Effect of Health Education Intervention on Diabetes-Related Knowledge of Community Dwelling Adults in Anambra Central Senatorial District, Anambra State

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Abstract

Diabetes mellitus is a chronic metabolic and disabling medical condition that has challenged the health of all ages and cultures in recent time. We assessed the effect of health education intervention (HEI) on diabetes-related knowledge among community dwelling adults (CDAs) in Anambra Central Senatorial District, Anambra State. In a quasi-experiment adopting pre-test post-test non-control group design, a total number of 276 (64 male and 212 female) adults participated. Data collection was done using the University of Michigan diabetes-knowledge Test (UMDKT). Mean, standard deviation and analysis of covariance were used for analyses. The findings reveal that the CDAs who were given HEI had better diabetes knowledge than their counterpart not exposed to HEI, and there was no significant interaction effect of HEI and age, gender and level of education on the mean diabetes knowledge scores of CDAs after HEI. This research proves that health education intervention showed that health education is implicated in adoption of knowledge of diabetes. However, health educators should ensure that adequate information and knowledge of diabetes are imparted on community dwelling adults using suitable channels and medium.

Keywords: Health education intervention, Diabetes mellitus, Community dwelling adults, knowledge.

Introduction

Diabetes is a chronic metabolic and disabling medical condition that has challenged the health of all ages and cultures in recent time, and has emerged as a significant non-communicable disease, threatening the health of community dwelling adults (CDAs). The Prevalence of diabetes is projected to rise to 552 million worldwide by the year 2030, representing more than 54 per cent increase in less than 20 years (World Health Organization [WHO], 2016). Also, International Diabetes Foundation (2017) reveal that 425 million people have diabetes worldwide, and that

Type I diabetes (previously known as juvenile or childhood onset diabetes) makes up about 10 per cent of the population, with Type 2 diabetes (T2D) making up about 90 per cent of the cases, and nearly 50 per cent of these are undiagnosed.

The increased cases of diabetes have resulted in millions of deaths, as over 1.6 million deaths were directly caused by T2D in 2016. This made it the eight-leading cause of death worldwide (WHO, 2016). In this report, the WHO further indicated that diabetes has tripled in the last two decades globally, with the highest prevalence rates found in developing countries.

Sub-Saharan African countries seem to be severely hit by diabetes. Mercer et al. (2019) disclosed that the burden of diabetes in Africa is rising at a faster rate compared to other parts of the world. World Health Organization (2016) reported that diabetes prevalence is highest in African region among adults aged 45 years and above. Uloko et al. (2018) posited that of the approximately 650 million people in Sub Saharan Africa; 10-20 million may be diabetic. Nigeria is the most populous country in Africa with an estimated population of 191 million (51% males, 49% females) people, having an estimated growth rate of 2.43 per cent per annum and a high dependency ratio of 88 per cent (National Bureau of Statistics, 2016). Due to this vast population, Nigeria immensely contributes to the total burden of diabetes in the continent (Adeloye et al., 2017).

In Nigeria, diabetes is associated with high morbidity and mortality, with more than 5 million Nigerians affected (Diabetes Association of Nigeria, 2014). Although T2D in the adult population in Nigeria is increasing, the prevalence rate varies yearly and regionally (Uloko et al., 2018). For instance, a systematic review and meta-analysis conducted by Adeloye et al. (2017) showed an estimated overall diabetes prevalence of 25.7 per cent while Uloko et al. reported that diabetes prevalence ranged from 2.1 per cent to 43.5 per cent in adult population. An individual therefore requires a health education intervention to engage in healthy behaviour practices that reduce the risk of developing diabetes.

This increase in prevalence of diabetes has been linked to rapidly changing demographic trends, different cultural structures, active socio-economic growth, increased rate of urbanization, unhealthy diets and gradual adoption of perhaps most importantly, adjustments to “Western – lifestyle” (Uloko et al., 2018). It was in recognition of this fact that Bett (2019) called for an increased community-based interventions for community-dwelling adults on Diabetes mellitus.

Diabetes mellitus is a disease that occurs when your blood glucose, also called blood sugar, is too high. It is a group of chronic diseases that usually manifest as high blood glucose levels, due to the pancreas inability to produce insulin and/or the body's inability to use insulin (Uloko et al., 2018). Diabetes is a group of metabolic disorders characterized and identified by the presence of hyperglycemia in the absence of treatment (World Health Organization, 2019). It can be categorized into insulin dependent (juvenile-onset diabetes) also known as type 1 diabetes and non-insulin (adult-onset diabetes) known as T2D (International Diabetes Foundation, 2017). However, contextually, diabetes mellitus can be classified into: type 1 diabetes mellitus, type 2 diabetes mellitus and gestational diabetes mellitus. Type 1 diabetes mellitus is caused by destruction of the pancreatic cells that produce insulin, and usually develops before the age of 30 years (American Diabetes Association, 2014). Non-insulin (adult-onset diabetes mellitus) known as T2D resulting from inability of the cells of the body to respond to insulin. About 90 per cent of diabetics have this form, which usually occurs after the age of 40 years (WHO, 2016). Gestational diabetes mellitus is common in women who are genetically predisposed to diabetes mellitus during pregnancy (DeSisto et al., 2014). However, an individual therefore requires adequate knowledge to engage in healthy behaviours that reduce the risk of developing diabetes.

Knowledge is a familiarity, awareness, or understanding of someone or something, such as facts, information, description or skills which are acquired through experience or education, by perceiving, discovering or learning. Ramirez and Valdes (2012) posited that knowledge is about information that can be used or applied; that is, it is information that has been contextualized in a certain domain, and therefore, any piece of knowledge is related with more knowledge in a particular and different way in each individual. In a nutshell, it is a prerequisite to any health practice, action or behaviour. A Nigerian study reported that only about 30 per cent of diabetic patients were aware of their condition at the time of diagnosis (Oputa & Chinenye, 2015). An individual's exposure to proper health knowledge will influence positively his or her health attitudes and practices, and thus, one could rightly say that knowledge is the key to optimum wellbeing. Evidences in literature (Chinenye, 2019; Diabetes Association of Nigeria [DAN], 2015) emphasize that health education is the most important part of diabetes mellitus care.

Health education is known to be the principle by which individuals or group of people learn to behave in a manner that maintain, promote and restore their health. Steinsbekk et al., (2012) reported that effective health education focus on helping adults achieve glycemic control and

stick to lifestyle changes through diet and exercise. Park (2015) expressed that health education is a process that informs, motivates and helps people to adopt and maintain healthy practices and lifestyles. Kjellsdotter et al., (2020) emphasized that when individuals are educated on their blood glucose level, they take more responsibility and acquire disease-specific knowledge and skills. This can be reinforced using early health education intervention.

Health education intervention (HEI) is activities designed to improve knowledge, attitude and good prevention practices. Evidence (Park, 2015; Steinsbekk et al., 2012) from literature has shown that health education interventions create change by influencing individual attitudes, beliefs, skills and practice. It also increases social support, and create supportive environment for health promotion (Bett, 2019). Diabetes education programme according to (WHO, 2017), may consist of information about diabetes, education and communication related to healthy lifestyle, proper nutrition, physical activity, and importance of regular medical checkups. It should also contain explanations on meaning of diabetes, its risk factors, control, treatment options, as well as prognosis.

Health education intervention tends to have an effect on diabetes-related knowledge of adults. Odili and Oparah (2013) reported an increase in the knowledge of the respondents after the educational intervention. Kassahun et al. (2016) and Pellulo et al. (2019) reported low knowledge scores after HEI. Chukwuani (2019), reveal that one of the benefits of structured diabetes education is to equip adults with an increased knowledge about diabetes and its complications. Again, Chen et al. (2020) in their study on effect of educational intervention on diabetes knowledge of patients with T2D in rural China concluded from results that knowledge scores increased significantly after health education intervention among the rural populace, and that educational intervention could increase collaboration between hospitals and communities. Hence, health education interventions support lifestyle changes especially among adults.

Adult is a person who has attained the age of majority and is therefore seen as independent, and responsible. It is a person older than 19 years of age unless national law delimits an earlier age (WHO, 2016). Adults can be categorized into three stages: young adulthood (21-40 years), middle adulthood (41-65 years) and older adulthood (65 years and above) (Samuel, 2006). Middle and older adults are still at the highest risk for developing T2D (Center for Disease Control and Prevention [CDC], 2017). Consequently, this study explored socio-demographic variables of age, gender and level of education in moderation of the study.

Age has been identified to have a strong effect on diabetes-related knowledge. Makki-Awouda et al. (2014) posited that Sudanese adults of higher age group showed significantly greater improvement on knowledge scores after HEI. Also, Adejoh (2014) reported that general level of knowledge of diabetes among adults in Igala land of Kogi State was low. Ahmed and Khresheh (2018) further recorded no significant interaction effect of age, gender and level of education on diabetes knowledge scores. Chawla et al. (2019) found that the age of CDA's had huge impact on their diabetes knowledge especially if an adult was above 50 years. Pal et al. (2020) reported that there is a significant difference in older adults aged 50 years and above after HEI.

Gender and level of education have been implicated to have strong effect diabetes-related knowledge. Dos Santos et al. (2014) reported that male adults' knowledge of diabetes is limited than females. Also, Ahmed et al. (2015) found that adults with low level education had improved post-test mean scores after intervention. Herath et al. (2017) reported that males demonstrated significantly higher knowledge scores than females. Karaoui et al. (2018) reported that there was no significant difference in knowledge scores after HEI based on education level. Shawahna et al. (2021) recorded a significant gender difference after HEI.

It is assumed that while growing up, adults should have basic knowledge of healthy lifestyle behaviours, such as: regular physical activity; consumption of healthy diets rich in whole grain, fruit and vegetables, weight control and low sugar and salt consumption through health education to help prevent metabolic diseases, such as diabetes. Nevertheless, some adults do not have adequate knowledge about diabetes while some undermine the consequences of T2D complications; thereby practising unhealthy lifestyle behaviours, such as excessive consumption of alcohol, sedentary lifestyle, excess consumption of refined sugar and carbohydrates, tobacco and cigarette smoking, reduced intake of fruit and vegetables, physical inactivity and consumption of foods rich in cholesterol. These practices may be because the adults are not adequately informed. Unfortunately, researchers and educators have not given much desired attention to the HEI. Evidently, limited research has been conducted on the HEI on diabetes knowlege. This study addressed this gap in the literature. In view of these facts, the study investigated the effect of health education intervention on diabetes related-knowledge among community dwelling adults. Specifically, the study determined: the mean diabetes-related knowledge scores of community dwelling adults before and after HEI; the mean diabetes-related knowledge scores, of community dwelling adults before and after HEI based on their ages; the

mean diabetes-related knowledge scores of male and female community dwelling adults before and after HEI; and the mean diabetes-related knowledge scores of community dwelling adults before and after HEI based on their education level. It was hypothesized that there is no significant interaction effect of age, gender, and different educational statuses on the mean diabetes-related knowledge scores of community dwelling adults in Anambra Central Senatorial District after HEI.

The study findings would help to inform a more effective response from health education programme planners and policy makers in designing health programmes that are culturally appropriate and relevant, and in sensitizing and guiding both diagnosed and undiagnosed adults on diabetes and its complications before diagnosis of the disorder. The findings would also provide diabetics with knowledge and skills to optimize self-management that would lead to substantial improvement in glycemic control, and significant reduction in complication rate as well as cost of management. Also, the findings would inspire both State and Federal authorities to make a commitment to improving Non-communicable diseases (NCD) and diabetes care in Nigeria.

Materials and Methods

Study design and setting

The design of the study was quasi-experimental. Specifically, the study adopted pretest posttest non-equivalent comparison (control) group design. The study was deemed appropriate based on the assertion of Cohen et al. (2011) which stipulated that the design facilitates the investigation of interaction effect of added independent variables (factors, e.g. demographics) on the treatment variable. The study was conducted in Anambra Central Senatorial District, among community dwelling adults. Anambra Central Senatorial District is one of the three Senatorial districts in Anambra State, South-East, Nigeria, which is comprised of seven Local Government Areas which make up Anambra Central Senatorial district with 58 communities. The area was chosen for the study due to its peculiar mixed culture which in many ways has profound influence on adult's health.

Participants

The study participants consisted of all the 868, 792 community dwelling adults in the study area. Out of this population, 412, 527 were males while 456, 265 were females. Adults aged 40 years

and above were considered appropriate since literature reports that adults of this age and older, are more susceptible to developing T2D (American Diabetes Association, 2015).

Sampling procedures

A sample size of 276 community dwelling adults, consisting of 212 females and 64 males was used for the study. From the seven local government areas (LGAs) that make up Anambra Central Senatorial District, the researchers selected four LGAs by random technique of balloting without replacement. From each of the four LGAs drawn, simple random technique of balloting without replacement was used to select four communities that were used for the study. From each of the four communities, adults were allowed to voluntarily opt for health education. Names of adults who indicated interest were taken, and they joined the health education class serving as the experimental group. However, 276 adults participated in the study.

Material and measures

The instrument used for data collection comprised University of Michigan Diabetes Knowledge Test (UMDKT) (Michigan Diabetes Research Centre, 2015). The UMDKT was adapted to determine diabetes knowledge of the participants. The test consists of 20 items which represents a test of general knowledge of diabetes. The UMDKT consisted of 20 multiple choice questions with options A-D that has only one correct answer. The participants were asked to circle the correct option from options A-D in any of the questions. The UMDKT was modified, substituting the food items on the original knowledge test with locally available foods consumed in the study population. The Diabetes Knowledge Test was used for pre-test and post-test.

The UMDKT was validated by three experts, Two experts came from the Department of Human Kinetics and Health Education, and one came from measurement and evaluation in the Department of Educational Foundations, Nnamdi Azikiwe University Awka. The UMDKT yielded a reliability coefficient of 0.88 using split-half method (Spearman Brown Coefficient).

Data collection procedure

The current research was developed in accordance with the Ethical Principles of the World Medical Association Declaration of Helsinki for medical research involving human subjects (World Medical Association, 2013), and the research was approved by Research Ethics Committee of the Faculty of Education, Nnamdi Azikiwe University, Awka, Nigeria.

In order to gain access to the respondents, a letter of introduction was obtained from the Head, Department of Human Kinetics and Health Education, Nnamdi Azikiwe University Awka. This was to enable the researchers obtain ethical clearance that was presented to the Presidents of Town Unions of the sampled Communities. The researchers requested the community leaders in the selected communities to inform the people about the study, rationale for the study and need for their involvement in the study. However, the researchers emphasized voluntary participation of the community dwelling adults by signing a consent form. Subsequently, a specified date and time based on mutual consent was agreed upon.

Prior to treatment, pretest scores were collected from the subjects in the selected communities using the UMDKT. After treatment, which lasted for six weeks, the items of the UMDKT were re-arranged randomly and re-administered to all the participants to collect the post-test scores.

Data analysis

The IBM Statistical Package for Social Sciences (SPSS) version 23.0 was used for all the statistical analyses. Mean, standard deviation and analysis of covariance were used for analyses. The normality of the data was checked through skewness, kurtosis and the Kolmogorov–Smirnov (K-S) test. Normal distribution was considered if the skewness showed values between -2 and +2, and the KS test is not significant (Bryne, 2010). In order to adjust the sample to normal, the data of each variable were adjusted using In(x) and x^2 algorithms if they were not normally distributed. The internal consistency of the UMDKT was estimated using split-half method (Spearman Brown Coefficient). All the tests were 2-tailed, and the probability values less than 0.05 ($p<0.05$) were considered significant.

Results

Table 1: Diabetes-Related Knowledge Scores of Community Dwelling Adults in Anambra Central Senatorial District Before and After Health Intervention

N	Pretest Mean	SD	Posttest Mean	SD	Gained Mean
276	8.36	2.85	12.82	3.02	4.46

Result in Table 1 shows that the pretest mean diabetes-related knowledge score of community dwelling adults in Anambra Central Senatorial District is 8.36 while their posttest mean score was 12.82. The gained mean score was 4.46 respectively. The educational intervention had a

positive effect on increasing the subject's diabetes knowledge as evidenced by the positive values of gained mean scores of diabetes related-knowledge.

Table 2: Diabetes-Related Knowledge Scores of Community Dwelling Adults in Anambra Central Senatorial District Before and After Health Intervention Based on their Ages

Age Range	Pre-test			Post-test			Mean Gain Score
	N	Mean	SD	N	Mean	SD	
Below 50 Years	143	8.73	2.94	143	12.91	2.79	4.18
50 Years and above	133	7.96	2.68	133	12.72	3.25	4.96

In Table 2, community dwelling adults in Anambra Central Senatorial District below 50 years had 8.73, 12.91 and 4.18 as pretest, posttest respectively and mean gain score while those from 50 years and above had 7.96, 12.72 and 4.96 as pretest, post-test and mean gain score, respectively. This indicates that diabetes knowledge scores of CDAs above 50 years increased more than adults below 50 years exposed to the same HEI.

Table 3: Diabetes-Related Knowledge Scores of Male and Female Community Dwelling Adults in Anambra Central Senatorial District Before and After Health Intervention

Gender	Pre-test			Post-test			Mean Gain Score
	N	Mean	SD	N	Mean	SD	
Male	64	8.34	2.51	64	12.83	3.29	4.49
Female	212	8.37	2.95	212	12.83	2.94	4.46

Result in Table 3 shows the mean diabetes-related knowledge scores of male community dwelling adults in Anambra Central Senatorial District to be 8.34, 12.83 and 4.49 as pretest, posttest and mean gain score respectively while their female counterpart had 8.37, 12.83 and 4.46 as pretest, post-test and mean gain score respectively. This indicates that the diabetes knowledge scores of male CDAs after HEI increased more than their female counterparts.

Table 4: Diabetes-Related Knowledge Dwelling Adults in Anambra Central Senatorial District Before and After Health Intervention Based on Level of Education

Educational Level	Pre-test	Post-test	Mean Gain Score

	N	Mean	SD	N	Mean	SD	
Low Education Level	178	7.79	2.82	178	12.44	3.32	4.65
High Education Level	98	9.40	2.61	98	13.52	2.23	4.12

Result in table 4 shows the mean diabetes-related knowledge scores of community dwelling adults in Anambra Central Senatorial District. Subjects with low education level scored 7.79, 12.44 and 4.65 for pretest, posttest and mean gain score respectively while those with higher education level had 9.40, 13.52 and 4.12 for pretest, post-test and mean gain score respectively. This indicates that CDAs with low education level had higher mean gain score than those with higher education level after HEI.

Table 5: Summary of Analysis of Covariance on the Mean Diabetes-Related Knowledge Scores of Community Dwelling Adults in Anambra Central Senatorial District by Age, Gender and Education Level

Source	***SS***	***df***	***MS***	***F***	***p-value***
Pretest	.106	1	.106	.012	.914
Age	2.253	1	2.253	.251	.617
Gender	2.713	1	2.713	.302	.583
Educational Status	34.187	1	34.187	3.806	.052
Age* Gender* Education Level	5.601	1	5.601	.624	.430
Error	2398.249	267	8.982		
Total	47910.000	276			

Result in Table 5 shows that there was no statistically significant interaction among age, gender and educational level on the mean diabetes-related knowledge scores of community dwelling adults in Anambra Central Senatorial District before and after health education intervention., $F(1,267)= .624$, $p>0.05$. The null hypothesis was therefore not rejected. This interaction was depicted better in figures 1 and 2.

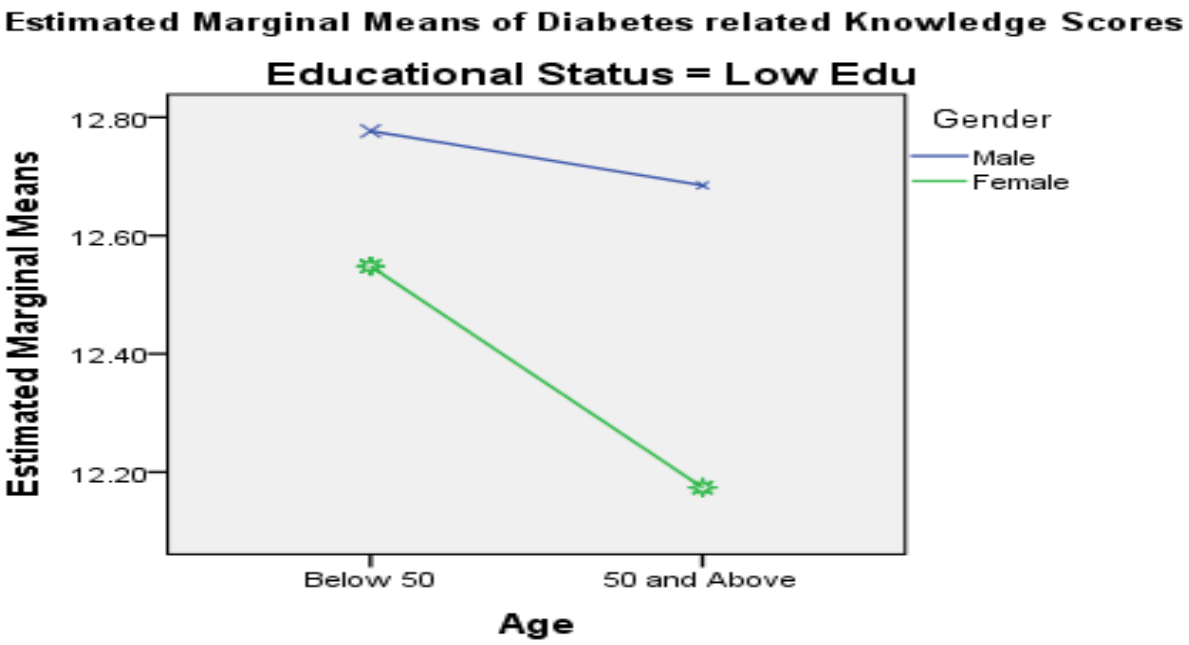

Figure 1: mean diabetes related knowledge scores of community dwelling adults in Anambra Central Senatorial District before and after health education intervention by age, gender and educational statu

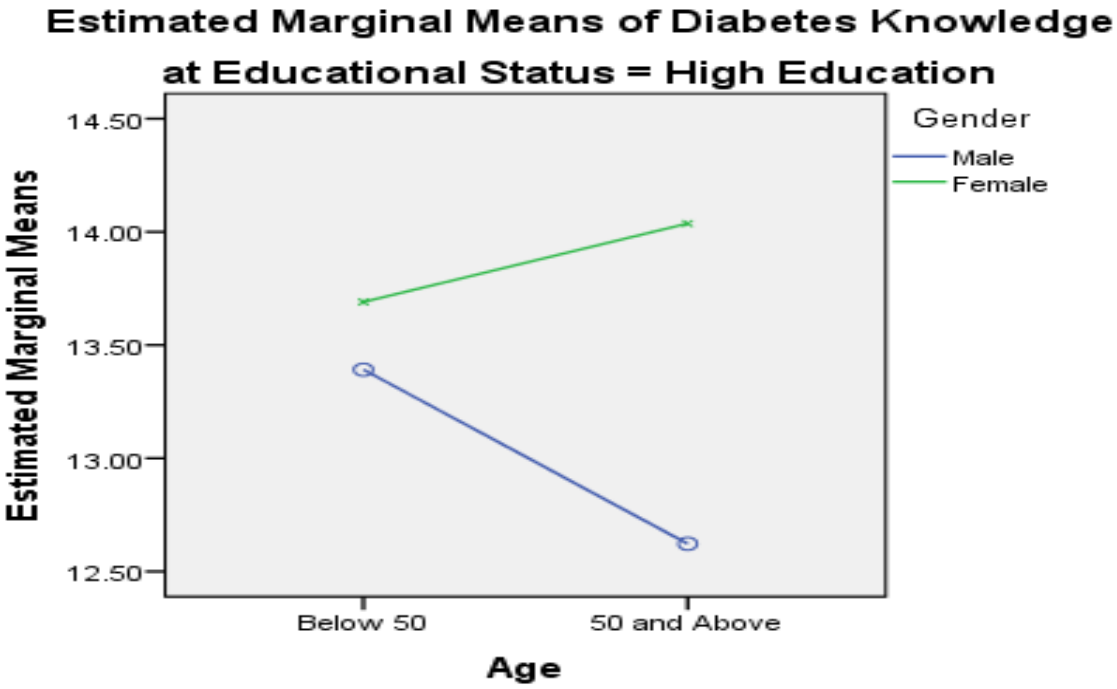

Figure 2: mean diabetes related knowledge scores of community dwelling adults in Anambra Central Senatorial District before and after health education intervention by age, gender and educational status

Discussion

The findings of this study reveal that the educational intervention had a positive effect on increasing the CDAs' diabetes knowledge as evidenced by the positive values of gained mean scores of diabetes-related knowledge. This finding was anticipated because knowledge is gained through education. The reason for the finding may be that, gaining knowledge about how what they eat affects the blood sugar directly, made them aware that they are in control of their health.

The improved knowledge mean scores after HEI was not surprising and can be linked to improvement in understanding and awareness. There are overwhelming evidences in the literature that back the efficiency of structured HEI. Steinsbekk et al. (2012) reported that, effective health education focus on helping adults achieve glycemic control and stick to lifestyle changes through diet and exercise. The finding was consistent with the findings of Odili and Oparah (2013) who reported an increase in the knowledge of the respondents after the educational intervention. The findings of this study is in line with the finding of Puepet et al. (2007) who reported that HEI is significant for improving knowledge among diabetics and non-diabetic adults. This is consistent with a previous study that reported higher post-test scores on diabetes knowledge than pre-test scores. Bett (2019) reported that using health education intervention achieved significantly higher post-test scores on diabetes knowledge. Additionally, the findings confirm that the positive values result from the content of the intervention programme modules which addressed the cultural misconceptions and myths about diabetes in the various communities, hence, the need for a HEI.

Again, Chen et al. (2020) in their study on effect of educational intervention on diabetes knowledge of patients with T2D in rural China concluded from results that knowledge scores increased significantly after HEI among the rural populace, and that educational intervention could increase collaboration between hospitals and communities. The researchers imparted a HEI to the CDAs, and the adults assimilated the information, stored it in their memory, and retrieved it when given the post-test instrument, thereby having higher mean knowledge scores. Overall, results of the study indicate that HEI is an effective tool for significant change in knowledge, and can mitigate the effect of T2D.

There was a significant difference in the mean diabetes knowledge scores of CDAs after health education. The finding was expected and not surprising. This is because Chukwuani (2019) posited that one of the benefits of structured diabetes education is that it equips adults with an increased knowledge about diabetes and its complications. Hence, there should be an increase in knowledge after HEI. The finding was consistent with the findings of Bett (2019) who reported that diabetes knowledge scores improved significantly more after HEI. However, the finding contradicts the findings of Kassahun et al. (2016) and Pellulo et al. (2019) who reported low knowledge scores after HEI. The similarities in the findings could be attributed to the same age bracket of the respondents in both studies. The disparity in the findings could be attributed to the adoption of different research designs by the researchers. The tenets of the reviewed information motivation behavioural skill (IMB) model were applied in this finding to show that CDAs after HEI became well informed, and highly motivated (personally and socially) to take health-related actions. There was a significant difference in the mean diabetes prevention practices scores of CDAs after HEI.

The finding in Table 2 shows that the diabetes knowledge scores of adults above 50 years increased more than adults below 50 years exposed to the same HEI. This showed that after HEI, adults above 50 years had gained more knowledge than adults below 50 years. The finding was surprising and not expected as younger adults tend to be more informed than older adults. However, the finding could be because, as adults age and get older, they become more conscious of the aging process, and become more interested in information that would improve their health due to decline in physical health. The higher gained mean score of adults 50 years and above can be linked to the fact that increased age is associated with diabetes which makes the subjects willing to accept and share health information. This finding corroborates with the finding of Makki-Awouda et al. (2014) who reported that Sudanese adults of higher age group showed significantly greater improvement on knowledge scores after HEI. Also, Pal et al. (2020) reported that there is significant difference in older adults aged 50 years and above after HEI. Therefore, HEI improves knowledge on diabetes, and can lead to better control of diabetes. The finding however, contradicts the finding of Adejoh (2014) who reported that general level of knowledge of diabetes among adults in Igala land of Kogi State was low. The similarities in the findings could be attributed to the adoption of similar research designs and experimental procedures by the researchers. The disparity in the finding could be attributed to the adoption of

different research designs and variations in geographical contexts by the studies. For instance, Adejoh (2014) adopted the cross-sectional research design while this study adopted a quasi-experimental research design. It is therefore plausible to attribute similarities in findings to the research design adopted by the study.

The finding in Table 3 reveals that the diabetes mean knowledge scores of male CDAs after HEI increased more than their female counterparts. This finding was surprising and not expected because women are more open to discuss health-related issues, and easily look out for warning signs. Hence, it is expected that their knowledge should increase after the intervention. The reason for the finding could be that the females were distracted during the HEI due to external factors from social structures, such as Umuada and Inyo m Di meetings. However, the finding is consistent with the finding of Herath et al. (2017) who reported that males demonstrated significantly higher knowledge scores than females. Therefore HEI improved the CDAs' knowledge and also had an impact on their attitude. However, dos Santos (2014) reported that CDAs' knowledge of diabetes is limited than females. The similarities in this study with that of Herath et al. (2017) could be attributed to the study population. The disparity in findings could be due to different areas studied. For instance, while dos Santos study was conducted in State of Goias, Brazil, this study was conducted in Nigeria.

The finding in Table 4 shows that CDAs with low level education had higher gained mean score than CDAs with higher education after HEI. This is both shocking and outstanding because low literacy is considered a barrier to improving health outcomes. The reason for the finding could be the effect of a culturally appropriate HEI, jingles on diabetes awareness and free diabetes screening in some rural communities in the district. This finding lends credence to the findings of Ahmed et al. (2015) who found that adults with low level education had improved post-test mean scores after intervention. Therefore, a culturally contextualized HEI improved knowledge of diabetes among the subjects. The similarities in the findings could be as a result of the adoption of similar design by researchers. However, the finding is at variance with the works of Adejoh (2014) who found that adults with high level education recorded higher knowledge score after HEI. The disparity could be attributed to variations in geographical contexts by the studies. The tenets of the reviewed information motivation behavioural skill (IMB) model was applied in this finding to explain that the adults with low level education acquired more diabetes-related knowledge after HEI than their counterparts with high level education.

The finding in Table 5 reveal that there was no significant interaction effect of age, gender and level of education on diabetes mean knowledge scores of CDAs. This shows that when the three factors are combined their interaction has no significant effect on the dependent variable. This hypothesis was therefore rejected because $p>0.05$. This is also similar to the finding of Ahmed and Khresheh (2018) who reported no significant interaction effect of age, gender and level of education on diabetes knowledge scores.

Implications of Findings of the Study to Public Health Education

The findings from the difference in the diabetes knowledge mean scores of CDAs increased after HEI. The educational implication of this finding is that structured HEI helped improve the health knowledge on diabetes in adults, a necessary skill that enabled them to understand the concept, the types of diabetes, risk factors and complications associated with it. Also, HEI demonstrated impact on improving knowledge, changing attitude and social norms, as well as building self - efficacy which in turn, improved their health behaviour. In addition, the behavioural implication of the finding cannot be overlooked. The CDAs have gradually turned to Western diet and way of life due to ignorance on the negative health implications. A community-based HEI would help improve their knowledge on the consequences and avoidance strategies.

The finding on interaction effect of HEI and age, gender and level of education on the diabetes-related knowledge scores of CDAs have a positive implication on their health and in their culture. The findings showed that the mean diabetes knowledge scores of adult males above 50 increased after HEI. When adults are exposed to HEI, they gain knowledge and skills which would aid them engage in healthy lifestyle behaviours. Culturally, HEI empowers adults to question their social context and challenge negative social norms, including gender norms, and to be part of broader societal efforts towards gender equality. The finding would help in policy making. It would make relevant stakeholders, health institutions, Non-Governmental Organizations (NGOs) working with adults in the area of diabetes education to be aware of, and sensitive to HEI strategies for positive outcomes. Hence, delivering the contents of the intervention effectively and efficiently.

Conclusions

Our findings have shown that HEI is effective in adoption of CDA's diabetes mellitus knowledge. The diabetes knowledge mean scores of CDAs after HEI increased. There was a

significant difference in the diabetes mean knowledge scores of CDA's after HEI. In addition, there was no significant interaction effect of HEI and age, gender and level of education on the mean diabetes knowledge scores of CDAs after HEI. The findings have established the fact HEI has positive effect on diabetes knowledge of CDAs in Anambra Central Senatorial District. A general increase in both diabetes knowledge and prevention practices was observed after HEI indicating improvements in the variables age, gender and level of education respectively. However, Health education programme planners and policy makers should develop structured diabetes mellitus education lesson plan to improve health education that is tailored to Igbo culture. Federal and State ministries of health should support health education and promotion Department for integration of structured diabetes mellitus education into the curriculum with well trained staff and time, allocated for the implementation of such interventions. Health care practitioners and community health extension workers who serve as first point of contact in the communities should recommend blood sugar testing to their clients during consultations to prevent complications from diabetes mellitus. Health educators should ensure that adequate information and knowledge of diabetes considering socio-demographic characteristics of age, gender, education level among others are imparted on community dwelling adults using suitable channels and medium. The cost of glucometer and test strips should be subsidized by the government and policy makers to enhance affordability for CDAs.

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