	50	50	50	50	50
Practice	Pearson Correlation	-.485**	.357*	-.659**	1	-.328*	-0.227
	Sig. (2-tailed)	0	0.011	0		0.02	0.113
	N	50	50	50	50	50	50
BMI	Pearson Correlation	.355*	-.328*	0.08	-.328*	1	.458**
	Sig. (2-tailed)	0.012	0.02	0.58	0.02		0.001
	N	50	50	50	50	50	50
WC	Pearson Correlation	.517**	-.485**	.405**	-0.227	.458**	1
	Sig. (2-tailed)	0	0	0.004	0.113	0.001	
	N	50	50	50	50	50	50

*****. Correlation is significant at the 0.01 level (2-tailed)***
****. Correlation is significant at the 0.05 level (2-tailed)***

Nutrition knowledge was positively associated with education attainment ($r^2 = 0.535$; $p = 0.000$), Knowledge of dietary management of diabetes has negative association with the occupation of the respondents, income level significantly ($r^2 = 0.280$; $p = 0.049$) influenced the knowledge of dietary management (table 7). Attitude of the respondents towards diabetes significantly ($r^2 = 0.512$; $p = 0.000$) influenced their education attainment. There was negative association ($r^2 = 0364$; $p = 0.009$) between attitude of the respondents and age. No significant association was found between the practice of the patients toward diabetes and their socioeconomic variables such as age ($r^2 = 0.240$; $p = 0.093$), marriage ($r^2 = 0.135$; $p = 0.350$), occupation ($r^2= -0.020$; $p = 0.888$), education ($r^2 = -0.085$; $p = 0.555$) and income ($r^2 = 0.102$; $p = 0.481$).

TABLE 7
RELATIONSHIP OF TYPE 2 DIABETICS SOCIOECONOMIC DATA ON KNOWLEDGE, ATTITUDES, AND PRACTICES

Correlation Parameters		Nutrition knowledge	Dietary mgt	Attitude	Practice	Age	Marriage	Occupation	Education	Income
Nutrition knowledge	Pearson Correlation	1	-.485**	.405**	-.485**	0.078	-0.002	0.273	.535**	-0.037
	Sig. (2-tailed)		0	0.004	0	0.59	0.987	0.055	0	0.801
	N	50	50	50	50	50	50	50	50	50
Dietary mgt	Pearson Correlation	-.485**	1	-0.058	.357*	-0.188	0.135	-.354*	-0.055	.280*
	Sig. (2-tailed)	0		0.687	0.011	0.19	0.35	0.012	0.703	0.049
	N	50	50	50	50	50	50	50	50	50
Attitude	Pearson Correlation	.405**	-0.058	1	-.659**	-.364**	0.001	0.258	.512**	0.004
	Sig. (2-tailed)	0.004	0.687		0	0.009	0.994	0.07	0	0.976
	N	50	50	50	50	50	50	50	50	50
Practice	Pearson Correlation	-.485**	.357*	-.659**	1	0.24	0.135	-0.02	-0.085	0.102
	Sig. (2-tailed)	0	0.011	0		0.093	0.35	0.888	0.555	0.481
	N	50	50	50	50	50	50	50	50	50
Age	Pearson Correlation	0.078	-0.188	-.364**	0.24	1	-0.17	0.078	0.006	-0.134
	Sig. (2-tailed)	0.59	0.19	0.009	0.093		0.237	0.592	0.965	0.354
	N	50	50	50	50	50	50	50	50	50
Marriage	Pearson Correlation	-0.002	0.135	0.001	0.135	-0.17	1	-.333*	-0.157	-.482**
	Sig. (2-tailed)	0.987	0.35	0.994	0.35	0.237		0.018	0.277	0
	N	50	50	50	50	50	50	50	50	50
Occupation	Pearson Correlation	0.273	-.354*	0.258	-0.02	0.078	-.333*	1	.523**	0.112
	Sig. (2-tailed)	0.055	0.012	0.07	0.888	0.592	0.018		0	0.437
	N	50	50	50	50	50	50	50	50	50
Education	Pearson Correlation	.535**	-0.055	.512**	-0.085	0.006	-0.157	.523**	1	.437**
	Sig. (2-tailed)	0	0.703	0	0.555	0.965	0.277	0		0.002
	N	50	50	50	50	50	50	50	50	50
Income	Pearson Correlation	-0.037	.280*	0.004	0.102	-0.134	-.482**	0.112	.437**	1
	Sig. (2-tailed)	0.801	0.049	0.976	0.481	0.354	0	0.437	0.002	
	N	50	50	50	50	50	50	50	50	50

*****. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed)***

The patients age had no significant ((p>0.005) association with BMI and WC, marital status was negatively associated with their BMI (r^2= -0.484), and significant positive associations exist between occupation and the waist circumference (r^2=0.537), education attained and BMI (r^2=0.293) and WC (r^2=0.676) as well as their income level and BMI (r^2=0.453) (table 8).

TABLE 8
RELATIONSHIP OF TYPE 2 DIABETICS' SOCIOECONOMIC DATA WITH BMI AND WC

Correlations parameters		Age	Married	Occupation	Education	Income	BMI	WC
Age	Pearson Correlation	1	-0.17	0.078	0.006	-0.134	0.123	0.078
	Sig. (2-tailed)		0.237	0.592	0.965	0.354	0.394	0.59
	N	50	50	50	50	50	50	50
Marriage	Pearson Correlation	-0.17	1	-.333*	-0.157	-.482**	-.484**	-0.176
	Sig. (2-tailed)	0.237		0.018	0.277	0	0	0.221
	N	50	50	50	50	50	50	50
Occupation	Pearson Correlation	0.078	-.333*	1	.523**	0.112	0.04	.537**
	Sig. (2-tailed)	0.592	0.018		0	0.437	0.783	0
	N	50	50	50	50	50	50	50
Education	Pearson Correlation	0.006	-0.157	.523**	1	.437**	.293*	.676**
	Sig. (2-tailed)	0.965	0.277	0		0.002	0.039	0
	N	50	50	50	50	50	50	50
Income	Pearson Correlation	-0.134	-.482**	0.112	.437**	1	.453**	0.241
	Sig. (2-tailed)	0.354	0	0.437	0.002		0.001	0.092
	N	50	50	50	50	50	50	50
BMI	Pearson Correlation	0.123	-.484**	0.04	.293*	.453**	1	.458**
	Sig. (2-tailed)	0.394	0	0.783	0.039	0.001		0.001
	N	50	50	50	50	50	50	50
WC	Pearson Correlation	0.078	-0.176	.537**	.676**	0.24	.458**	1
	Sig. (2-tailed)	0.59	0.221	0	0	0.092	0.001	
	N	50	50	50	50	50	50	50

*. Correlation is significant at the 0.05 level (2-tailed)
**. Correlation is significant at the 0.01 level (2-tailed)

IV. DISCUSSION

Most of the patients were of Igbo ethnicity as the study was conducted in Abia state located in Eastern Nigeria, dominated by the Igbo ethnic group (table 1). It was surprising that more of the patients were rural dwellers as the hospital is in an urban area. This is contrary to the documentation that proximity/nearness to health facilities encourages attendance [17] and in consonance with the report on diet-related non-communicable diseases in Ghana which had fewer respondents (46.4%) from urban and more (53.6%) from rural [18]. The low turn-out of urban patients could be that they can manage their disease condition or may have other private health facilities available to them in the urban area. The age bracket of most patients (≥40 years) was related to type 2 diabetes which occurs mainly in adult populations over 40 years. Most diabetic patients in developing countries are within the productive age range of 40 years and above [19]. Diabetes is a chronic disease that advances with age because organs like the pancreas become incapacitated and unable to produce or utilize sufficient insulin. There were more female diabetic patients than males. Other studies have reported a female majority (64.9% female and 35.1% males) in diabetic patients attending Federal health facilities [20, 21]. It has already been explained that females are more vulnerable to diet-related non-communicable diseases than men [22]. The greater percentage of patients that were married and monogamous is a reflection that they were mainly adults and of Christian religion respectively. Marriage is usually convened between two adults, and Christianity encourages and compels its members to monogamy. The low education status of a good number of the patients explained why the majority were poorly occupied with poor monthly earnings too. Lower education status is synonymous with poor/low-paying jobs, and the inability to secure high-paying jobs. This status translated to very poor income. The percentage of patients with Type 2 and type 1 diabetes (table 2) was in line with the WHO global prevalence of type 2 diabetes which is about 90% and type 1 only about 10% [14, 23, 24]. Majority of the diabetic patients were diagnosed by doctors. This is expected as disease diagnosis in hospital patients is one of the primary assignments of medical officers. The duration of the disease condition in many of the patients was because of the chronic nature of diabetes. Type 2 Diabetes mellitus

is a disease that develops over time, once diagnosed, the treatment and management follow. When diabetes is poorly managed, it could predispose one to other complications like diabetic retinopathy as seen in a good number of the patients. The percentage of patients with diabetic retinopathy aligns with earlier studies on the high prevalence of diabetic retinopathy amongst diabetics. [15, 23, 25]. Kertes *et al.* [26] reported up to 80% diabetic retinopathy in people with diabetes. Diabetic retinopathy was a common complication among the study patients (20%), more so, patients who had other complications also had retinopathy (Table 2). This explained the challenges encountered during questionnaire administration as most of the patients, had trouble in reading the written questionnaire due to eye problems. It has been discussed that the prevalence of diabetes complications could be due to non-compliance to both dietary and medical advice and poor follow-ups [27]. Evidence has shown that patient education is the most effective way to lessen the complications of diabetes and its management [28]. IDF [3] listed genetic predisposition as one of the major causes of type 2 diabetes. This is consistent with the percentages of the patient's family members who have diabetes. The level of education affects patients' knowledge of nutrition and dietary management of diabetes [29]. Although most of the study patients had low education status, and are not economically empowered due to low income, a good number had good nutrition knowledge, attitude, and practice of dietary management respectively (Table 3). This could be that the patients were duly informed of the disease condition and were involved in their care process. It was revealed that dietary care for some patients (over five years on diet therapy) was mainly from doctors in the facility that is housing a nationally recognized Dietetic unit. This could mean that either the medical team in the hospital does not include Dietitians or the medical officers are not referring patients to dietitians who are experts in diet therapy. This situation could explain the 22% of the patients that had poor knowledge of diabetes dietary management. Diabetics' knowledge influenced attitudes and practices towards dietary intake [30]. It is encouraging that most of the patients do not indicate quitting their dietary regimen (Table 4), although some had inconsistent dietary regimens with poor economic status as the biggest challenge to dietary management. In this study, most patients revealed that health with lifestyle and religion was the main motivation for good attitude and practice of dietary management. A greater number of the patients had normal BMI (Table 5) this is because dietary modification encourages weight control. The total percentage (56%) of the respondents that were overweight, obese, and underweight could be that these patients were having difficulties in managing the disease situation; confirming the inconsistency in adherence or non-adherence to the dietary modification, and no contact with Dietitians in the hospital care reported above. This situation indicates the urgent need for Dietitians to be involved in assisting these patients to confidently manage the disease. The abnormal waist circumference (WC) recorded for more than half of the study population is an additional reflection of their inability to manage their situation. The significant (x^2=6.202; p=0.013) difference in the waist circumference of the male and female outpatients with the females having high WC implied that the females were more at risk of cardiovascular diseases. This could be attributed to the differences in body composition of women and men. Women have more body fat than men, although men have relatively more central fat distribution. Waist circumference has been known to predict abdominal fat better than waist-to-hip ratio, independently it can predict health risks when BMI is not markedly increased (BMI >35) and is important in diagnosing metabolic syndrome [31]. More explicitly, a high waist circumference is associated with an increased risk for type 2 diabetes, dyslipidemia, hypertension, and CVD in patients with a BMI in a range between 25 and 34.9kg/m^2 as documented [32]. Consequently, the number of patients that had abnormal waist circumference (54%) could be associated with the prevalence of complications among these patients. The positive correlation coefficient observed between KAP and BMI of the respondents (r^2=0.355; p=0.012) and waist circumference and their knowledge of nutrition (r^2=0.517; p=0.000) (Table 6) are indications that these components are positively related. Good nutrition knowledge, attitude, and practice (KAP) impart positively to BMI and WC. The positive relationship was more significant between respondents' WC and nutrition knowledge (52%) than respondents' KAP and BMI (36%). The negative relationships observed between the knowledge of dietary management of the respondents and their BMI (r^2=-0.328; p= 0.020) and waist circumference (r^2=-0.485; p=0.000) suggested that the respondents' knowledge of diabetes dietary management does not necessarily translate to better nutritional status, indicating the possibility of other causal factors. The positive correlation coefficient found between the attitude of the respondents toward diabetes management and their waist circumference (r^2=0.405; p=0.004), implied that a good attitude will initiate good health and poor attitude to diabetes management may prevent the respondents from making the right food choices which will in turn predispose them to abnormal waist circumference and poor health outcome. The negative association (no relationship) found between the respondents' dietary practice and their BMI (r^2=-0.328; p=0.020) suggested the existence of other factors in maintaining a good BMI. Nutrition knowledge was significantly (r^2=0.535; p=0.000) associated with the respondents' education attainment (Table 7). Knowledge of dietary management of diabetes has no relationship with their occupation, this implied that the respondents' occupation was not a major determinant of their knowledge of dietary management. Conversely, their income level was directly (r^2=0.280; p=0.049) related to the knowledge of dietary management of diabetics. This implies that more income (coupled with better knowledge) will translate to better dietary management. The

respondents' attitude towards diabetes management was significantly (r^2=0.512; p=0.000) related to their educational attainment. Education is known to inform and broaden one's knowledge of a concept, and consequently, better knowledge will encourage better attitude, practice, and adherence to dietary regimens. The negative association (r^2=0364; p=0.009) found between the attitude of the respondents and their age was expected as one's attitude toward diabetes may not necessarily relate to one's age. The relationship between the practice of the patients toward diabetes and their socioeconomic variables such as age (r^2=0.240; p=0.093), marriage (r^2=0.135; p=0.350), occupation (r^2= -0.020; p=0.888), education (r^2= -0.085; p=0.555) and income (r^2=0.102; p=0.481) was not significant. There was no significant (p>0.005) relationship between BMI and WC of the respondents. Their marital status was negatively associated with their BMI (r^2= -0.484; p=0.000), meaning that marriage is not a direct factor that may either increase or decrease their body composition, showing the existence of other stronger factors. Factors like Food consumption pattern, diet quality, activity level and genetics have stronger associations with BMI [33, 34]. The significant positive association found between occupation and the waist circumference (r^2=0.537; p=0.000) of the respondents is an indication that the type of job one does can affect the person's waist circumference. It could further indicate that an active person may not have excessive fat accumulation in the waist compared with one who is sedentary. There was a significant positive association between the education attained by the respondents and their BMI (r^2=0.293; p=0.039) and WC (r^2=0.676; p=0.000). This indicates that the level of education acquired by a person could go a long way in determining his dietary and lifestyle pattern which will end up affecting the BMI and WC of the person. The positive significant association between the income level of the respondents and their BMI (r^2=0.453; p=0.001), may suggest that those with high income will be able to make informed food choices that will prevent overweight or obesity, and further diabetic complications. It may also enable them to adhere to prescribed dietary regimens, unlike low-income patients.

Conclusion Weight is an important factor in Diabetes management. The appreciable percentage of the patients who had complications and were unable to manage their weight suggests an urgent inclusion of the hospital's Dietitians in the patients' care process. Correlations exist between socioeconomic characteristics, KAP of diabetic patients to dietary management, and their anthropometric indices. These associations were positive and significant between education attained, occupation, and nutrition knowledge, with WC respectively. Nutrition knowledge was significantly associated with the respondents' education attainment. Diabetes management needs a holistic approach for sustainable success.

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