

## HEALTH DISPOSITION, SIGNS OF POTENTIAL NUTRIENT DEFICIENCIES AND LIFESTYLE CHARACTERISTICS OF DIABETIC ADULTS ATTENDING THE OUTPATIENT CLINIC OF UNIVERSITY OF NIGERIA TEACHING HOSPITAL ENUGU, NIGERIA

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### ABSTRACT

**Background/ Objective:** The health and physical routine of an individual patient has implication on management of chronic diseases. This study investigated the health disposition, signs of potential nutrient deficiencies and lifestyle characteristics of out-patient type 2 diabetic adults.

**Methodology:** A total of 370 subjects were purposively selected from the Out-patients Diabetic clinic of University of Nigeria Teaching Hospital Ituku-Ozalla, Nigeria. Physical examination and questionnaire were used to obtain information of the medical disposition, potential signs of nutrient deficiencies and lifestyle characteristics. Data obtained were analyzed with IBM SPSS statistics version 21) and presented with descriptive statistics.

**Result:** The results indicated that 71.4% of the patients had consulted a dietitian, 55% were on diet regime, 35.4% were regular on medications, and 42.4% consider the drugs were many with side effects. Few were susceptible to hypoglycemia (15.4%), frequent cold, and upper respiratory/urinary tract infections (17%). Very few (1.7% women) had fibrocystic disease. Cracks on lip margin (16.8%), scaly, flaky seborrheic condition of the nose (17%), Sore/burning tongue (9.2%), decreased taste acuity (9.2%), bleeding gum (28%) small red spots under their skin (2.7%), easy bruising (9.7%), slow wound healing (6.8%), soft nails (3.2%), white spots on/under the fingers nails (1.3), and ridges in the nails (4.9%), were the nutrient deficiency signs the patients experienced. Many (44.3%) desired weight reduction, 62.1% engage in regular exercise and 45.7% devise alternative exercise when they have health challenges. Some (60%) drank alcohol occasionally, and 97.3% were non-smokers. There was no relationship between being on expert-guided diet regime and ethnicity, physical activity and religion, physical activity and ethnicity, exercise type and ethnicity.

**Conclusion:** Nutritional deficiency signs were found in some adult outpatient diabetics, although their lifestyle characteristics were commendable, management of these signs will make for effective diabetes control.

**Keywords:** health disposition, nutrient deficiencies; lifestyle factors, chronic disease; Type 2 diabetes; Out-patient.

### INTRODUCTION

The well-being and lifestyle characteristics of a patient can impact significantly on the health outcome. Nutrient deficiency states presents in all life cycle stages and are usually due to poverty, inadequate nutrient intake, insufficient nutrition, and health information, poor management of the presenting health conditions as well as other environmental factors like family and work related stresses. These conditions tend to increase the chances of hospitalization and development of complications in chronic diseases. Type 2 diabetes mellitus (T2DM) is one of the chronic diseases that are plagued with different nutrient deficiencies. Its management relies heavily on diet, drugs, and lifestyle characteristics. Evidences suggest that as much as 8.5% of the global community had diabetes as at 2014 [1] and the prevalence were increasing tremendously in low and middle income countries. WHO [2] estimate in 2016 was 1.6 million deaths due to diabetes and 2.2

million deaths due to high blood glucose in 2012. It was reported that about 1 in 11 adults have diabetes Mellitus, 90% of which have T2DM [3]. Current global estimate of T2DM prevalence for 2018 to 2028 shows 500 million prevalent cases with comparable prevalence in high and low income countries with the later having the highest growth [4]. The upsurge in the number of people with diabetes as well as the enormous deaths attributed to diabetes and high blood glucose necessitates a holistic look into nutritional conditions presenting in people with diabetes to facilitate proper management of the disease condition. This present study examined the health disposition, signs of potential nutrient deficiencies and lifestyle characteristics amongst diabetic adults attending a tertiary health facility in a rural Nigeria community to underscore other presenting conditions/variables that might have implications on diabetes management.

## **MATERIALS AND METHODS**

### **Study design**

This study adopted a cross sectional survey design.

### **Study area**

The study was conducted in the Out-patient Diabetic Clinic of the University of Nigeria Teaching Hospital (UNTH) Ituku-Ozalla. The hospital is located on Enugu Port- Harcourt Express Way, some minutes from Enugu, the capital city of Enugu state. Enugu state is the main state in southeastern Nigeria with a population of 3,267,887 people (Federal, Republic of Nigeria Census, 2006), a good soil-land and climatic conditions all year round. UNTH is a tertiary health facility, currently the center of excellence in cardiovascular health in Nigeria with a chest bay of over 500 beds and enormous number of personnel (both professional and non-professional) that serves patients in and around Enugu,

### **Study Population and Size:**

The study population consisted of out-patient diabetics attending UNTH Ituku-Ozalla. The annual average (2,888) attendance of 2013 to 2015 (3227, 2668, and 2517) diabetics at UNTH (UNTH Records, 2016) made up the population size for the study.

**Sample Size and Sampling Calculation:** The sample size was calculated using the formula  $n = N / (1 + N(e)^2)$ . Where  $n$  = sample size,  $N$  = population size,  $1$  = constant,  $e$  = marginal error (0.05) Source: Yamane, 1967.  $N = 2888 / (1 + 2888(0.5)^2) = 351$ . Five (5) percent attrition provided an additional 17.55 to the total for possible drop out.  $(351 + 17.55 = 368.55 = 369)$  approximated to 370

**Sampling Technique:** A purposive sampling method was used to select the 370 out-patients diabetics that participated in the study. Inclusion criteria involved all type 2 adult diabetics with or without hypertension, on diet therapy alone, on oral hypoglycemic drugs, on both diet therapy and oral hypoglycemic drugs. Only those who consented to be part of the study were selected.

The study excluded those on insulin therapy, those with major organ disease and complications other than hypertension, those with diabetes insipidus, those on drugs (such as corticosteroids, hormones among others).

**Ethical Clearance and Informed Consent:** The study obtained ethical clearance from the UNTH's Ethical Committee and certificate (no UNTH/CSA/329/vol. 5 given. The patients were fully informed of the purpose and procedures of the research and their personal consent obtained in written form.

**Methods of Data Collection:** Physical examination and structured questionnaire adapted from Lifestyle questionnaire of the Institut de Recherches Cliniques de Montreal, 2008 (2.1) were used to obtain information on the demographic/socio-economic characteristics, health disposition, potential signs of nutrient deficiencies and lifestyle characteristics of the patients.

### **Statistical Analysis**

Data collected was analyzed with IBM SPSS Statistics (version 21). Results from the questionnaire were presented as frequencies and percentages. Chi-square was used to evaluate the relationship between socio-demographic characteristics and lifestyle factors.

## **RESULTS**

Table 1 shows the demographic and socioeconomic characteristics of the patients. More than half (59.2%, 38.4% females, 20.8% males) of the respondents reside in the urban area, 65.4% (42.4% females, 23males) were between the ages of 41 -60, more females (64.9%) than males (35.1%) and up to 39.5% (25.6% females, 13.9% males) had tertiary education. They were mainly (43%) civil servants (27.9% females, 15.1% males), with many (45.1%, 29.3% females, 15.8% males) earning above ₦50,000 per month.

**Table 1: Demographic/socioeconomic characteristics of the patients**

Variables		Females (%)	Males (%)	Total
Residence	Urban	38.4	20.8	59.2
	Semi-urban	9.8	5.3	15.1
	Rural	16.7	9.0	25.7
		<b>64.9</b>	<b>35.1</b>	<b>100.0</b>
Age (years)	20 -40	3.3	1.8	5.1
	41 -60	42.4	23.0	65.4
	>60	19.1	10.4	29.5
		<b>64.9</b>	<b>35.1</b>	<b>100.0</b>
Marital status	single	1.6	0.8	2.4
	married	55.9	30.3	86.2
	widowed	6.2	3.3	9.5
	Divorced/separated	1.0	0.5	1.5
		<b>64.9</b>	<b>35.1</b>	<b>100.0</b>
Education	Non-formal	9.1	5.0	14.1
	Primary	15.8	8.6	24.4
	Secondary	14.3	7.8	22.1
	Tertiary	25.6	13.9	39.5
		<b>64.9</b>	<b>35.1</b>	<b>100.0</b>
Occupation	Farming	5.1	2.7	7.8
	Artisans	0.9	0.5	1.4
	Trading	6.8	3.7	10.5
	Civil service	27.9	15.1	43.0
	Business	12.1	6.5	18.6
	Retired	5.1	2.7	7.8
	None	7.0	3.8	10.8
		<b>64.9</b>	<b>35.1</b>	<b>100.0</b>
Income	<₦10,000	7.2	3.9	11.1
	₦10,000 - ₦19,999	4.5	2.5	7.0
	₦20,000 - ₦29,999	4.0	2.2	6.2
	₦30,000 - ₦39,999	4.5	2.5	7.0
	₦40,000 - ₦49,999	6.5	3.5	10.0
	≥₦50,000	29.3	15.8	45.1
	None	8.8	4.7	13.5
		<b>64.9</b>	<b>35.1</b>	<b>100.0</b>

Table 2 shows dietitian's consultation, time of first diagnosis/consultation duration, diet type and attitude to drugs of the respondents. Many (71.4%) of the respondents had consulted a dietitian. The duration of the expert consultation was ≤ 5years for 37.8%, > 10years for 11.1%, and 41.4% of the respondents could not remember the duration of their expert

consultation. More than half (55.1%) indicated that they were on diet regime and 53.5% presented different dietary regime. Some (35.4%) were regular on medications, 8.1% asserted that diabetic drugs were too many with side effects, and 49.5% took only prescribed drugs.

**Table 2: Dietitian Consultation, and Duration, Diet type, and Medication disposition of the Respondents**

Variables		Males F(%)	Females F(%)	Total F(%)
Dietitian consultation	No	37 (10.0)	69 (18.6)	106 (28.6)
	Yes	93 (25.1)	171 (46.3)	264 (71.4)
First diagnosis/duration	>10 yrs	130 (35.1)	240 (64.9)	370 (100.0)
	6 -10 yrs	15 (3.9)	26 (7.2)	41 (11.1)
	≤ 5yrs	13 (3.4)	23 (6.3)	36 (9.7)
	Forgot first diagnosis/duration time	49 (13.3)	91 (24.5)	140 (37.8)
On diet regime	No	53.6(14.5)	99.4 (26.9)	153 (41.4)
	Yes	130 (35.1)	240 (64.9)	370 (100.0)
Type of diet	No	71 (19.3)	133 (35.8)	204 (55.1)
	Yes	58 (15.8)	108 (29.1)	166 (44.9)
	Low fat (Lf)	130 (35.1)	240 (64.9)	370 (100.0)
	Complex carbohydrate (CoCHO)	7 (1.8)	12 (3.3)	19 (5.1)
	High fiber (Hf)	10 (2.7)	19 (5.1)	29 (7.8)
	High protein (Hp)	11 (3.0)	20 (5.6)	31 (8.6)
	Low salt (Ls)	3 (0.8)	6 (1.6)	9 (2.4)
	Diabetes diet	2(0.5)	3 (0.9)	5 (1.4)
	Lf. CoCHO	17 (4.7)	33 (8.8)	50 (13.5)
	Lf, Ls, CoCHO	9 (2.4)	16 (4.4)	25 (6.8)
	Lf, Hf, CoCHO	8 (2.3)	15.5 (4.2)	24 (6.5)
Forget taking drugs	None specific	2 (0.5)	3 (3.2)	5 (1.4)
	Always	61 (16.3)	112 (30.4)	173 (46.5)
	Sometimes	130 (35.1)	240 (64.9)	370 (100.0)
	Never	25(6.6)	45 (12.3)	70 (18.9)
Many drug/side effect	Always	59 (16.0)	110 (29.7)	169 (45.7)
	Sometimes	46 (12.4)	85 (23.0)	131 (35.4)
	never	130 (35.1)	240 (64.9)	370 (100.0)
Stages of change	Always	10 (2.8)	20 (5.3)	30 (8.1)
	Sometimes	44 (12)	83 (22.3)	127 (34.3)
	never	75 (20.2)	138 (37.4)	213 (57.6)
	Maintenance	130 (35.1)	240 (64.9)	370 (100.0)
	Action	64 (17.4)	119 (32.1)	183 (49.5)
Stages of change	Preparation	27 (7.4)	51 (13.7)	78 (21.1)
	Contemplation	13 (3.5)	24 (6.5)	37 (10.0)
	Pre-contemplation	6 (1.7)	12 (3.2)	18 (4.9)
		19 (5.1)	36 (9.5)	55 (14.6)
		130 (35.1)	240 (64.9)	370 (100.0)

The respondents' signs of potential nutrient deficiencies presented in Tables 3 shows that 15.4% and 17% of the respondents experienced hypoglycemia, and frequent cold, upper respiratory/urinary tract infections respectively. Very few (1.7%) of the female respondents had fibrocystic disease. Few (16.8%) respondents had cracks on their lip margin, 17% had scaly, flaky seborrheic condition of the nose,

and 9.2% had Sore/burning tongue and decreased taste acuity respectively. Some (28%) experienced bleeding gum, 2.7% had small red spots under their skin, 9.7% of the respondents experienced easy bruising while 6.8% had slow healing wounds. Very few (3.2%) had soft nails, 1.3% had white spots on/under their fingers nails, 4.9% had ridges in their nails, while 3.2% had familial rectal polyps.

**Table 3: Signs of potential nutrient deficiencies of the Respondents**

<b>Variables</b>		<b>Males F(%)</b>	<b>Females F(%)</b>	<b>Total F(%)</b>
Hypoglycemia	Yes	20 (5.4)	37 (10.0)	57 (15.4)
	No	110 (29.7)	203 (54.9)	313 (84.6)
		130 (35.1)	240 (64.9)	370 (100.0)
Frequent cold, upper respiratory/urinary tract infection	Yes	22 (6.0)	41 (11.0)	63 (17.0)
	No	107 (29.1)	199 (53.9)	307 (83.0)
		130 (35.1)	240 (64.9)	370 (100.0)
Fibrocystic disease (women only)	Yes	0 (0.0)	5 (1.4)	5 (1.4)
	No	130 (35.1)	235 (63.5)	365 (98.6)
		130 (35.1)	240 (64.9)	370 (100.0)
Pre-menstrual symptoms	Yes	0 (0.0)	12 (3.2)	12 (3.2)
	No	130 (35.1)	228 (61.7)	358 (96.8)
		130 (35.1)	240 (64.9)	370 (100.0)
Lip margin cracks	Yes	22 (5.9)	40 (10.9)	62 (16.8)
	No	108 (29.3)	200 (53.9)	308 (83.2)
		130 (35.1)	240 (64.9)	370 (100.0)
Scaly, flaky seborrheic nose condition	Yes	22 (6.0)	41 (11.0)	63 (17.0)
	No	107 (29.1)	200 (53.9)	286 (83.0)
		130 (35.1)	240 (64.9)	370 (100.0)
Sore/burning tongue	Yes	12 (3.2)	22 (6.0)	34 (9.2)
	No	118 (31.9)	218 (58.9)	336 (90.8)
		130 (35.1)	240 (64.9)	370 (100.0)
Decreased taste	Yes	12 (3.2)	22 (6.0)	34 (9.2)
	No	118 (31.9)	218 (58.9)	336 (90.8)
		130 (35.1)	240 (64.9)	370 (100.0)
Bleeding gum	Yes	10 (2.7)	18 (4.9)	28 (7.6)
	No	120 (32.4)	222 (60.0)	342 (92.4)
		130 (35.1)	240 (64.9)	370 (100.0)
Small red spots under the skin	Yes	3 (0.9)	6.5 (1.8)	28 (7.6)
	No	126 (34.2)	234 (63.1)	342 (92.4)
		130 (35.1)	240 (64.9)	370 (100.0)
Easy bruising	Yes	13 (3.4)	23 (6.3)	36 (9.7)
	No	117 (31.7)	217 (58.6)	334 (90.3)
		130 (35.1)	240 (64.9)	370 (100.0)
Slow healing wound	Yes	9 (2.4)	16 (4.4)	25 (6.8)
	No	121 (32.7)	224 (60.5)	345 (93.2)
		130 (35.1)	240 (64.9)	370 (100.0)
Soft nails	Yes	4 (1.1)	8 (2.1)	12 (3.2)
	No	126 (34.0)	232 (62.8)	358 (96.8)
		130 (35.1)	240 (64.9)	370 (100.0)
White spots on/under fingernails	Yes	2 (0.5)	3 (0.8)	5 (1.3)
	No	128 (34.6)	237 (64.1)	365 (98.7)
		130 (35.1)	240 (64.9)	370 (100.0)
Ridges in nail	Yes	6 (1.7)	12 (3.2)	18 (4.9)
	No	124 (33.4)	228 (61.7)	352 (95.1)
		130 (35.1)	240 (64.9)	370 (100.0)
Familial rectal polyps	Yes	4 (1.1)	8(2.1)	12 (3.2)
	No	126 (34.0)	232 (62.8)	358 (96.8)
		130 (35.1)	240 (64.9)	370 (100.0)

The physical activity pattern of the respondents presented in Table 4 shows that 62.1% engaged in regular exercise, with frequent walking as the main (50.8%) type of exercise. Although 1.4% used stationary cycle, 56.2% used staircase than elevator

always, 48.6% engaged in 30 minutes exercise four times/week, and 45.4% were motivated to exercise sometimes. Some (30.5%) were undecided on weight management options and 40.0% were too tired to exercise.

**Table 4: Physical Activity Pattern of the Respondents**

Variables		Males F(%)	Females F(%)	Total F(%)
Regular exercise	No	81 (21.8)	149 (40.3)	230 (62.1)
	Yes	49 (13.3)	91 (24.5)	140 (37.8)
		130 (35.1)	240 (64.9)	370 (100.0)
Exercise type	Walking	66 (17.8)	122 (33.0)	188 (50.8)
	Stationary cycle	2 (0.5)	3 (0.9)	5 (1.4)
	Walking/cycling	5 (1.3)	8 (2.3)	13 (3.6)
	None	58 (15.5)	106 (28.8)	164 (44.3)
		130 (35.1)	240 (64.9)	370 (100.0)
Exercise frequency	Most times	45 (12.2)	84 (22.7)	129 (34.9)
	>3times/week	30 (8.1)	57 (15.3)	87 (23.5)
	1 - 2times/week	33 (9.0)	62 (16.7)	95 (25.7)
	Rarely	21 (5.6)	38 (10.3)	59 (15.4)
		130 (35.1)	240 (64.9)	370 (100.0)
Stairs/elevator use	Always	73 (19.7)	135 (36.5)	208 (56.2)
	Sometimes	37 (10.0)	68 (18.4)	105 (28.4)
	Never	20 (5.4)	37 (10.0)	57 (15.4)
		130 (35.1)	240 (64.9)	370 (100.0)
30 minutes exercise	5 7times/week	28 (7.7)	53 (14.2)	81 (21.9)
	4times/week	63 (17.1)	117 (31.5)	180 (48.6)
	2 - 3times/week	24 (6.5)	45 (12.1)	69 (18.6)
	< once/week	5 (1.4)	10 (2.7)	15 (4.1)
	Never	9 (2.4)	16 (4.4)	25 (6.8)
		130 (35.1)	240 (64.9)	370 (100.0)
Motivation to exercise	Always	41 (11.0)	75 (20.4)	116 (31.4)
	Sometimes	59 (15.9)	109 (29.5)	168 (45.4)
	Never	30 (8.1)	56 (15.1)	86 (23.2)
		130 (35.1)	240 (64.9)	370 (100.0)
Weight reduction	Not at all	68 (18.5)	127 (34.2)	195 (52.7)
	A little	22 (5.9)	40 (10.9)	62 (16.8)
	completely	40 (10.7)	73 (19.8)	113 (30.5)
		130 (35.1)	240 (64.9)	370 (100.0)
Too tired to exercise	Never	34 (9.1)	62 (16.8)	96 (25.9)
	Sometimes	52 (14.0)	96 (26.0)	148 (40.0)
	Always	44 (12.0)	82 (22.1)	126 (34.1)
		130 (35.1)	240 (64.9)	370 (100.0)

Table 5 presents the alcohol and smoking frequency of the respondents. Some (60%) of the respondents took alcohol occasionally, 97.3% were non-smokers, although 1.4 % had smoked daily and occasionally respectively. All respondents (100%) had never

smoked filter/pipe cigarettes/tobacco/snuff. There were no current smokers and 1.4% had maintained non-smoking status and was pre-contemplating not smoking respectively.

**Table 5: Alcohol and Smoking Frequency of the Respondents**

Variables		Males F(%)	Females F(%)	Total F(%)
Alcohol intake	None	43 (11.7)	80 (21.5)	123 (33.2)
	Occasionally	78 (21.1)	160 (43.2)	238 (64.3)
	2 drinks/day	11 (3.0)	0 (0)	11 (3.0)
	>2drinks/day	14 (3.8)	0 (0)	14 (3.8)
		130 (35.1)	240 (64.9)	370 (100.0)
Cigarette smoking	Daily	5 (1.4)	0 (0.0)	5 (1.4)
	Occasionally	5 (1.4)	0 (0.0)	5 (1.4)
	Never	120 (32.3)	240 (64.9)	360 (97.2)
		130 (35.1)	240 (64.9)	370 (100.0)
Smoking cessation stage	Maintenance	5 (1.4)	0 (0.0)	5 (1.4)
	Pre-contemplation	5 (1.4)	0 (0.0)	5 (1.4)
	Not applicable	120 (32.3)	240 (64.9)	360 (97.2)
		130 (35.1)	240 (64.9)	370 (100.0)



Table 6 shows chi square presenting the relationship between lifestyle factors and socio-demographic/socio-economic characteristics of the respondents. Chi square calculated was lower than chi

square tabulated for being on diet regime and ethnicity(8.5), physical activity and religion (8.6), physical activity and ethnicity (5.8), exercise type and ethnicity(10.9) at p value = 0.01.

**Table 6: Relationship between lifestyle factors and socio-demographic and economic characteristics, of respondents**

Lifestyle factors	Socio-demographic/ economic characteristics										
	Location	Age	Sex	Marital status	Family type	Family size	Religion	Ethnicity	Education	Occupation	Income
Dietitian consultation	*63.5	*561.2	*275.5	*598.0	*24.6	*536.3	*16.3	*11.0	*512.6	*488.3	*440.9
Time of consultation	*101.7	*133.9	*318.5	*296.2	*325.1	*95.6	*393.4	*375.0	*275.6	*330.1	*307.0
On Diet regime	*113.0	*497.7	*277.4	*536.3	*19.2	*473.7	*12.6	<b>8.5</b>	*501.3	*426.6	*380.2
Diet type	*328.4	*503.6	*570.2	*263.8	*606.2	*438.2	*615.6	*615.8	*519.2	*431.7	*3448.9
Alcohol consumption	*68.5	*448.4	*232.0	*492.1	*34.9	*423.7	*25.0	*10.9	*534.6	*416.4	*358.9
Smoking	*13.9	*36.4	9.0	*62.9	*18.2	*51.3	*128.8	*58.6	*140.2	*101.3	*36.8
Physical activity	*81.3	*426.3	*171.6	*467.5	*13.4	*412.8	<b>8.6</b>	<b>5.8</b>	*433.8	*351.9	*310.1
Exercise type	*63.9	*353.8	*295.5	*478.1	*35.4	*404.1	*88.8	<b>10.9</b>	*465.1	*377.9	*332.2
Exercise frequency	*89.0	*273.8	*114.7	*305.6	*217.2	*163.0	*303.0	*153.4	*287.6	*302.5	*440.8
Exercise duration	*139.1	*71.5	*103.4	*112.1	*342.0	*52.0	*389.8	*393.9	*423.3	*415.3	*357.5

\*Relationship exists when Chi-cal > Chi-tab at p value = 0.01

## DISCUSSION

Dietitian's consultation, consultation duration, diet type and attitude to drug were among the indicators of the respondents' health disposition (Table 1). Many of the respondents had consulted a dietitian. This maybe because these diabetics were informed on the importance of consulting dietitian, or their attendance of specialist hospital where doctors are aware of the importance of teamwork and diet in the management of diabetes and as such refer patients to the dietitians. Dietitians' role in promoting self-care with positive clinical outcomes at reduced cost has been reported [5, 6]. Evidence suggests that intensive dietary advice can improve glycaemic control and anthropometric measures in patients with type 2 diabetes mellitus (T2DM) and unsatisfactory HbA1c despite optimized hypoglycaemic drug treatment/chemical outcome in T2DM [7]. There are reports of sub-optimal use of dietary counseling services by T2DM diabetics and low compliance with nutrition consultation among patient ≥65years [8, 9].

The duration of the expert consultation was lower for majority of the patients and consistent with the report of Ugwu et al. [10]. This trend may be attributed to increase in the prevalence of T2DM. It was estimated that the number of diabetics will double in the next 25years [11]. Existing evidence shows that early nutrition intervention can reduce complication rates, length of hospital stay, readmission rates, mortality and cost of care [12]. The respondents that forgot the duration of consultation may include those that had not consulted a diet expert before and those that had memory issue common in adults. Ward, Berry, and Shinks, [13] and Fleischman [14] revealed that explicit (recognition) memory declined with age and implicit (priming) memory is preserved in healthy aging. More than half of the respondents indicated that they were on diet regime and presented different dietary regime. In dietetics practice, diet is individualized: subject to age, weight, gender, health condition, and occupation. The amount and type of food consumed by an individual determines the health of that individual. Good dietary regimen is effective in the management of T2D [15 -17]. The respondents that were regular on

medications were lower than 76.1% medium and 23.9% high adherence reported by Unyime et al. [18]. The latter respondents could be more knowledgeable on the importance of regular medication. It was therefore not surprising that some considered the diabetic drugs too many with many side effects and some practiced self-medication. The chronic nature of diabetes may have informed the patients on the use of diabetic drugs. The practice of self-medication by patients has also been recorded by Idongesit et al [19] though as a result of unrestricted access to drugs, mildness of the disease, and being knowledgeable about drugs.

The respondents' clinical signs of potential nutrient deficiency presented in Table 2 shows that some of the respondents experienced hypoglycemia. This may be due to poor or inadequate food intake or a result of treatment conditions like diabetic ketoacidosis [20]. An appreciable percentage experienced frequent cold, upper respiratory/ urinary tract infections. This is suggestive of people with compromised immune system and deficiency of vitamin D [21], zinc [22], vitamin A [23], and vitamin E [24]. Howard [25] associated infections in diabetics with poor circulation coupled with glucose-rich urine. Fibrocystic disease is mainly hormonal in origin [26], although it is often associated with nutritional deficiencies. Very few female respondents experienced pre-menstrual syndromes (PMS) which has been associated with inappropriate food frequency resulting from the distress [27]. Kia et al. [28] reported that Vitamin D, calcium and magnesium status were compromised in subjects with PMS. Pitman [29] implicated sugar, caffeine, alcohol, and sodium with PMS consequently, patients with PMS are required to reduce the intake of the above-mentioned food items. Some had cracks on their lip margin which are associated with vitamin B<sub>2</sub> deficiency (ariboflavinosis) [30]. Chaitra [31] linked cracks at lip margin with yeast (*Candida albican*) infections in the older persons because of a compromised immune system and nutritional deficiencies of vitamin, B<sub>2</sub> and zinc, iron deficiency anemia and poor diet regimen. Robertson (32) explained that the weakened immune system may also be due to certain health conditions (diabetes, yeast infection of the vagina, HIV/AIDS, cancer), medication (antibiotics, corticosteroids) and some lifestyle habits (ill-fitted dentures, poor oral hygiene, dry mouth, smoking). Some had scaly, flaky seborrheic condition of the nose - a condition associated with vitamin B<sub>3</sub> deficiency, weakened immune system and Zn deficiency [33], illness and stress, deficiencies of biotin, pyridoxine (B<sub>6</sub>), and riboflavin (B<sub>2</sub>) [34], and excess intake of vitamin A [35]. IDF [36] attributed scaly skin to changes in blood

sugar that results in loss of fluid and dehydration as well as neuropathy which causes less sweat and dry skin.

Few had Sore/burning tongue. This has been found to be more frequent in patients with poor glycemic control [37]. Baldwin [38] associated inflammatory disease in oral cavities with diabetes due to micro-circulation and reduction in the rate of salivary flow and composition. Nutritional deficiencies like iron, zinc, folate (vitamin B-9), thiamin (vitamin B-1), riboflavin (vitamin B-2), pyridoxine (vitamin B-6) and cobalamin (vitamin B-12) have also been implicated in sore and burning mouth condition [39]. Other causes may include menopause, psychological problems, disorders of the mouth (oral thrush and dry mouth) xerostomia and dysfunctional or damaged nerves [40]. Some had decreased taste acuity. Significant decrease in taste dysfunction in diabetic patients has already been reported [41]. Several authors have associated decreased taste sensation with ageing, vitamin B12 or zinc deficiencies, inadequate nutritional intake, reduced social pleasure, and decreased psychological well-being, drug use, oral and systemic diseases, and severe trauma and irradiation of the oral cavity [42 - 47]. The number (28%) that experienced bleeding gum is in consonance with the report that it occurs almost three-fold in people with diabetes than the 10 -15% in adults without diabetes[48]. Bleeding gum although had many causes (nutrient deficiencies like vitamin C, B<sub>3</sub>, A, K, iron deficiency anemia, higher hormonal levels due to pregnancy, cancer treatment, medications (aspirin), systemic conditions/disease, poor dental health, etc.) of which underlying bacterial infection is foremost has been linked to uncontrolled diabetes [49].

Very few (2.7%) observed small red spots under their skin. This was comparably low with the 79.2% reported by Demirseren et al. [50] to experience skin changes. Hoffman [51] associated the deficiencies of vitamins B<sub>3</sub> and C with tiny red spots under the skin (petechiae), while Bell [52] included vitamin K, B<sub>9</sub> (folate), and B<sub>12</sub>. Almost one-tenth (9.7%) of the respondents experienced easy bruising. Webster [53] reported increased bruising in older persons and attributed it to a Confederacy of a three factors - normal age-related changes (thinner epidermis, capillary fragility and less subcutaneous fat), common age-related changes (diabetes and hypertension), and medications (especially drugs that thin blood). IDF [36] further implicated easy bruising in the etiology of diabetic blisters. This study's diabetics accustomed to slow wound healing was lower than the 15% and 34% reported in other studies [54, 55] to be due to vascular



network . Poor wound healing has also been associated with zinc deficiency. Hoffman [51] linked impaired wound healing and dermatitis to protein, zinc and vitamin C deficiencies. The diabetics with nail changes in this study was comparable to 3.8% reported in older diabetics [56] and significantly lower than 68.9% reported among patients (diabetics and hemodialysis) with compromised immune system [57]. Ridging of nails for instance is an indication of protein and iron deficiency [51]. The proportion with oral, skin and nail changes were lower than the 7% reported by Wayas et al. [58]. This study reported significant association between these changes and *Lichen planus* (an itchy dermatosis that can affect skin, mucous membranes, genitals and nails.) Hoffman [51] also elaborated that oral, skin and nail changes were some of the physical presentations of nutrient malnutrition (protein, energy, vitamins - B<sub>3</sub>, B<sub>6</sub>, B<sub>12</sub>, A, and C); and Mineral - iron and zinc) since protein as well as essential fatty acids specifically served as building blocks for these structures. This study diabetics (3.2%) with familial rectal polyps was significantly lower than 29.8% reported to be associated with diabetics especially older, male gender, race (Hispanic), and higher BMI [59]. Familial rectal polyp is a risk factor in colorectal cancer [60]. It is more common in people over 50years, overweight, use tobacco and drink alcohol. Diets low in fat, high in fiber, vitamin D and calcium are beneficial in patients with familial polyps [61].

The physical activity pattern of the respondents presented in Table 3.3 shows that many engaged in regular exercise compared to Unyime et al. [18]. Hamasaki [62] reported that patients with diabetes can be physically weak and as such could hardly engage in recommended levels of physical activity. This may explain why some respondents did not participate in regular physical exercise. Regular physical activity lowers blood sugar levels by helping the cells to take up glucose thus decreasing the need for insulin [36]. It encourages weight loss and decreases the risk of obesity, improves lipid profile and decreases stress levels thus reducing the risk of heart diseases [15]. Walking most times was the main type of exercise, although very few used stationary cycle. This was expected as most of them cannot afford stationary cycle or register with a gym. Naja et al. [63] had a similar result. Light physical activity in combination with adjustment to the diabetic diet can reduce the odds of DM [64].

Many (56.2%) always used staircase than the elevator. This indicated that the study area had more bungalows and story buildings without elevators. The use of staircase is beneficial as it will improve the

respondents' physical activity. Some of the respondents that engaged in 30 minutes exercise 4 times/week may be in line with ADA recommendation of 15-90minutes of exercise per week [65]. Physically active adults with normal BMI have a decreased risk of diabetes. The respondents (23.2%) that were not motivated for exercise were less than 50.7% reported by Awosan et al., [66] that lived sedentary lifestyle. It has been demonstrated that people with high risk of developing heart disease included sedentary and obese with HBP and high cholesterol [67]. Lack of physical activity may also play a role in the development of some types of cancers [68]

The percentages (30.5%) that were completely undecided on weight management may be those that were physically weak due to diabetes as already reported [62] or were completely ignorant of the benefits of weight loss in diabetes management. Poor education and socioeconomic status as well as individual willpower were implicated in lack of weight management [69] Parajuli et al. [70] reported 42.1% non-adherent to physical activity in in middle class diabetics, with negative family history, divorced and of extended family type. The effect of improved body weight with dietary counseling with or without oral nutrition supplements have been demonstrated [71]. The percentage that were too tired to exercise was expected because apart from being diabetic, these adults engaged in different daily livelihood activities and were likely to get tired. This lack of exercise due to tiredness/weakness may result in overweight and obesity. Obesity and physical inactivity have been associated with increased diabetes burden in developed world [72].

The respondents' attitude to exercise (Table 3.4) was expected considering their economic status. It was obvious that majority were occupied with different livelihood activities to remember to include exercise in their daily routine. A good number (61.1%) did not engage in in-door exercises during rainy weather. This was expected as many were already too weak to exercise and rainy weather presents an opportunity to skip regular exercise. Most did not consider their heart condition when embarking on an exercise routine. This could mean the respondents were unaware that ones' heart condition can be affected by the type of activity one undertakes. Some (20.8%) were completely afraid to exercise for fear of getting hurt. This was understandable because as one gets older the frequency of falls and sprains become more.

The number that always devised alternative exercise when they had health challenges (joint problem) may be knowledgeable about the importance of continuous

exercise to health because as one reduces physical activities, the body stiffens in equal magnitude. Less than half (32.8%) completely engaged in recommended physical exercise to lose weight. Overweight Impaired glucose tolerant (IGT) adults who lose weight voluntarily had a decreased risk of diabetes [73]. The respondents that always limits exercise for hunger shows the proportions that were food insecure because food security indicates the availability and accessibility of adequate safe food at all time. Many always drank water during and after sessions. Water is needed for various metabolic processes and the body systems perform well when they are hydrated. Uloko et al. [74] had 1/3 of diabetics adhering to exercise. Physical activity in leisure-time has been associated with higher levels of physical health, well-being and improved mental health [75 - 77].

Many respondents took alcohol occasionally compared to 21.4% reported by Awosan et al. [66]. Despite the fact that moderate alcohol is good for the heart, diabetics should not exceed the recommended dose as alcohol has been associated with liver cancers and chronic inflammation of the pancreas [19]. The respondents that were non-smokers was higher than those reported by Naja et al. [63] and Ugwu et al. [10]. The non-smoking status of majority of the study respondents was expected as smoking was not indigenous in the study area. Consequently, it was not surprising that all respondents had never smoked filter/pipe cigarettes nor used tobacco/snuff. There were no current smokers and 1.4% had maintained non-smoking status and was pre-contemplating not smoking respectively. This was much lower than 20% reported by Awosan et al. [66] and Soyoye et al. [78]. Smoking is a major risk factor for coronary heart disease, cardio-vascular disease, diabetes mellitus [79, 80].

Although diabetes has been shown to occur more in some ethnic groups [81, 82] especially due to differences in type of diet [83], this study observation of no relationship between ethnicity and being on diet regime could be explained by the fact that the desire to adopt an expert advice on diet regime is a crucial component of individual self-management package that is based on self-determination and compliance. For the same reason, this study observed no relationship between engagement in physical activity and religion, contrary to the report that some religion determines the physical activity of some diabetics [84]. Also, dissimilarity between the present study and studies [85 -87] that reported differences in physical activity and pattern among diabetics of varied ethnicity could be that the choice to adopt a healthy

lifestyle is a personal issue that is not based on race/ethnicity.

## CONCLUSION

Different signs of nutrient deficiencies were found in some of the adult diabetics, the identification of these signs will initiate effective treatment and prevention of complications. A good number of the respondents had laudable lifestyle characteristics. There was no relationship between being on diet regime and ethnicity, physical activity and religion, physical activity and ethnicity, exercise type and ethnicity. Intensive nutrition education on adequate nutrient intake, proper management of T2DM and positive lifestyle changes is recommended generally.

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