



Influence of Age and Gender on the Effectiveness of Type 2 Diabetes prevention Education Programs: Knowledge and Attitudes Among Elderly Populations in Enugu State Nigeria

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Abstract

Type 2 diabetes mellitus (T2DM) remains a pressing global health challenge, disproportionately affecting elderly populations. Understanding and addressing the impacts of age and gender on the knowledge and attitude of the elderly populations is pivotal in examining the effectiveness of type 2 diabetes prevention education programme. The present study examines the influence of age and gender on the effectiveness of Type 2 Diabetes prevention Education Programs on Knowledge and Attitudes of the Elderly Populations. The study adopted quasi experimental research design. Specifically, the pre-test – post-test non randomized control group design. Twenty seven specific objectives with corresponding research questions and null hypotheses guided the study. The population for the study comprised of all the elderly populations that are registered as retirees (10779) in Enugu State Public service. A total of 78 retirees constituted the sample for the study. The instrument for data collection was the researcher designed- structured questionnaire titled Influence of age and gender on the effectiveness of Diabetes Prevention Education Program on Knowledge and Attitude of the elderly population Questionnaire (IAGEDEPKAEPQ) The reliability indices of $r = 0.63$, and $r = 0.75$ were obtained. The split half method with Spearman- Brown Correction formula was used to measure knowledge. Cronbach's alpha statistical tool was used to determine the reliability coefficient that measured attitude. Mean and standard deviation were used to answer research questions while t-test was used to test the null hypotheses at .05 level of significance. The findings showed that younger elderly populations and male elderly populations had higher mean T2DM knowledge scores than older and female elderly populations, while the mean T2DM attitude scores of younger elderly populations and male elderly populations exposed were higher. In addition, There was no significance interaction effect of age and gender the effectiveness of diabetes prevention education programe (DPEP) on the mean T2DM knowledge and attitude scores of elderly populations in Enugu State, $F(.041) = .177$, $p = .840$, (r^2) = .001.; $F(.175) = .017$, $p = .895$, (r^2) = .000. This implies that, age and gender was not effective in improving T2DM knowledge and attitude score of the elderly populations. Based on the findings, the authors recommended that,



Healthcare facilities providing geriatric services should integrate structured diabetes prevention education into routine health screening and follow-up visits for elderly patients.

Keywords: Diabetes, Age, Gender, Effectiveness, Influence

Introduction

Type 2 diabetes mellitus (T2DM) is one of the fastest-growing public health challenges worldwide, with prevalence rates increasing significantly among elderly populations. Advancing age is associated with reduced insulin sensitivity, comorbidities, and lifestyle factors that contribute to the onset and progression of T2DM. In 2021, an estimated 537 million adults aged 20–79 were living with diabetes—a figure projected to rise to 643 million by 2030 and 783 million by 2045. Among individuals aged 75–79, prevalence already reached 24% in 2021 and is expected to climb further by 2045 (Alguwaihes, 2025). According to the International Diabetes Federation (2021), nearly half of individuals living with diabetes are aged 65 years and above. Effective education programs play a critical role in improving knowledge, attitudes, and self-management among older adults, thereby combating disease progression and reducing complications. Health education has been recognized as a cornerstone in diabetes management, as it equips individuals with essential knowledge and positive attitudes toward self-care, lifestyle modification, and adherence to treatment. However, the effectiveness of diabetes education programs is not uniform across all demographic groups. Age and gender, in particular, have been shown to influence how individuals perceive health information, engage in educational interventions, and adopt long-term behavioral changes.

Age is the length of time an individual has lived, measured from birth to a specific point in time (ADA, 2025). It is both a biological characteristic and a social construct that influences how individuals are perceived and treated (Araki, 2017). In research, age may be measured as a continuous variable or grouped into categories. Age is an important demographic factor influencing knowledge, attitudes, and self-management of Type 2 diabetes mellitus (T2DM) (Chrisler, 2016). Older adults often experience challenges such as cognitive decline, sensory impairments, comorbidities, and lower health literacy, which can limit their ability to understand and apply diabetes education (Holt et al., 2021; McCoy et al., 2022). Differences within the elderly population (e.g., 60–69, 70–79, and ≥ 80 years) may also affect knowledge retention and attitudes toward lifestyle modification. Evidence from Egypt and Jordan shows that age-related differences in knowledge and health literacy significantly influence diabetes self-care, although translating knowledge into practice remains a challenge (Abdallah et al., 2024; Alguwaihes, 2025).

Gender refers to the socially constructed roles, behaviors, and identities associated with men, women, and gender-diverse individuals and differ from biological sex (Forskningsetikk, 2022; Harvey, 2025). Gender influences healthcare access, treatment adherence, and diabetes self-management (Hill-Briggs et al., 2021). Studies suggest that women generally demonstrate higher diabetes knowledge, are more likely to seek health information, and adhere to treatment recommendations than men, who may be more resistant to lifestyle changes. Evidence from Jordan and Egypt further indicates that women often report better diabetes knowledge and self-care behaviors, likely due to greater engagement with healthcare services (Abdallah et al., 2024; Alguwaihes, 2025).



Effectiveness according to Xu et al, (2024) is generally refers to the ability to produce desired outcomes. In this study, effectiveness pertains to how diabetes prevention education programme or intervention's outcome or result improved health of the elderly populations in Enugu state.

Influence is referred to the interplay of personal factors (e.g., age, gender, culture) affecting phenomena such as conformity and behavior. Modern research confirms that age and gender significantly modulate how individuals conform in different contexts, including digital environments (International Journal of Social Psychology 2023). Influence in the study is referred to the effects or impact of age and gender on the effectiveness of diabetes prevention education programme on the knowledge and attitude of the elderly population in Enugu state.

The elderly are individuals who have attained the age of 60 years or older, representing a stage of life associated with progressive biological aging, increased susceptibility to chronic diseases, and changing physical, psychological, and social needs (World Health Organization, 2024). However, The term is sometimes divided into subcategories such as young old (60-74 years), old old (75- 84yrs) and oldest old (85 yrs above). The elderly are a high-risk group for T2DM and its complications. However, understanding specific needs and challenges of the elderly is crucial for tailoring effective diabetes education programs. However, Individuals diagnosed before age 60 have up to three times the risk of developing dementia later in life compared to peers without diabetes. Early onset amplifies long-term health consequences (Eating well, 2023). Despite these observations, limited research has systematically explored the intersection of age and gender in shaping the outcomes of diabetes education among elderly populations, especially in low- and middle-income settings where health literacy gaps persist and Enugu state is not an exception. However, Gender differences may affect engagement, health-seeking behaviors, and the responsiveness to education. Understanding the impact of age and gender on knowledge and attitudes toward Type 2 diabetes education is essential for designing inclusive, culturally sensitive, and effective educational programmes. Such insights will not only enhance programme outcomes but also contribute to reducing diabetes-related morbidity and mortality among elderly populations.

This study, therefore, sought to examine the influence of age and gender on the effectiveness of Type 2 diabetes education programmes on knowledge and attitudes of the elderly individuals. By doing so, the findings may provide evidence-based recommendations for tailoring diabetes education interventions to meet the diverse needs of older adults. Specifically, the study assessed the: interaction effect of age and the effectiveness of diabetes prevention education programme (DPEP) on the mean T2DM knowledge scores of Elderly populations in Enugu State, interaction effect of gender and the effectiveness of diabetes prevention education programme (DPEP) on the mean T2DM knowledge scores of Elderly populations in Enugu State, interaction effect of age and the effectiveness of diabetes prevention education programme (DPEP) on the mean T2DM attitude scores of Elderly populations in Enugu State, and interaction effect of gender and the effectiveness of diabetes prevention education programme (DPEP) on the mean T2DM attitude scores of Elderly populations in Enugu State. By doing so, the findings may provide evidence-based recommendations for tailoring diabetes education interventions to meet the diverse needs of older adults.



Methods

Study design and setting

A quasi-experimental pretest–posttest non-equivalent control group design was adopted to determine the effectiveness of a Diabetes Prevention Education Programme (DPEP) on Type 2 Diabetes Mellitus (T2DM) knowledge and attitudes among elderly retirees in Enugu State, Nigeria. The design was considered appropriate because participants were assigned to intervention and control groups based on existing pension zones rather than individual randomisation. Two pension zones, Enugu and Nsukka, were selected from the 16 pension zones in the state and designated as the intervention and control groups, respectively. The use of intact groups helped to minimise the possibility of contamination between participants.

Study population

The study population comprised 10,779 registered retirees in Enugu State, based on records from the Enugu State Ministry of Finance. The study focused on elderly retirees who met the predetermined eligibility criteria. Participants were eligible if they were aged 65 years or older, registered within the selected pension zones, were able to participate in the educational sessions, and provided written informed consent. Retirees who were unable to participate throughout the intervention or complete the study instruments were excluded.

Sample size and sampling technique

A sample of 78 elderly retirees was determined using the formula for comparing two independent means. A multistage sampling procedure was used. First, two pension zones were selected from the 16 pension zones in Enugu State through simple random sampling by balloting without replacement. The selected zones were subsequently assigned as the intervention and control groups using intact-group allocation. Eligible retirees within the selected zones were recruited consecutively until the required sample size was achieved. The allocation of participants by pension zone rather than individual randomisation resulted in a non-equivalent group design.

Data collection instrument

Data were collected using a researcher-developed questionnaire titled Influence of Age and Gender on the Effectiveness of Diabetes Prevention Education Programme on Knowledge and Attitude of the Elderly Population Questionnaire (IAGEDEPKAEPQ). The questionnaire consisted of three sections and 20 items.

Section A contained two demographic items assessing participants' age and gender. Age was categorised into 65–74 years and ≥ 75 years, while gender was classified as male or female. Section B contained nine multiple-choice items assessing knowledge of T2DM, including its risk factors, prevention and healthy lifestyle practices. Each correct response was scored 1 and each incorrect response 0, giving a total possible knowledge score of 0–9, with higher scores indicating greater knowledge.

Section C contained nine attitude statements assessing participants' attitudes towards T2DM prevention and healthy lifestyle practices. Responses were rated on a four-point Likert scale from



Strongly Agree (4) to Strongly Disagree (1). The total attitude score was obtained by summing the item scores, with higher scores representing more favourable attitudes towards T2DM prevention. Where negatively worded items were included, they were reverse-scored before computation of the total score.

The instrument was subjected to face and content validation by experts in Human Kinetics and Health Education. The experts assessed the items for clarity, relevance, appropriateness and adequacy in measuring the study variables, and their observations were incorporated into the final version of the questionnaire. A pilot study was subsequently conducted among elderly retirees in Imo State who were not included in the main study. The internal consistency of the knowledge section was determined using the Kuder–Richardson 20 (KR-20), while Cronbach's alpha was used to determine the internal consistency of the attitude section. The coefficients obtained were considered acceptable for the main study.

Data collection procedure

Prior to data collection, ethical approval was obtained from the Research Ethics Committee of the Faculty of Education, University of Nigeria, Nsukka. Permission was also obtained from the relevant authorities overseeing the selected pension zones. Potential participants were informed about the purpose and procedures of the study, the expected duration of participation, potential benefits and their rights as research participants.

Written informed consent was obtained from each participant before enrolment. Participation was voluntary, and participants were informed that they could decline participation or withdraw from the study at any stage without penalty or loss of benefits. Privacy was maintained during questionnaire administration by providing participants with an appropriate setting in which to complete the instrument, while confidentiality was ensured by excluding personally identifying information from the research dataset and restricting access to the collected information to the research team.

The intervention group participated in the structured DPEP for six months. The programme consisted of interactive lectures, group discussions, demonstrations, educational leaflets and question-and-answer sessions. The programme addressed major components of T2DM prevention, including diabetes risk factors, healthy nutrition, physical activity, weight management, blood glucose monitoring, medication adherence and lifestyle modification. Sessions were delivered by trained health educators at a frequency of one 60-minute session per month.

The control group received the usual information/services available to retirees and did not receive the structured DPEP during the intervention period. This wording is preferable to “received placebo,” unless the control group actually received a specific placebo intervention. The IAGEDEPKAEPQ was administered to both groups before commencement of the intervention and immediately after completion of the six-month programme.

Data analysis

Data were coded and analysed using IBM SPSS Statistics version 27. Descriptive statistics, including frequencies, percentages, means and standard deviations, were used to summarise participants' demographic characteristics and describe T2DM knowledge and attitude scores at



pretest and posttest. Mean gain or difference scores were used to describe changes in outcomes following the intervention.

Analysis of Covariance (ANCOVA) was used to test the hypotheses concerning the effects of DPEP and the interaction of DPEP with age and gender, while controlling for participants' pretest scores. Statistical significance was assessed at the 0.05 level. F-statistics, degrees of freedom, p-values and partial eta squared (η^2) were reported to indicate statistical significance and effect magnitude. The null hypotheses were rejected when the corresponding p-value was less than .05 and retained when $p \geq .05$.

Results

Table 1: Interaction Effect of Age and the effectiveness of Diabetes Prevention Education programme (DPEP) on the Mean T2DM knowledge scores of elderly populations in Enugu State(n=78)

Group/Treatment	Age Group	Pre-test			Post-test		MG/MD
		N	$\bar{X}$	SD	$\bar{X}$	SD	
Experimental group	65-74yrs	31	4.48	1.48	7.85	2.78	3.37
	≥ 75 yrs	07	4.42	1.39	7.28	4.28	2.86
Control group	65-74yrs	20	5.05	1.57	5.23	1.70	0.18
	≥ 75 yrs	20	3.95	2.06	3.95	2.06	0.00

Note: $\bar{X}$ =Mean; SD = Standard deviation; MG= mean gain score; MD=Mean Difference score

Table 1 presents the mean and standard deviation of T2DM knowledge scores by age group. In the experimental group, participants aged 65–74 years improved from a pre-test mean of 4.48 (SD = 1.48) to 7.85 (SD = 2.78), while those aged ≥ 75 years improved from 4.42 (SD = 1.39) to 7.28 (SD = 4.28). In the control group, participants aged 65–74 years showed a slight increase from 5.05 (SD = 1.57) to 5.23 (SD = 1.70), whereas those aged ≥ 75 years showed no change (3.95 ± 2.06). Mean gain scores were higher among participants aged 65–74 years (3.37) than those aged ≥ 75 years (2.86) in the experimental group, suggesting greater improvement among the younger elderly following the DPEP intervention.



Table 2: Analysis Of Interaction Effect Of Gender and the Effectiveness of Diabetes Prevention Education Programe (DPEP) on the Mean T2DM Knowledge Scores of elderly population in Enugu State (n=78)

Group/Treatment	Gender	Pre-test			Post-test		
		N	$\bar{X}$	SD	$\bar{X}$	SD	MG/MD
Experimental group	Male	33	4.36	1.49	7.74	3.14	3.38
	Female	5	5.20	0.84	7.80	2.68	2.06
Control group	Male	21	4.38	1.86	4.54	2.02	0.16
	Female	19	4.63	1.98	4.63	1.98	0.00

Note: $\bar{X}$ =Mean; SD = Standard deviation; MG= mean gain score; MD=Mean Difference score

Table 2 shows the effect of DPEP on T2DM knowledge by gender. In the experimental group, males improved from 4.36 (SD = 1.49) to 7.74 (SD = 3.14), while females improved from 5.20 (SD = 0.84) to 7.80 (SD = 2.68). In the control group, males showed only a slight increase (4.38 $\pm$ 1.86 to 4.54 $\pm$ 2.02), whereas females showed no change (4.63 $\pm$ 1.98). Mean gain scores were higher for males (3.38) than females (2.60) in the experimental group, indicating greater improvement in T2DM knowledge among male participants following the intervention.

Table 3:Interaction Effect of the Effectiveness of Age and Diabetes Prevention Education Programe (DPEP) on the Mean T2DM Attitude Scores of the Elderly populations in Enugu State (n=78)

Group/Treatment	Attitude score	Pre-test			Post-test		
		N	$\bar{X}$	SD	$\bar{X}$	SD	MG/MD
Experimental group	65-74yrs	32	1.98	1.68	1.66	1.05	-0.32
	≥ 75 yrs	10	1.94	1.86	1.68	1.00	-0.26
Control group	65-74yrs	20	2.34	1.16	2.22	1.11	-0.12
	≥ 75 yrs	18	2.27	1.83	2.18	1.56	-0.09

Note: $\bar{X}$ =Mean; SD = Standard deviation; MG= mean gain score; MD=Mean Difference score

Table 3 presents the mean attitude scores by age group. In the experimental group, participants aged 65–74 years changed from 1.98 (SD = 1.68) to 1.66 (SD = 1.05), while those aged ≥ 75 years changed from 1.94 (SD = 1.86) to 1.68 (SD = 1.00). In the control group, participants aged 65–74 years changed from 2.34 (SD = 1.16) to 2.22 (SD = 1.11), and those aged ≥ 75 years from 2.27 (SD = 1.83) to 2.18 (SD = 1.56). Mean difference scores were slightly higher among participants aged 65–74 years (0.32) than those aged ≥ 75 years (0.26), suggesting a modestly greater improvement in attitude among the younger elderly.



Table 4: Analysis of Interaction Effect of Gender and the effectiveness of Diabetes Prevention Education Programme (DPEP) on the Mean T2DM Attitude Scores of the elderly populations in Enugu State (n=78)

Group/Treatment	Gender	Pre-test			Post-test			MG/MD
		N	$\bar{X}$	SD	$\bar{X}$	SD		
Experimental	Male	33	1.99	1.79	1.66	1.84		-0.33
	Female	7	1.87	1.80	1.73	1.05		-0.14
Control	Male	21	2.27	1.34	2.13	1.50		-0.14
	Female	17	2.35	1.98	2.28	1.33		-0.07

Note: $\bar{X}$ =Mean; SD = Standard deviation; MG= mean gain score; MD=Mean Difference score

Table 4 shows the mean attitude scores by gender. In the experimental group, males changed from 1.99 (SD = 1.79) to 1.66 (SD = 1.84), while females changed from 1.87 (SD = 1.80) to 1.75 (SD = 1.05). In the control group, males changed from 2.27 (SD = 1.34) to 2.13 (SD = 1.50), whereas females changed from 2.35 (SD = 1.98) to 2.28 (SD = 1.33). Mean difference scores were higher for males (0.33) than females (0.14) in the experimental group, indicating a slightly greater improvement in T2DM attitude among male participants.

Table 5: Two-way Analysis of covariance (ANCOVA) Showing Interaction Effect of DPEP and Age on the Mean T2DM Knowledge Scores of Elderly Populations Exposed to DPEP and those not Exposed (n= 78)

Source	Type III sum of squares	dF	Mean square	F	p-value	Partial squared	Eta
Corrected model	375.273	4	93.818	21.643	.000	.543	
Intercept	38.333	1	38.333	8.843	.004	.108	
KT2DM pretest scores	162.268	1	162.268	37.433	.000	.339	
Group/DPEP	2.371	1	82.371	.547	.462	.007	
Age	132.735	1	.132.735	30.620	.000	.296	
Treatment *age	.177	1	.177	.041	.840	.001	
Error	316.445	73	4.335				
Total	3621.000	78					
Corrected total	691.718	77					

Note. a. R squared (R^2) = .543 Adjusted R squared = .517)

b. Dependent variable = KT2DM post-test scores

C. Covariate = KT2DM pre-test scores



Cohen's Guidelines for Interpreting partial Eta Squared

Small effect size = 0.20

Medium/moderate effect size = 0.50

Large effect size = 0.80

Table 5 presents the ANCOVA results examining the interaction effect of DPEP and age on T2DM knowledge. After adjusting for pre-test scores, the interaction between treatment and age was not statistically significant, $F(1,75) = 0.041$, $p = .840$, partial $\eta^2 = .001$. Therefore, the null hypothesis was retained, indicating that age did not significantly moderate the effect of DPEP on T2DM knowledge. The negligible effect size (partial $\eta^2 = .001$) further suggests that the interaction had virtually no influence on knowledge outcomes.

Table 6: Two-way Analysis of covariance (ANCOVA) Showing the Interaction Effect of DPEP and Gender on the Mean T2DM Attitude Scores of Elderly population. (n= 78)

Source	Type III sum of squares	dF	Mean square	F	p-value	Partial squared	Eta
Corrected model	11.534	4	2.884	19.102	.000	.496	
Intercept	3.024	1	3.024	20.034	.000	.200	
T2DM attitude pretest scores	5.541	1	5.541	36.705	.000	.326	
Treatment /DPEP	1.101	1	1.101	7.294	.009	.133	
Gender	.187	1	.187	.1241	.269	.000	
Treatment * gender	.003	1	.003	.017	.865	.000	
Error	11.322	75	.151				
Total	322.309	78					
Corrected total	22.857	77					

Note. a. R squared (R^2) = .505 Adjusted R squared = .478)

b. Dependent variable = T2DM attitude post-test scores

C. Covariate = T2DM attitude pre-test scores

Cohen's Guidelines for Interpreting Partial Eta squared

Small effect size = 0.20

Medium/moderate effect size = 0.50

Large effect size = 0.80

Table 6 presents the ANCOVA results examining the interaction effect of DPEP and gender on T2DM attitude. After controlling for pre-test scores, there was no significant interaction between treatment and gender, $F(1,75) = 0.017$, $p = .895$, partial $\eta^2 = .000$. The null hypothesis was therefore retained, indicating that gender did not significantly influence the effectiveness of DPEP on participants' attitudes toward T2DM. The effect size was negligible, suggesting that both male and female participants responded similarly to the intervention.



Discussion

The present study found that younger elderly participants (65–74 years) recorded slightly higher mean T2DM knowledge scores than participants aged 75 years and above following exposure to the Diabetes Prevention Education Programme (DPEP). This finding suggests that although the intervention improved diabetes knowledge across both age groups, younger elderly participants appeared to derive greater benefit from the educational programme. This finding was expected because advancing age is often associated with cognitive decline, reduced information processing speed, memory impairment, lower literacy levels, and diminished participation in health education activities. Consequently, younger elderly adults may be better able to understand, retain, and apply health information than their older counterparts. However, the subsequent ANCOVA analysis demonstrated that the interaction between age and treatment was not statistically significant, indicating that age did not significantly influence the effectiveness of the DPEP. Therefore, while descriptive differences existed, the programme was beneficial across all age categories. The finding agrees with Lamis et al. (2018), who reported no significant age-related differences in diabetes knowledge among adults with diabetes. Similarly, Herath et al. (2017) found that age was not significantly associated with diabetes knowledge. However, the finding differs from Olanrewaju and Yahaya (2017), who reported that age significantly influenced diabetes knowledge. The discrepancy may be explained by differences in study populations, educational attainment, healthcare accessibility, cultural contexts, and the nature of the educational interventions employed. While the present study evaluated the effect of a structured education programme, previous studies were largely observational and assessed existing knowledge levels. The implication of this finding is that diabetes education programmes should continue to target all elderly populations irrespective of age, while incorporating age-friendly teaching approaches such as simplified educational materials, repetition of key messages, larger print, audiovisual aids, and caregiver involvement to enhance learning among the oldest adults.

The study further found that male elderly participants achieved slightly higher mean T2DM knowledge scores than female participants after the intervention. This suggests that male participants appeared to benefit marginally more from the DPEP than female participants.

Although this finding was not entirely unexpected, it should be interpreted cautiously because the difference was not statistically significant after controlling for baseline scores. The slightly higher knowledge observed among males may reflect greater educational attainment, increased exposure to health information through occupational and social networks, or greater confidence in participating during educational sessions. Conversely, many older women in the study area may have experienced lower educational opportunities earlier in life, which could have influenced health literacy. The finding supports Kaniz et al. (2017), who reported better diabetes knowledge among male participants. However, it contradicts the findings of Murugesan et al. (2007), who observed inadequate diabetes awareness among men. These inconsistencies may reflect differences in sociocultural settings, health promotion activities, gender roles, and educational backgrounds across study populations. The implication is that diabetes education interventions should adopt gender-sensitive communication strategies that ensure equal access to health information while addressing barriers that may limit women's participation and comprehension during health education programmes.



The study found that younger elderly participants demonstrated slightly more favourable attitudes toward T2DM prevention than participants aged 75 years and above following the intervention. Although the difference was relatively small, it indicates that younger elderly adults may be more receptive to preventive health education and behavioural change. This finding was expected because younger elderly individuals generally maintain greater physical independence, social interaction, and motivation to adopt healthy lifestyles than the oldest age group. Nevertheless, the statistical analysis revealed that age did not significantly moderate the effect of the DPEP on attitude, suggesting that the programme was equally effective in improving attitudes across both age groups. The finding is consistent with Debrah, Godfrey, and Ritah (2020), who reported that diabetes is highly prevalent among adults aged 61–65 years, emphasizing the importance of preventive education within this age group. It also agrees with studies indicating that structured health education can improve diabetes-related attitudes irrespective of age when educational content is appropriately designed. The implication is that diabetes prevention education should be integrated into routine healthcare services for all elderly adults while adapting instructional methods to accommodate the learning needs of older participants.

The findings also showed that male elderly participants had slightly higher mean attitude scores than female participants after exposure to the DPEP. This suggests that male participants exhibited a marginally more positive attitude toward diabetes prevention following the intervention. Although this finding may appear unexpected because women generally demonstrate greater health-seeking behaviour, the observed difference was not statistically significant after adjustment for baseline scores. The similarity in post-intervention attitudes indicates that the DPEP effectively improved attitudes among both genders. The finding disagrees with Kaniz et al. (2017), who reported that females demonstrated more favourable attitudes toward diabetes than males. However, it agrees with Mohammed, Hasan, and Merzah (2018), who found generally positive attitudes toward diabetes among adults, irrespective of gender. The observed differences across studies may be explained by variations in cultural beliefs, educational attainment, access to healthcare services, and methods used to assess attitudes. The implication is that well-designed diabetes education programmes can promote positive attitudes toward diabetes prevention among both male and female elderly populations without requiring substantially different educational content.

The study further established that age did not significantly moderate the effect of the DPEP on T2DM knowledge ($F = 0.041$, $p = .840$, partial $\eta^2 = .001$). This finding indicates that the effectiveness of the intervention was comparable across the different age groups. This finding was expected because the DPEP was specifically designed using simple language, interactive teaching methods, and culturally appropriate educational materials that were accessible to all participants irrespective of age. The negligible effect size further indicates that age contributed very little to differences in post-intervention knowledge. The finding corroborates Lamis et al. (2018), who also reported no significant age-related differences in diabetes knowledge. However, it differs from Daniel Asmelash et al. (2019), who found that older adults possessed significantly better diabetes knowledge. Differences in study design, educational exposure, participant characteristics, and healthcare systems may explain these inconsistencies. The implication is that age should not be considered a barrier to diabetes prevention education. Rather, educational programmes should be made accessible and understandable for all elderly individuals through appropriate teaching strategies.



Finally, the study found no significant interaction effect between gender and the DPEP on T2DM attitude scores ($F(1,75) = 0.017, p = .895, \text{partial } \eta^2 = .000$). This indicates that both male and female elderly participants benefited similarly from the intervention. This finding was expected because the DPEP provided participants with equal access to standardized educational content delivered using identical teaching methods. Consequently, both genders had similar opportunities to improve their attitudes toward diabetes prevention. The finding agrees with Herath et al. (2017) and Shima et al. (2016), both of whom reported no statistically significant association between gender and diabetes-related attitudes. However, it contrasts with Kaniz et al. (2017), who observed more favourable attitudes among female participants. The differences may be attributable to variations in cultural norms, educational attainment, gender roles, healthcare access, and sample characteristics across study settings. The implication is that gender does not appear to influence the effectiveness of diabetes prevention education among elderly populations. Therefore, future diabetes prevention programmes can be implemented effectively among both men and women while ensuring equitable access to educational resources and opportunities for participation.

Conclusion

The findings indicate that the Diabetes Prevention Education Programme improved T2DM knowledge and produced modest improvements in attitudes among elderly retirees, with somewhat greater descriptive gains observed among participants aged 65–74 years and males. However, neither age nor gender greatly moderated the effect of the programme on the respective outcomes. Thus, the effectiveness of DPEP on T2DM prevention outcomes appeared to be broadly comparable across age and gender groups.

Recommendations

Based on the findings and conclusion of this study, the following recommendations were made;

1. The Enugu State Ministry of Health and Local Government Health Departments should incorporate the Diabetes Prevention Education Programme (DPEP) into routine community-based health promotion activities for older adults. Regular diabetes education sessions should be organized in primary healthcare centres, community halls, churches, and other community gathering points to improve diabetes knowledge and promote positive preventive behaviours among elderly populations.
2. Healthcare facilities providing geriatric services should integrate structured diabetes prevention education into routine health screening and follow-up visits for elderly patients. This will facilitate early identification of individuals at risk of Type 2 Diabetes Mellitus and encourage the adoption of healthy lifestyles before disease onset.

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