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Original Research Article

Weight reduction and glycemic control in type 2 diabetes mellitus using a wholly Nigerian diet at university of Port Harcourt teaching hospital, Nigeria

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ABSTRACT

Background: Weight gain is associated with poor glycaemic control in patients with type 2 diabetes and worsened by resource restrained environment with almost no access to sustainable therapy. In the absence of effective access to health care and medication due to poverty, safer locally available and proven scientific options to manage their health becomes a priority. Today, targeted lifestyle interventions are found to be clinically effective and affordable for diabetes prevention and treatment. This study aimed to evaluate the efficacy of a wholly Nigerian diet in achieving weight reduction and good glycaemic control in patients with type 2 diabetes mellitus.
Methods: Sixty study participants were randomized into matched control (standard of care) and intervention (caloric restriction dietary intervention) groups. Participants were followed for 24 weeks and samples taken 3 times a week for the duration of the study.
Results: The result revealed a significant drop in weight (waist circumference and BMI) in the intervention group. Mean waist circumference decreased from 88.82 cm to 80.0 cm (p=0.001) while BMI decreased from 22.67 to 22.86 kg/m^2 (p=0.025). The fasting blood sugar dropped from a group mean of 7.97 on the initial visit to a mean of 5.35 after six months in the intervention group.
Conclusions: Caloric restriction with locally available food reduced weight and normalized fasting blood sugar in study participants with type 2 diabetes mellitus.

Keywords: Diet, Glycaemic control, Intervention, Type 2 diabetes, Remission, Waist circumference and BMI

INTRODUCTION

People who are burdened with body mass index greater than 30 and with the diagnosis of T2DM can feel like they are in the end zone of their lives, especially given that diabetes currently has no cure and on account of that fact, they are suddenly facing an intractable, progressive disease that will be with them for the rest of their lives.[1] The increase in T2DM in the last half century is directly related to changes in lifestyle. As our lifestyles have continued to change to include more processed foods and less activity, the proportion of people with T2DM has continued to rise.[2]

The scourge of non-communicable diseases is increasing globally and this includes people below and on the poverty line. Nigeria has the highest number and burden of diabetes in Sub-Saharan Africa; thus, treatment of diabetes is of paramount importance to every Nigerian.[3] The role of foods and natural antioxidants in preventing disease cannot be over-emphasized.

In 2016, diabetes was the 6th leading cause of death globally, leading to just under 2 million deaths annually. Global projected increase in T2DM from 2013 to 2025 reveals that Africa will have a 109% rise, closely followed by the Middle East and North Africa with 96%. The global increase is put at 55%.[2] In the US, by 2050, it is estimated that nearly 100 million persons will have T2DM, and the cost of managing T2DM will be 2.3 times more than non-diabetics who seek hospital care.[2] For kids born after 2000, 33% of males and 39% of females will develop T2DM (Wilmot and Idris, 2014).[4] Also, having T2DM increases the risk of having Alzheimer's disease with age.[5]

While diet and exercise are the first steps to effectively prevent and even manage diabetes non-pharmacologically, the primary goal of Dietary use in treatment in T2DM is to reduce the risk factors and forestall complications resulting from the disease. Currently, the hypothesis that dietary and lifestyle factors can contribute significantly to pushing T2DM into remission is gaining widespread acceptance.[1]

The suggested dietary interventions in T2DM are largely Western in nature (not readily seen or accessed by the common man in Nigeria); hence, they may not be readily available to adapt for local use. This study therefore, seeks to use local, readily available whole plant-based options to create a menu for T2DM subjects while obeying standard operating procedures in menu.

NFkB pathway is activated by inflammation and free radicals which can come from radiation and toxins. NFKB can also activate telomerase, cytokines, adhesion molecules, VEGF and TNF alpha and it is associated with diabetes etc.[6] Diet however, is a known modifier of and regulator of NFkB through phytonutrient and antioxidant formation, causing a down regulation of NFkB production and gene modulation that occurs from NFkB pathway. This down regulation has not been fully achieved with medications.

The traditional use of dietary modification can lead to the discovery of new potential treatments of several diseases. Finally, a lot of people may readily have what to eat but may not have access to funds to access health care. The use of foods they are already used to, to enable health and wellness would be extremely helpful to these individuals with T2DM. These studies on dietary modification (wholly Nigerian foods) in T2DM hasn't been studied much, as findings will help improve health outcomes in individuals with T2DM.

Lifestyle is the cause and cure of T2DM, meaning lifestyle can prevent it. T2DM improvements occur with structured intervention programs that produce significant weight loss.[7,8] Targeted lifestyle interventions are found to be clinically effective and cost effective for diabetes prevention and treatment.[9,10]

Drugs used in managing T2DM do not come without side effects and complications.[11] ADVANCE Collaborative Group and Ling et al. concluded that when glycaemic control was improved for 3-5 years with medications, that did not reduce macrovascular complications due to epigenetic changes.[12,13] Genome wide studies have shown that cell type specific changes in histone methylation patterns under diabetic conditions persist for 5 years. This explains why macrovascular complications are not improved even with glycaemic control with medications.[14]

This study has added to the body of knowledge, improving the use of this diet among the Nigerian populace. This study set out to evaluate the effects of diet on diagnosed adults with T2DM compared to standard of care, in the University of Port Harcourt Teaching Hospital, Rivers State, Nigeria.

METHODS

Research approach

This was a qualitative study. The study had 60 study participants who were randomized and equally matched into 2 (standard of care- control and dietary intervention-treatment) group. These participants were known diabetics attending diabetes clinic and were followed up for 24 complete weeks (August 2021 to February 2022) were randomized into matched control (standard of care) and treatment (dietary caloric restriction intervention) groups. The control group and treatment group had self bi weekly reporting of FBS throughout the study.

Test of significance was done using ANOVA in each of the two sets of observations (within the control and intervention group). Then, to ensure that significance in the treatment group is due to intervention, a more robust statistic with greater experimental sensitivity such as ANCOVA was carried out for totally removing the effect of covariates on the treatment group.[15]

Recruitments

Participants were recruited from diabetic patients attending the general outpatient and diabetes clinics at the University of Port Harcourt, Nigeria. To be included in the study, patients had to be known diabetics, 18 years of age or older, not on any herbal, traditional or complementary medicines in the last 2 weeks prior to commencement of the study and not any known medication that will impair pancreatic or kidney function. Also, poorly controlled blood sugar at the last routine clinical check and body mass index (BMI) >26 kg/m^2 and <45 kg/m^2, patients with existing complications of diabetes or co-morbidities, severely ill patients and patients with mind altering medications were excluded.

Informed consent was obtained from each participant and then the 60 participants were randomized into open label control (standard of care) and intervention arms of this study. The control arm consisted of diabetic patients with at least one oral hypoglycaemic agent while the intervention group received a calorie-restricted diet consisting of locally grown foods. Statistical tests were done to ensure that there was no significant difference between the control and intervention groups.

The study questionnaires which were divided into several parts including disease and medication history, frequency of consumption of various foods, physical activity or other lifestyle practices, level of education and income, were piloted around the University of Port Harcourt Teaching Hospital and the University of Port Harcourt residents for legibility, comprehension, cultural sensitivity and relevance.

All study participants were seen on a monthly basis for clinical evaluation and assessment of adherence and morbidity. All participants were called on their mobile phones, at least once a week, to follow up and deal with any concerns as they progressed with the study. Participants with deteriorating clinical conditions were removed from the study and placed on full pharmacological therapy under the supervision of an endocrinologist, until they were stable. Each participant had a bi-weekly self-reported fasting blood glucose test. The primary end point of the study was a FBS value consistently between 3.5-5.5 mmol/l for 6 months while the secondary end-point was weight loss equivalent to 10% of body weight.

Statistical analysis

Statistical analysis was done using the computer software, Microsoft Office Excel 2017 for the graphs and Statistical Packages for Social Science (SPSS) version 22.0 for inferential statistics. The study adopted the following statistics for analysis of data- descriptive statistics for data cleaning, stem-and leaf plot and box plot for detecting and removing outliers, Kolmogorov-Smirnov test and histogram for normality. Crosstab and frequency, ANOVA and ANCOVA were used answer the research questions and test the hypotheses of the study, while significant variables were subjected to post hoc or pairwise comparison tests (i.e., Bonferroni test). In order to determine statistical significance of the differences between means, the Wilcoxon signed-rank test for dependent samples (such as: FBS) and the Mann-Whitney U test for independent samples (such as anthropometric parameters) was used. Statistical significance between the means was set at p<0.05. The relationships between the indices were evaluated using Pearson's linear correlation with the level of statistical significance set at p<0.05 at 95% confidence.

Ethical clearance

Ethical approval was sought and obtained from the Ethics Review Committee of the University of Port Harcourt with reference number UPH/CEREMAD/REC/MM71/001.

RESULTS

Demographic characteristics showed no statistically significant difference between age (p=0.934), gender (p=0.605), and the clinical group, as shown in Table 1.

Table 1: Demographics.

Variables	Group		χ^2 (p value)
	Intervention n_2=30	Control n_2=30	
	Freq (%)	Freq (%)	
Age group			
30-49	11 (36.67)	9 (30.0)	
50-69	15 (50.0)	17 (56.67)	0.934$^\alpha$
≥70	4 (13.33)	4 (13.33)	
Mean (SD)	54.73±11.29	57.6±9.73	1.05 (0.292)$^\mu$
Gender			
Male	13 (43.33)	16 (53.33)	0.27 (0.605)
Female	17 (56.67)	14 (46.67)	

*Statistically significant (p<0.05); χ^2=Chi-square; μ=Student t-test; α=Fishers Exact p

Table 2: Descriptive statistics showing an association between clinical parameters for the standard of care (control) group.

Variables	Standard of care (control) group		ANOVA (F-test)	P value
	Mean	SD		
FBS control				
Initial	8.570	3.3124		
3 months	7.003	2.3839	2.298	0.107
6 months	7.367	3.1119		
Overall	7.647	3.0059		
Waist control				
Initial	90.817	10.9359		
3 months	89.800	10.6298	0.078	0.925
6 months	90.000	10.1608		
Overall	90.206	10.4701		
BMI control				
Initial	26.907	4.5521		
3 months	26.093	4.5572	0.763	0.469
6 months	25.417	4.9173		
Overall	26.139	4.6662		

NS-Not significant at p>0.01; ANOVA=analysis of variance

Results from Table 2 shows mean differences in the clinical parameters (FBS, waist circumference and BMI) of T2DM patients subjected to a standard of care (control) over a 6 months period. Changes in means were noted in FBS, and waist circumference parameters in the standard of care group but for BMI that had steady drop in mean values (from 26.06 to 25.0). ANOVA results of the clinical parameters on the average presented show no significant mean differences for all the measured clinical parameters after a period of six months. As such the null hypothesis of no significant mean difference was sustained. Therefore, there were no significant mean differences on the clinical parameters (FBS, waist circumference and BMI) of T2DM patients subjected to a standard of care (control) over a 6 months period.

Results from Table 3 shows mean differences on the clinical parameters (FBS, waist circumference and BMI) of T2DM patients subjected to Intervention over a 6months period. The result showed a steady drop of parameter means from the initial visit to six months in the intervention group. The fasting blood sugar dropped from a group mean of 7.97 on the initial visit to a mean of 5.35 after six months. Similarly, the result showed substantive weight loss after six months of intervention. This was revealed in the waist circumference mean which fell from 88.82 cm to 80.0 cm after six months, and BMI that dropped from 26.670 to 22.857 kg/m^2 after six months.

The One-way analysis of variance was conducted to investigate if there are significant mean differences on the clinical parameters (FBS, waist circumference and BMI) of T2DM patients subjected to MNT therapy over a 6 months period. ANOVA results, presented in the above table, show significant mean differences for all the clinical parameters. There were significant mean differences on the clinical parameters (FBS, waist circumference and BMI) of T2DM patients subjected to intervention therapy over a 6 months period. Thus, the intervention had no significant effect on the lipid profile of T2DM patients after six months.

Table 3: Statistical descriptions of the association between clinical parameters in Intervention group.

Variables	MNT therapy (intervention) group		ANOVA (F-test)	P value
	Mean	SD		
FBS control				
Initial	3.8471	0.7024		
3 months	1.9670	0.3591	7.388	0.001*
6 months	1.5855	0.2895		
Overall	2.8416	0.2995		
Waist control				
Initial	88.82	9.900		
3 months	82.93	8.777	7.572	0.001*
6 months	80.00	8.034		
Overall	83.92	9.574		
BMI control				
Initial	26.670	4.1194		
3 months	24.920	4.0177	7.667	0.001*
6 months	22.857	3.1076		
Overall	24.816	4.0487		

*Statistically significant at p≤0.05; ANOVA=analysis of variance

Table 4: Percentage of reduction of FBS using both standard of care (control) and intervention after a period of six months.

Group	All participants n (%)	FBS change n (%)			% Reduction (no. of normal subjects after 6 months – initial no. of normal)	Fishers exact p
		Initial	3 months	6 months		
Control	30 (100.0)	8/30 (26.7)	12/30 (40.0)	12/30 (40.0)	12-8; 4 (13.33)	0.237 µ
Intervention	30 (100.0)	11/30 (36.67)	13/30 (43.33)	20/30 (66.67)	20-11; 9 (30.0)	

µ=Fisher's exact p (recommended where cell values are <5)

Table 5: Percentage of reduction of BMI at an individual level using standard of care (control) after a period of six months.

Group	All participants n (%) n=30	BMI change n (%)			% Reduction (no. of normal subjects after 6 months – initial no. of normal)	Fishers exact p
		Initial	3 months	6 months		
Control						0.681µ
Normal		12/30 (40.0)	15/30 (50)	17/30 (56.7)	17-12; 5 (16.7)	
Overweight		8/30 (26.7)	8/30 (26.7)	6/30 (20)	6-8; -2 (6.67)	
Obese class 1		10/30 (33.3)	6 (20.0)	7 (23.3)	7-10; -3 (10.0)	
Obese class 2		0/30 (0)	1/30 (3.3)	0/30 (0)	0-0; 0 (0.0)	
Intervention						
Normal		11/30 (36.7)	16/30 (53.3)	23/30 (76.7)	23-11; 5 (16.7)	
Overweight		11/30 (26.7)	11/30 (26.7)	6/30 (20)	6-11; -5 (16.67)	
Obese class 1		8/30 (33.3)	2/30 (20)	1/30 (23.3)	1-8; -7 (23.33)	
Obese class 2		0/30 (0)	1/30 (3.3)	0/30 (0)	0-0; 0 (0.0)	

µ=Fisher's exact p (recommended where cell values are <5)

Table 6: Percentage of reduction of FBS at an individual level using both standard of care (control) and MNT therapy (intervention) after a period of six months.

Group	All participants n (%)	FBS change n (%)			% Reduction (no. of normal subjects after 6 months – initial no. of normal)	Fishers exact p
		Initial	3 months	6 months		
Control	30 (100.0)	8/30 (26.7)	12/30 (40.0)	12/30 (40.0)	12-8; 4 (13.33)	0.237 µ
Intervention	30 (100.0)	11/30 (36.67)	13/30 (43.33)	20/30 (66.67)	20-11; 9 (30.0)	

µ=Fisher's exact p (recommended where cell values are <5)

Table 7: ANCOVA summary of the effect of intervention on FBS level of T2DM patients and post-hoc (Bonferroni) summary of the effect of intervention on FBS level of T2DM patients.

ANCOVA summary of the effect of intervention on FBS level of T2DM patients						
Parameters	**MNT therapy on the FBS level**			**F**	**P value**	**Effect size η^2**
	Initial visit Mean±SD	**3 months Mean±SD**	**6 months Mean±SD**			
FBS intervention	7.94±1.97	6.42±1.95	5.36±1.94	6.790	0.002*	0.136
Post-hoc (Bonferroni) summary of the effect of Intervention on FBS level of T2DM patients						
FBS intervention						
(I) Groups	**(II) groups**		**Mean difference (I-II)**		**Std. error**	**P value**
Initial visit	3 months		1.514		0.706	0.104
	6 months		2.568*		0.699	0.001*
3 months	Initial visit		-1.514		0.706	0.104
	6 months		1.054		0.690	0.391
6 months	Initial visit		-2.568*		0.699	0.001*
	3 months		-1.054		0.690	0.391

*Statistically significant at p≤0.05

Results from Table 4 show that after a period of six months, the intervention controlled the FBS level of 30% of T2DM patients, and the standard of care controlled the FBS level of 13% of T2DM patients. Therefore, the intervention has the efficacy to control the FBS in more than twice the number of T2DM patients as the standard of care. However, this observed difference was not statistically significant (p=0.237).

Results from Table 5 show that after a period of six months, the intervention controlled overweight by 16.67%, unlike the standard of care-controlled group with a reduction of 6.67% in overweight. Obese observed a reduction of 23.3% in the intervention group and 10% in the standard of care-controlled group. Therefore, the intervention proves to be more effective than standard of care in controlling BMI of T2DM patients. However, this observed difference was not statistically significant (p=0.681).

Results from Table 6 show that after a period of six months, the intervention controlled the FBS level of 30% of T2DM patients, and the standard of care controlled the FBS level of 13% of T2DM patients. However, this observed difference was not statistically significant (p=0.237).

The analysis of covariance was conducted to investigate the effect of Intervention group on the fasting blood sugar (FBS) level of T2DM patients over a period of six months while controlling for the influence of standard of care. ANCOVA results, presented in Table 7, show a significant difference in mean FBS level amongst treatment groups [$F(2, 86) = 6.790$, $p<0.01$, partial $\eta^2=0.136$]. However, the calculated effect size indicates a small proportion of variance accounted for about 13.6% change in the FBS level of the treatment group.

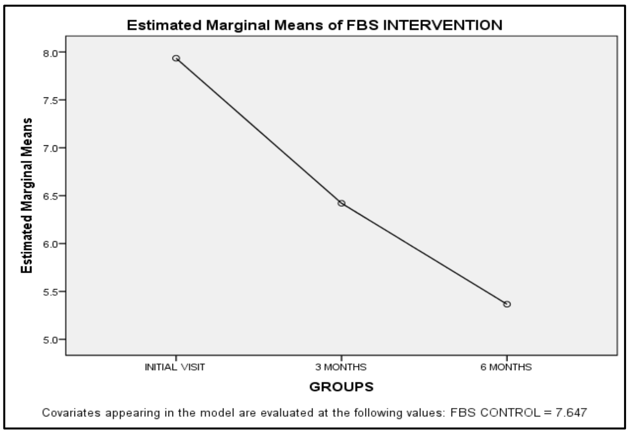

Figure 1: Estimated marginal means of FBS intervention.

Bonferroni post hoc tests (Table 7) showed there was a significant difference between group 1 (initial visit) and group 3 (6 months) (p<0.01) only. Comparing the estimated marginal means showed that the lowest FBS level was in group 3 (mean =5.36 mmol/l) compared to groups 2 and 1. The graph in Figure 1 highlights the mean differences amongst the groups.

The analysis of covariance was conducted to investigate the effect of MNT therapy on the body mass index (BMI) of T2DM patients over a period of six months while controlling for the influence of standard of care. ANCOVA results, presented in Table 8, show a significant difference in mean FBS level amongst treatment groups [F(2, 86) =8.333, p<0.01, partial η^2=0.162]. However, the calculated effect size indicates a small proportion of variance which accounted for about 16.2% change in the BMI of the treatment group.

Bonferroni post hoc tests (Table 8) showed there was a significant difference between group 1 (initial visit) and group 3 (6 months) (p<0.01) only. Comparing the estimated marginal means showed that the lowest BMI level was in group 3 (mean =22.77 kg/m^2) compared to groups 2 and 1 respectively (mean =24.915 kg/m^2, mean =26.76kg/m^2). The graph in Figure 2 highlights the mean differences amongst the groups.

Table 8: ANCOVA summary of the effect of intervention on BMI of T2DM patients and post-hoc (Bonferroni) summary of the effect of intervention on BMI level of T2DM patients.

ANCOVA Summary of the effect of Intervention on BMI of T2DM patients						
Parameters	**MNT therapy on the BMI Control**			**F**	**P value**	**Effect size η^2**
	Initial visit Mean±SD	**3 months Mean±SD**	**6 months Mean±SD**			
BMI intervention group	26.76±2.74	24.92±2.73	22.77±2.74	8.333	0.001*	0.162
Post-hoc (Bonferroni) summary of the effect of intervention on BMI level of T2DM patients						
BMI intervention group						
(I) groups	**(II) groups**		**Mean difference (I-II)**		**Std. error**	**P value**
Initial visit	3 months		1.846		0.972	0.183
	6 months		3.990*		0.978	0.001*
3 months	Initial visit		-1.846		0.972	0.183
	6 months		2.144		0.972	0.090
6 months	Initial visit		-3.990*		0.978	0.001*
	3 months		-2.144		0.972	0.090

Statistically significant at p≤0.05

Table 9: ANCOVA summary of the effect of MNT therapy on waist circumference of T2DM patients and post-hoc (Bonferroni) summary of the effect of intervention on waist circumference of T2DM patients.

ANCOVA Summary of the effect of MNT therapy on waist circumference of T2DM patients						
Parameter	**MNT therapy on the waist circumference**			**F**	**P value**	**Effect size $\eta 2$**
	Initial visit Mean±SD	**3 months Mean±SD**	**6 months Mean±SD**			
Waist circumference	88.75±6.47	82.98±5.73	80.02±6.74	7.435	0 .001*	0.147
Post-hoc (Bonferroni) summary of the effect of intervention on waist circumference of T2DM patients						
BMI intervention						
(I) groups	**(II) groups**		**Mean difference (I-II)**		**Std. Error**	**P value**
Initial visit	3 months		5.767		2.301	0.042*
	6 months		8.723		2.300	0.001*
3 months	Initial visit		-5.767		2.301	0.042*
	6 months		2.956		2.299	0.606
6 months	Initial visit		-8.723		2.300	0.001*
	3 months		-2.956		2.299	0.606

*Statistically significant at p≤0.05

The analysis of covariance was conducted to investigate the effect of Intervention on the waist circumference of T2DM patients over a period of six months while controlling for the influence of standard of care. ANCOVA results, presented in Table 9, show a significant difference in mean waist circumference (weight loss) amongst treatment groups [F(2, 86) =7.435, p<0.01, partial eta η^2=0.147]. However, the calculated effect size indicates a small proportion of variance, accounting for about 14.7% change in the waist circumference of patients in the treatment group.

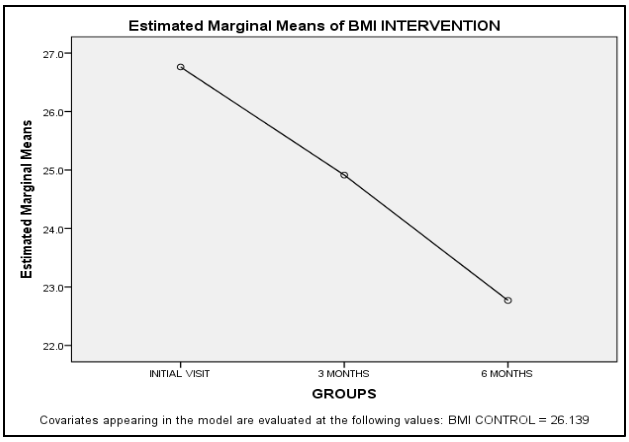

Figure 2: Estimated marginal means of BMI intervention.

Bonferroni post hoc tests (Table 9) showed there was a significant difference between group 1 (initial visit) and group 2 (3 months) ($p<0.05$) and groups 1 and 3 ($p<0.01$). Comparing the estimated marginal means showed that the most weight loss in waist circumference was in group 3 (mean =80.024 cm) compared to groups 2 and 1 (mean =82.98 cm and 88.747 cm respectively). The graph below highlights the mean differences amongst the groups.

DISCUSSION

The principles of prevention and management in T2DM include frequent blood glucose monitoring, reduction in carbohydrate and therapy adjustment. Blood glucose monitoring before and after meal will enable early recognition of glucose abnormalities and allow prompt action to prevent several diabetic complications.

Demographic factors give information of a study population. Although this study considered age and sex, it did not affect FBS, or influence weight reduction. It showed a mean age of 54.74±11.29 years for intervention group with gender equally matched (Table 1). Tonstad et al showed that appropriate diet was associated with weight reduction in patients at risk for T2DM when BMI was adjusted.[16] An unhealthy diet like non-vegetarian with processed red meat, excess fats were even reported to have a 3.8 times chance of having diabetes linked to their cause of death irrespective of age and sex.[17]

Side effects, cost and poor health seeking behaviours are linked to poor adherence to therapy even with abundance of drugs for T2DM on the market, which sometimes hinders patient with T2DM from being compliant with therapy.[11,18,19]

The evidence that the right diet can contribute to good glycaemic control and normalization of patients' health has been demonstrated by this study. Although the observed differences were not significant, the study showed that twice the number of study participants in the intervention group had a drop in Fasting blood glucose (well controlled) throughout the study period compared to the control group in a ratio of 2:1. It is safe to document that the intervention had more efficacy at glycaemic control (Table 6). Lim et al found normalized in the diabetic group (from 92±0.4 mmol/l to 5.9±0.4 mmol/l, p=0.003).[20] This finding was similar to finding in Pories et al, affirmed by Schauer et al; reaffirmed by the Diabetes Remission Clinical Trial (DiRECT) study and currently by Akoko et al, using wholly Nigerian diet to achieve remission in T2DM patients.[21-24]

A reduction in calorie over several weeks to months may result in weight loss with a decrease in leptin production, decreased fatty acid infiltration into liver and muscles cells. All of these leads to weight loss and a fall in the mediators of inflammation with a resultant insulin sensitivity. Western diet, antibiotics and other factors causes dysbiosis from disruption of the microbiome and a reduction in the production of short-chain fatty acid-butyrate that assists in blood sugar management.[25] Parker documented a high protein, low carbohydrate diet in patients with T2DM can achieve weight loss, reduced insulin requirements and reduced blood sugar level.[26] Trapp et al. showed that a high fibre-based diet helped to reverse diabetes despite no weight loss occurring implying the type of food consumed impacted blood sugar regulation.[27] The BMI is also known as the Quetelet's index with normal range of 18.5-24.9 kg/m^2. Values below 18.5 kg/m^2 suggests underweight. From 25.0-29.9 is overweight, 30-39.9 is obese, while 40.0 and above is severe obesity. BMI, however, as a measure of excess weight does not differentiate lean body mass from fat.[28]

The limitations in this study are the small sample size and sustainability of the glycaemic control after 6 months of achieved blood sugar control. The study showed the feasibility of diet in weight reduction and glycaemic control when controlling for influences of standard of care (control group). The analysis of covariance for FBS (Table 7); BMI (Table 8) and waist circumference (Table 9) all show evidence.

Observed changes in this study were seen within a short period. This may be due to participant getting one call and 2 text messages per week as follow up for incentives and sustainable health education. These calls served the need for psychosocial support and interactions to help deal with concerns during study period and reminded them of the need do daily blood sugar test and chart and to adhere to study protocol. It also helped to monitor possibilities of complications within and across the groups. Sustainable changes following long term lifestyle intervention if not encouraged may be phased out stemming from a lack in proper support system and adverse environmentally unfavourable conditions like no immediate economic benefit for the hospital where study was done. Van Ommen et al finding showed that the theory and practice differ, and we face a multifactorial challenge that requires removing economic, social, psychological and biological barriers.[29]

CONCLUSION

Control of fasting blood sugar and weight reduction are linked to remission of T2DM. This study showed a link with available food sources with limited calories causing weight loss and stabilizing blood sugar control over twenty-four weeks period in study participants. Further studies on the durability of proper caloric restrict wholly Nigerian diet will be needed to expand the body of knowledge.

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