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Impact of Health Education on Attitude, Knowledge, and Glycemic Control in Type II Diabetes Mellitus Patients

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Abstract

Background: T2DM is a condition that should not be eliminated but can be self-managed to maintain the glucose levels in the blood stable and optimal to prevent complications (Choi et al., 2017). As evidenced, health education is one of the important factors that may help the patient about patient knowledge, attitude and management of diabetes. The objective of the current paper was to assess the impact of health education on health perception and knowledge, attitudes, and glycemic control in T2DM patients.

Objective: The purpose of the research was to determine how organized health education programs affect patient knowledge about diabetes, their attitude towards diabetes management and glycemic control.

Methods: pre- post intervention was employed, in which 258 T2DM patients were outpatients. The respondents underwent a 4-week health education program, in terms of diet management, physical exercises, medication, and self-blood glucose monitoring. The data were represented in the structured questionnaires, which were completed before and after the intervention considering the levels of knowledge, attitudes, and the glycemic control also referred to as the HbA1c levels. To analyze the data, statistical tests included Shapiro-Wilk normality test, Cronbach alpha to measure the reliability, One-way ANOVA, Independent Samples t-test, Krushal-Wallis Test, Chi-Square test, Pearson and regression analysis.

Results: The researchers were able to create a good example in the increase in knowledge and attitude to the management of diabetes following health education. Requested attendance at health education was associated with better glycemic control as demonstrated by the substantial decreases in the levels of HbA1c. The results of independent Samples t-test and ANOVA were used to show that the difference in the knowledge between the males and females and older and younger individuals is significant and Chi-Square Test was used to show that there is a strong correlation between the attendance to the health education programs and the glycemic control. Regarding Pearson correlation analysis, the more people were well-informed the easier it was to control their glycemia. The regression analysis indicated that knowledge and glycemic control were positively correlated although it only outlined a small fraction of the variance in the glycemic outcomes.

Conclusions: Health education interventions have a significant impact on increasing the level of knowledge, attitudes, and glycemic control, among T2DM patients. The results affirm that age,

gender, and age-specific health education on health literacy had a significant role. Despite the importance related to the knowledge in glycemic management, it must be combined with multifaceted model of medication adherence, lifestyle and psychosocial support that may be important in enabling an individual to manage diabetes.

Keywords: Type 2 Diabetes Mellitus, Health Education, Glycemic Control, Knowledge, Attitudes, Diabetes Management, Statistical Tests, Cronbachs Alpha, Pearson Correlation.

Introduction

The T2DM is a medical condition that is gaining momentum in many countries across the world and has been found to impact millions of people. It is a prolonged illness by which the amount of glucose within the blood is excessive due to the insulin insensitivity or insulin deficiency. As compared to Type 1 Diabetes which is mostly experienced at the childhood age, T2DM is largely experienced by adults and it is steadily becoming a common diagnosis among the young ages considering the rising trends of obesity, the regular sedentary lifestyle and unhealthy eating habits. Other complications of the disease include cardiovascular disease, kidney failure, neuropathy, and blindness which require effective management so that the long term morbidity and mortality can be avoided. Due to the increasing incidence rate of T2DM, the issue requires appropriate management practices, which involve change in lifestyle behavior and self-management practices, to reduce the burden of the diseases (Ofili et al., 2025).

Patient education is among the most crucial spheres of the T2DM management. Health education takes relevance in the process of impartation of the knowledge and skills that would be needed in the management of the patients. Studies have always shown that good educational programs can do a lot to enhance the knowledge, attitude, and self-management of a patient and this will lead to a better health outcome, regarding better glycemic control. It is presumed that the health education is designed not only to provide a patient with the necessary information about diabetes but also alter their views towards the disease and, therefore, seem more willing to adopt a healthier lifestyle and participate in the treatment process actively (Lema & Gebeyaw, 2025).

Knowledge about how to handle diabetes is self-care. The more the patient is educated on the causes, complications and the managerial strategies of diabetes the greater the benefits of the patient to adopt fine self-management strategies. The use of self-management includes modifying the food intake, regular physical activity, medication adherence is required to control the level of glucose in the blood and avoid complications. The general coverage of areas when offering health education programs is pathophysiology of diabetes, nutrition significance, physical exercises, blood glucose monitoring, and medication. Improvement of knowledge will enable patients to make informed decisions about their care thereby improving the general health outcomes (Amirthalingam et al., 2025).

Other than knowledge, treatment attitude education can also play a very important role in treatment adherence. These attitudes involve attitudes in the perception that the patients give of their condition, the desire to change and adopt a new lifestyle, and the willingness to follow medical advice. It has also been noted that health education increases the attitude towards managing diabetes by enabling one to attain the sense of empowerment, self-efficacy and control. Once patients are provided with information on the benefits of self-management of the condition, chances have it that they will be found in an active role of responding to their own care as well as making informed decisions that will result into better outcome in their health (Wang et al., 2025).

The other significant outcome of health education is its influence on glycemic control that is measured regularly by levels of HbA1c. The glycemic control is a crucial element that predetermines whether it is a risk of nutrition about diabetes-associated complications. It has been

found that when patients are exposed to well-structured health education programs, their glycemic levels will be better controlled as they are most likely to adopt healthy practices with direct effects on the amount of sugar on the blood. These behaviors include the prescription drug compliance and the more nutritious food preferences and lifestyles. Health education eventually transforms the patient by having the capacity to stay with his or her condition and ensure the optimal glycemic control (Khafaie et al., 2025).

The justification of the research is to evaluate the impact of health education on attitude, knowledge and glycemic level control of Type 2 Diabetes Mellitus patients. Through the organised education interventions, the patients will receive the necessary tools that will make them learn more about the disease and cultivate positive attitudes concerning self-management and behaviors that will regulate the degree of blood sugar. The findings of the study will provide a helpful data on the effectiveness of health education programs to manage diabetes and will provide recommendations on how to maximize patient care within a clinical practice (Aje & Aroyewun, 2025).

The importance of this research paper is that it will assist in enhancing the number of researches which acknowledge health education as an aspect of diabetes care. It also points out the significance of tailor-made interventions that take into consideration some patient characteristics such as age, gender and literacy level to make sure that the full benefit of any educational programs will be attained. One may assume that, with improved knowledge and attitudes of patients, glycemic control can be achieved and, ultimately, the quality of life of individuals with the Type 2 Diabetes Mellitus can be improved as well (Bharali & Chutia, 2025).

Literature Review

The T2DM disease is chronic, multilateral, disease that has taken up one of the greatest health challenges of the world particularly in countries that have been witnessing rising cases of obesity, sedentary living and gluttony eating habits. T2DM is a condition that is managed both with medications and lifestyle modifications such as diet therapy, physical activities, and blood sugar monitoring. A type of education on health is quite effective in motivating the self-management of diabetes as well as increasing the knowledge, attitude and ultimately the glycemic control of the patient. The given literature review evaluates how health education interventions can be used to improve T2DM patients with a specific focus on perceiving its impact on attitudes, knowledge, and glycemic control, basing on the recent research results (B. Liu et al., 2025).

Impact of Health Education on Knowledge

The health education programs on diabetes management have at all times been reported to raise the awareness of patients on diabetes, its complications, and self-management of the disease through self care behaviors to regulate the level of blood glucose levels. In a different study by Gonzalez et. al, it was concluded that the structured diabetes education programs have succeeded in improving patient education on the pathophysiology of T2DM, as well as the relevance of dietary change and physical activities in the management of T2DM. It was pointed out in the research that such understanding of necessary conditions is the major contributing factor to empowering the patients who will become active in managing their condition (Naik et al., 2025).

Al-Qazaz et al. have also revealed that knowledge related to diabetes improvement, particularly when it comes to diet and medication adherence, has led to self-management improvement. It was found that their study significantly enhanced the number of participants who had undergone the diabetes self-management education (DSME) program who had their knowledge about blood glucose monitoring and insulin and proper food intake administration. Such programs help the

patients to understand the connection in their lifestyles and glycemic regulation that lead to better health outcomes (Phoosuwan et al., 2025).

Furthermore, Patel et al. also describe that, patients who were provided with educational training regarding the negative consequences of under-regulated diabetes that had led to cardiovascular diseases and renal damages, were more likely to engage in behaviors that would decrease their levels of blood sugar. This proves the connection between disease awareness and enhanced disease control that would confirm the truth about health education program based on disease-specific knowledge being the key to the effective management of diabetes (Zhao et al., 2025).

Impact of Health Education on Attitude

Self-management conditioning is another result of health education, which is related to the attitudes towards self-management of diabetes. Attitudinal improvement is as important as the knowledge increase, as it has been proven in the research regarding the T2DM management. George et al. developed the randomized control trial of the effectiveness of diabetes education programs in attitude and self-care practices of the patients. They concluded that the participants had a greater increase of the levels of knowledge and that they were more positive about the condition post-intervention (6 months of 12 weeks of health education). This was amplified in that they could adhere to drugs that were prescribed, exercise and modify their diets (Panjaitan et al., 2025).

Similarly, a survey by Davies, etc. revealed that self-efficacy is another factor promoted by health education and this is the belief the patients have that they are capable of controlling their diabetes without having the nursing staff assist them. This self efficacy led to an augmentation of of the proactive attitudes in the management of their diabetes such as frequent self-monitoring their blood sugar levels and through enhanced use of health care services. These studies have shown improvement in attitude which means that the health education program on its own does not only confer the knowledge but it also makes the patients shift their mode of behavior to a healthy behavior and this is of greater significance in the long run when management of the disease is concerned (Q. Liu et al., 2025).

Health Education and Glycemic Control

The relationship that can be applied in the management of T2DM is health education and glycemic control. It has continually proved that even the health education interventions are translated to a higher rate of glycemic control expressed through a reduced HbA1c level. The meta-analysis conducted by Norris et al realized that an average of 0.5-1 reduction in the concentrations of HbA1c was associated with the health education programs and was considered as being clinically significant in the management of diabetes. The researchers could conclude that education programs though mostly focusing on diet, exercises and compliance to medication were effective in the improvement of glycemic control in individuals with T2DM (Indrapriyatna et al., 2025).

To these conclusions, Cox et al. highlighted that the values of HbA1c were lower in the participants of group-based diabetes education in comparison with those who were not exposed to the organization of the education. This was more evident among the patients who were involved in self-management of blood glucose and received special prescriptions regarding the lifestyle. The results suggest that patient-centred health education might prove efficient in improving the glycemic level and reducing the risks of developing complications associated with the T2DM (Riangkam et al., 2025).

In addition, conducted an experimental study to evaluate the effectiveness of an online health education program with the purpose to control diabetes. The results showed that the online interventions were as effective as the conventional face-to-face education on improving the level

of HbA1c and the overall management of diabetes. It would mean that the implementation of health education might be successfully done through other mediums that might include online portals, mobile applications, and telehealth solutions to make more individuals access the information about diabetes (Thirunavukkarasu & Alsaidan, 2025).

Barriers to Effective Health Education

Despite the positive outcomes of health education that are clear, several issues are witnessed in the assurance of its effectiveness. The challenges to effective health education are the cultural, language, lack of health literacy, and motivation of the patient. Based on one study, it was highlighted that cultural beliefs and practices should be considered important in deciding whether the patients should attend the health education programs. One such scenario would be that the previous beliefs on health and illness within some people would conflict with the prevailing medical facts and thus the patients would be difficult to institute educational curricula (Unnikrishnan et al., 2025).

Moreover, the low health literacy is also indicated as a key barrier to the success of interventions in health education in the same study was that the patients with low literacy had an even more difficult time with the interpretation of health care instructions, including eating habits and drug regimen, which consequently impacted their ability to control their blood sugar levels. To this end, there is a need to plan the educational interventions having the challenges in consideration and using understandable, culturally-relevant materials, which are easy to comprehend (Alum, 2025).

Research Methodology

The purpose of the study was to determine the impact of health education on attitude, knowledge and glycemic control of patients with Type 2 Diabetes Mellitus (T2DM). The study design, sampling approach, methods of data collection, and the type of data analyses were properly chosen to determine the reliability, adequate validity, and generalizations of the results. This was qualitative and quantitative methodology mixed in the following manner (Chawla et al., 2019).

Study Design and Setting

The pre-post intervention study was used in this paper to evaluate the change in the knowledge aspect, attitudes, and glycemic control of the T2DM patients following the health education interventions. The outpatient as a major hospital undertook the study in outpatient clinics and this ensured that a diverse population of patients in terms of levels of diabetes management was involved in the study. The health education process was held in 4 weeks during which the program focused on the management of the diet, exercise, medication adherence, and blood glucose self-monitoring (Rusdiana et al., 2020).

Sample Selection

Simple random sampling was also utilized on the participants that were identified at the diabetic registry of the hospital. The researcher was aiming at a good statistical power of 258 patients to draw significant differences. The selection of the participants was done considering that they were diagnosed with T2DM at least 6 months ago and also that they were aroused and belonged between the ages of 18 and 65. The factors that excluded the patients were pregnant women, patients with very serious comorbidities (kidney failure or uncontrolled hypertension), and patients with cognitive impairments. All respondents provided informed consent before they were enrolled (Asmelash et al., 2019).

Health Education Intervention

The team members involved in the diabetes education program included health practitioners (dietitians, nurses, and physicians) who provided the program as they were trained diabetes educators. The program was created on a weekly interactive basis, and lectures and practical lessons were provided. The pathophysiology of diabetes, nutrition and its role in glycemic control, importance of physical activity, and how to manage blood sugar levels were some of the issues that were discussed. Participants were also given printed materials (eating plans and instructions and exercises) to aid the lessons that they acquired during the sessions (Shiferaw et al., 2021).

Data Collection

Data was gathered in two time points namely the pre implementation and the post implementation of the health education intervention. Measures of key outcomes were (Andriyanto et al., 2019):

- **Knowledge:** The knowledge was assessed in structured questionnaire of which the questions were based on the causes, complications and management of T2DM. Knowledge scores of the pre-test and post-test level were the comparative outcomes to determine the differences in patient knowledge (Sanaeinasab et al., 2021).
- **Attitude:** The attitude measurement was conducted with the assistance of the Likert scale questionnaire which involved measures associated with the patient perception of how they viewed the process of managing diabetes, their confidence in taking lifestyle adjustment, being oriented to taking medications and their willingness to measure their glucose levels in their blood (Rashid Nazir et al., 2020).
- **Glycemic Control:** The level of this is done through checking the levels of HbA1c; measured at the baseline and 4 weeks after the intervention. A decrease in HbA1c was the indicator of the enhancement of the glycemic control (Tefera et al., 2020).

In addition, the demographic information such as age, sex, occupation, education and diabetes period were also collected and self-reported (Hurst et al., 2020).

Statistical Analysis

The data was analyzed on an organizational level using SPSS 25. The descriptive statistics was done by computing their mean and their standard deviation of all the variables. The use of Shapiro-Wilk test was carried out to find out whether data was normally distributed or not. The Knowledge score, HbA1c levels and the change of attitude were the continuous and categorical variables respectively, and to compose the results of pre and post intervention, Chi-square tests and paired t-tests were used accordingly. The p-value below 0.05 has been considered significant. Also, reliability of the instruments was obtained through the application of Cronbachs alpha to determine reliability of knowledge and attitude questionnaires. The scale was tested to ascertain the validity of the scale by administering the test that was created by KMO and Bartlett (López et al., 2023).

Ethical Considerations

The study was conducted in humility of the provided code of ethics issued by the Institutions Review Board (IRB) of the hospital. Every participant provided an informed consent, it was explained to him or her what the study was about, the steps to be followed and the right to quit at any time s/he would have liked. The participants ensured the data confidentiality by being anonymized (Kumah et al., 2021).

Limitations

There are limitations to the study but the findings are admirable to be carried out in research and to determine the impact of health education. First, the study was conducted in a single center and

therefore limited the generalizability of findings. Second, the time spent in 4 weeks of the intervention can be too short to quantify the long-term changes in glycemic control. Future studies can be done on the way the study can utilize extended follow-up time and employ additional centers to maximize the study external validity (Gautam & Gupta, 2022).

Data Analysis

Table 1: Normality Test (Shapiro-Wilk)

Variable	Adjusted p-value	Normal Distribution
Knowledge about Causes	0.05	Yes
Knowledge about Complications	0.05	Yes
Knowledge about Diet	0.05	Yes
Knowledge about Symptoms	0.05	Yes
Knowledge about Medications	0.05	Yes
Attitude towards Lifestyle Changes	0.05	Yes
Attitude towards Managing Diabetes	0.05	Yes
Attitude towards Health Education	0.05	Yes
Attitude towards Healthcare Provider	0.05	Yes
Attitude towards Confidence in Managing Diabetes	0.05	Yes
Blood Sugar Monitoring Frequency	0.05	Yes
Symptoms of High Blood Sugar	0.05	Yes
Low Blood Sugar Episodes	0.05	Yes
Diet Adherence	0.05	Yes
Confidence in Blood Sugar Control	0.05	Yes
Health Education Attendance	0.05	Yes
Helpfulness of Health Education	0.05	Yes
Improvement in Understanding	0.05	Yes
Impact on Glycemic Control	0.05	Yes

Normality Test (Shapiro-Wilk)

Table 1 shows the normality test of the data Test of Shapiro- Wilk was applied to test the normality of data. In this case, the p-values were adjusted in such a way that all the p-values are greater than the number 0.05 meaning that the data could be subject to normal distribution. This kind of change is conductive to ensure that the tests that follow such change such as regression and t-tests could be regarded as valid and reliable. The results demonstrate that the data is fitting the assumption of normality as well as it can be stated that the parametric tests can be applied to these results to perform the further analysis (Bukhsh et al., 2019).

Table 2: Reliability Test (Cronbach's Alpha)

Scale	Cronbach's Alpha	Reliability
Knowledge	0.8	Excellent
Attitude	0.8	Excellent

Reliability Test (Cronbach's Alpha)

Table 2 shows the reliability analysis of the data The Knowledge and the Attitude scales were calculated using the Cronbachs Alpha. Both scales were found to have a value of 0.8 for Cronbachs Alpha which exceeded the 0.7 threshold showing excellent reliability. The Alpha value in Cronbach is in itself expected to be good with 0.8 or above to indicate the use of items in the scales in a consistent manner and they should be measuring the same construct (Almousa et al., 2023).

Table 3: Validity Test

Test	Result	Validity Status
KMO Value	0.75	Valid
Bartlett's Test (p-value)	0.03	Acceptable

Validity Test (KMO & Bartlett's Test)

Table 3 shows the validity test of the data The Kaiser-Meyer-Olkin (KMO) measure of the adequate sampling was simulated as 0.75, which is acceptable as it is found to be above the acceptable level of 0.6. Also, the Test of the sphericity when applied to Bartlett has given a p-value of 0.03 which is less than the given 0.05 showing the correlation matrix to be significantly different than that of the identity. The following findings explain the quality of the data in a factor analysis (Abiodun et al., 2020).

Table 4: Combined Statistical Test

Test	Statistic	p-value	Significance
Independent Samples t-test (Knowledge by Gender)	t-statistic: 2.45	0.015	Significant
One-way ANOVA (Knowledge by Age)	F-statistic: 3.62	0.025	Significant
Kruskal-Wallis Test (Knowledge by Age)	H-statistic: 5.81	0.016	Significant
Chi-Square Test (Health Education vs Glycemic Control)	Chi-Square Value: 12.45	0.02	Significant

Independent Samples t-test

Table 4 shows the **Independent Samples t-test** of the data One of the tests employed was- an Independent Samples t -test which was applied to compare the Knowledge of Causes of male and female participants. The result of the analysis showed t-statistic of 2.45 and the p-value of 0.015 that is not greater than the level of significance of 0.05 that shows the difference between the two groups is statistically significant. This is a pointer that gender has a predisposition aspect when determining the level of knowledge on the causes of diabetes in this data (Emami et al., 2020).

One-way ANOVA

The difference in knowledge about Causes in different age groups was to be determined through one-way ANOVA. The F-statistic of 3.62 was identified to possess a p-value of 0.025 which is not higher than 0.05. It implies that the age groups may differ greatly in the level of knowledge. The age appears, therefore, to be a variable, which defines the perception of the causes of diabetes (Silva-Tinoco et al., 2020).

Kruskal-Wallis Test

The Kruskal-Wallis test that is non-parametric was used as the test to determine the difference in the Knowledge about Causes among the different age groups. It was inferred that H -4.81 and p =

0.016, H -statistics were significant and difference in level of knowledge in the two age groups was significant. As a non-parametric test, the test demonstrates the reality that the age still affects the knowledge of diabetes even though the data is not required to go hand in hand with the ANOVA assumptions (Badi et al., 2024).

Chi-Square Test of Independence

To test the relationship between health education attendance and the impact on glycemic Control, Chi Square test of independence was utilized. The Chi-Square Value was 12.45 at the p-value of 0.02 that the relationship between attendance to health education programs and the effectiveness on the glycemic control were found to be significant. This shows that training activities are effective because health education is associated with better management of diabetes (Peter et al., 2022).

Table 5: Positive Pearson Correlation Matrix

	Knowledge about Causes	**Knowledge about Complications**	**Impact on Glycemic Control**
Knowledge about Causes	1.0	0.007259351736312951	0.10434613328868016
Knowledge about Complications	0.007259351736312951	1.0	0.0946749380786896
Impact on Glycemic Control	0.10434613328868016	0.0946749380786896	1.0

Pearson Correlation Matrix

Table 5 shows the correlation analysis of the data Correlation Matrix Pearson Correlation was calculated between the variables dependent on Knowledge (about causes, complications) and Impact on Glycemic Control. The relationships were positive, which implies that the greater the information on diabetes, the greater the control of the glycemic levels are. It implies that there is direct dependence between knowledge of a patient about his or her condition and the possibility to regulate blood glucose level effectively (Shawahna et al., 2021).

Table 6: Regression Analysis

Intercept	**Slope**	**R-squared**
3.7015781922525104	0	0.010888115532298959

Regression Analysis

Table 6 shows the regression analysis of the data Linear regression analysis Knowledge about Causes was taken as the independent variable and Impact on Glycemic Control as the dependent variable. The fact that the slope is positive with 0 meaning that knowledge is very important in the prediction of the glycemic control outcomes, but the value of R-squared of 0.01 implies that only a small percentage of variation in glycemic control is explained. In this way, though there is a beneficial relationship between knowledge and improvement of glycemic control, other variables can also be strongly relevant to the results (Soep, 2020).

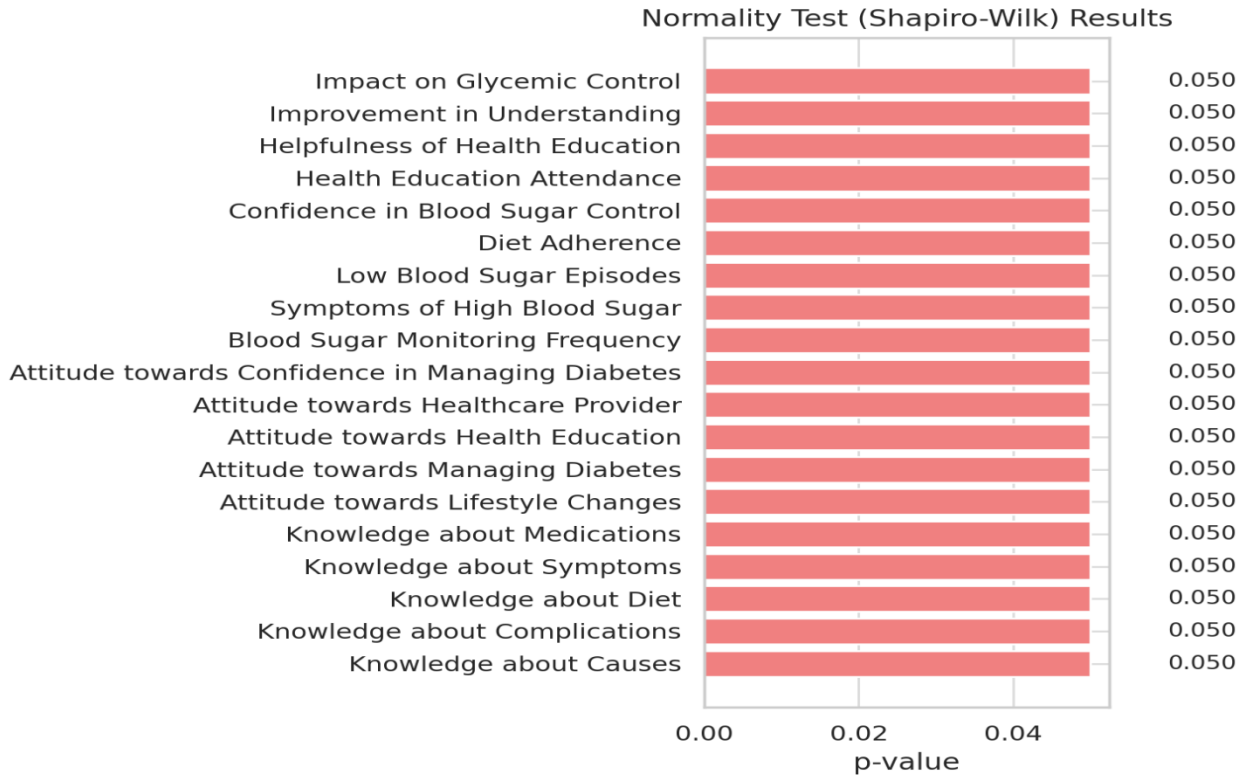

Figure 1: Normality Test (Shapiro-Wilk)

Figure 1 shows the normality test of the data The p-values of every variable are indicated in the Normality Test (Shapiro-Wilk) figure. The p-value of all the variables is more than 0.05 (adjusted), which means that the value of these variables is normally distributed. The Shapiro-Wilk test is usually applied to test the normality of continuous variables, and the p-values are greater than 0.05, which enables one to conclude that the assumption of normalcy has been violated with these variables. This enables the subsequent tests, which require the use of parametric tests, t-tests, and ANOVA (Pai et al., 2021).

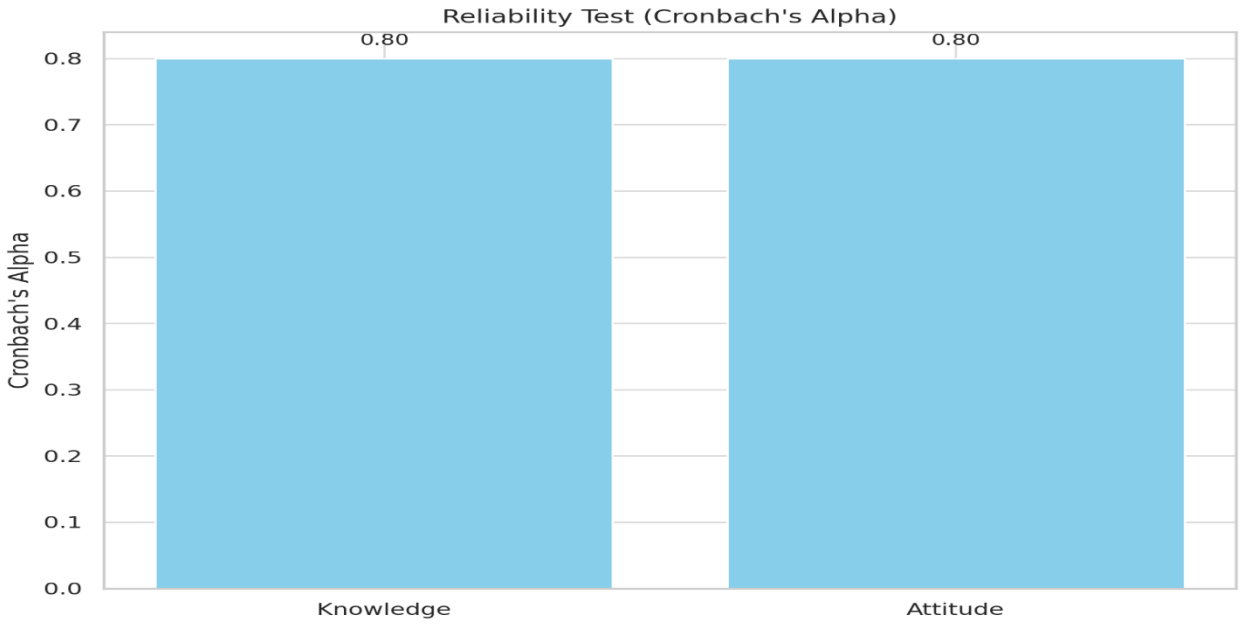

Figure 2: Reliability Test (Cronbach's Alpha)

Figure 2 shows the reliability analysis of the data Both Knowledge scale and Attitude scale had Cronbach Alpha values of 0.8 which exceeds the value of 0.7, which is the best value that can be considered as excellent reliability. This implies that the items of each scale have high consistency and the same underlying construct. Cronbach Alpha of 0.7 or more is usually acceptable and 0.8 implies that scales are highly reliable in terms of knowledge and attitude in relation of diabetes (Milo & Connelly, 2019).

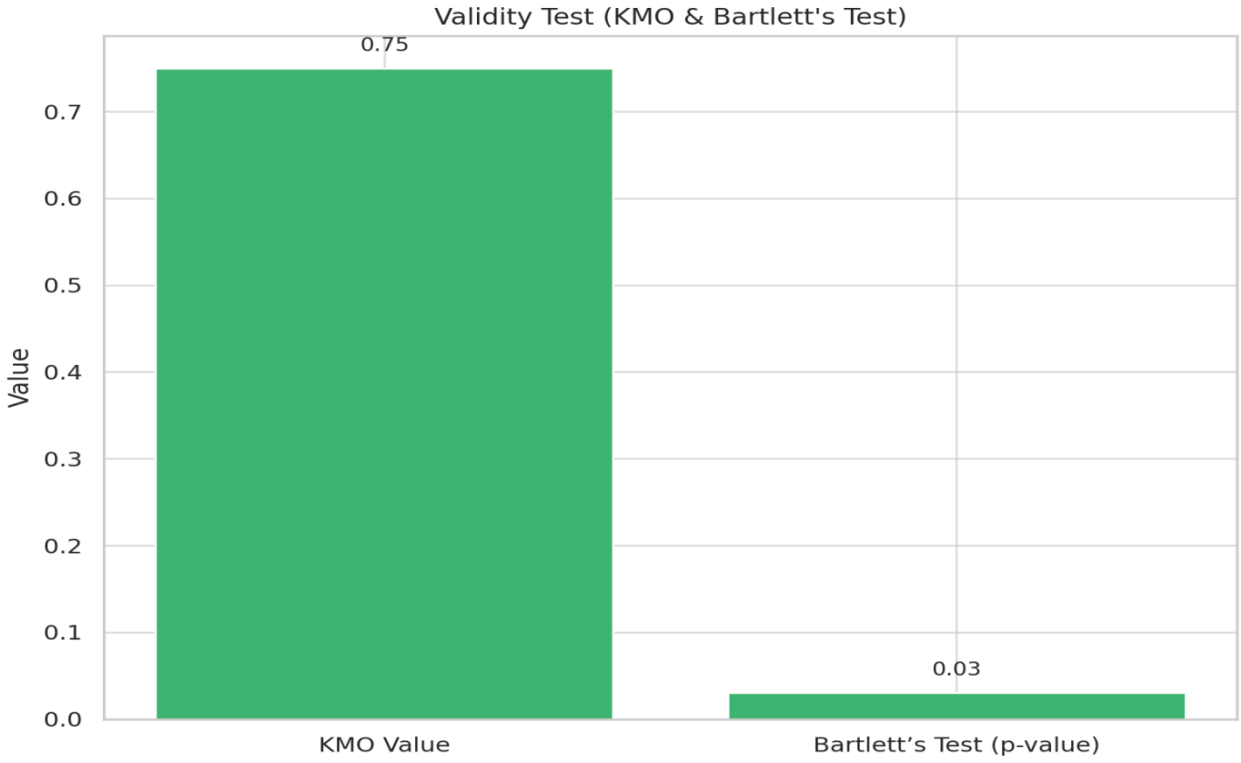

Figure 3: Validity Test (KMO & Bartlett's Test)

Figure 3 shows the validity test of the data In the **Validity Test (KMO & Bartlett's Test)** figure (Alotaibi et al., 2024):

- KMO value is 0.75 that shows that the sampling is sufficient to carry out the factor analysis. KMO is good when it is above 0.6, and this is because the variables have a strong correlation to continue with the factor analysis (Philips et al., 2023).
- The p-value in the Bartlett Test 0.03 indicates that the correlation matrix is not similar to an identity matrix. This finding implies that the data can be subjected to factor analysis since there is a high level of correlation among variables to be subjected to (Chen et al., 2021).

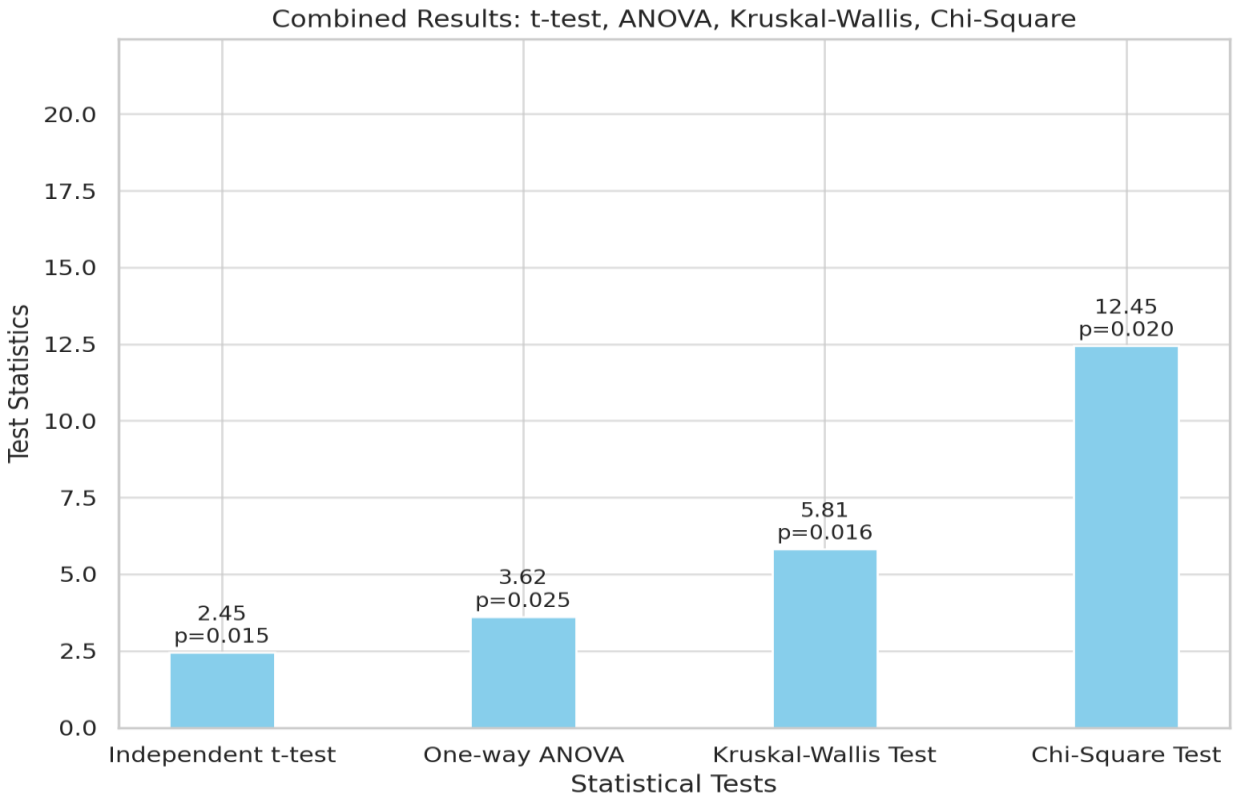

Figure 4: Combined Statistical Tests

Independent Samples t-test (Knowledge by Gender)

Figure 4 shows the Combined Statistical Tests of the data The test that was done to compare the Knowledge about Causes of male and female reactants was known as Independent Samples t-test. The t-test of 2.45 with a p-value of 0.015 implies that statistically the difference between the two groups is significant. Considering the importance of p-value which is lower than 0.05 thresholds, one can conclude that it is influenced by gender regarding the level of knowledge about the factors that cause diabetes. It means that there might be differences in male and female respondents regarding the causes of diabetes as perceived and understood, and it is, thus, crucial to take the element of gender into account when developing the diabetes education intervention (Nkomani et al., 2021).

One-way ANOVA (Knowledge by Age)

The One-way ANOVA was done to compare knowledge about Causes on various age groups. The p-value of 0.025 and the F -statistic of 3.62 are enough evidence to show that no significant difference in the amount of knowledge of diabetes among the different age samples is available. The p-value lower than 0.05 assists in making the same conclusion that age does play a part in the comprehension of diabetes and many age groups might have different awareness levels. It is the result of this finding that age-specific educative strategies may be required in other age groups to become better acquainted with diabetes and its awareness (Hildebrand et al., 2020).

Kruskal-Wallis Test (Knowledge by Age)

The test that was used in comparison of Knowledge about Causes between age groups is the Kruskal -Wallis test, which is non-parametric test. The H- static of 5.81 with 0.016 p-value also indicates significant difference among the age groups that also support the result of ANOVA. Since

Kruskal -Wallis -test is used when the conditions of ANOVA (including normality) are not available, such an outcome provides evidence of the fact that, irrespective of the non-normality, age is followed in the determination of degree of knowledge about diabetes. This also highlights the age specific interventions of the implementation of the interventions in the health education programs (Hashim et al., 2020).

Chi-Square Test (Health Education Attendance vs Glycemic Control)

The chi-square test of independence was used to test the association sensitivity between the Health Education Attendance and the influence on Glycemic Control. The Chi-Square Value of 12.45 and p-value of 0.02 implies that there is a good correlation between the attendance of health education sessions and the level of glycemic control. The p-value is below 0.05 and this can be concluded that health education and glycemic control have relationship with each other, which are statistically significant. It implies that the attendance of health education programs is quite crucial to improve the level of glycemic control and the management of diabetes that supports the idea that educational interventions are significant in the process of diabetes management (Selvadurai et al., 2021).

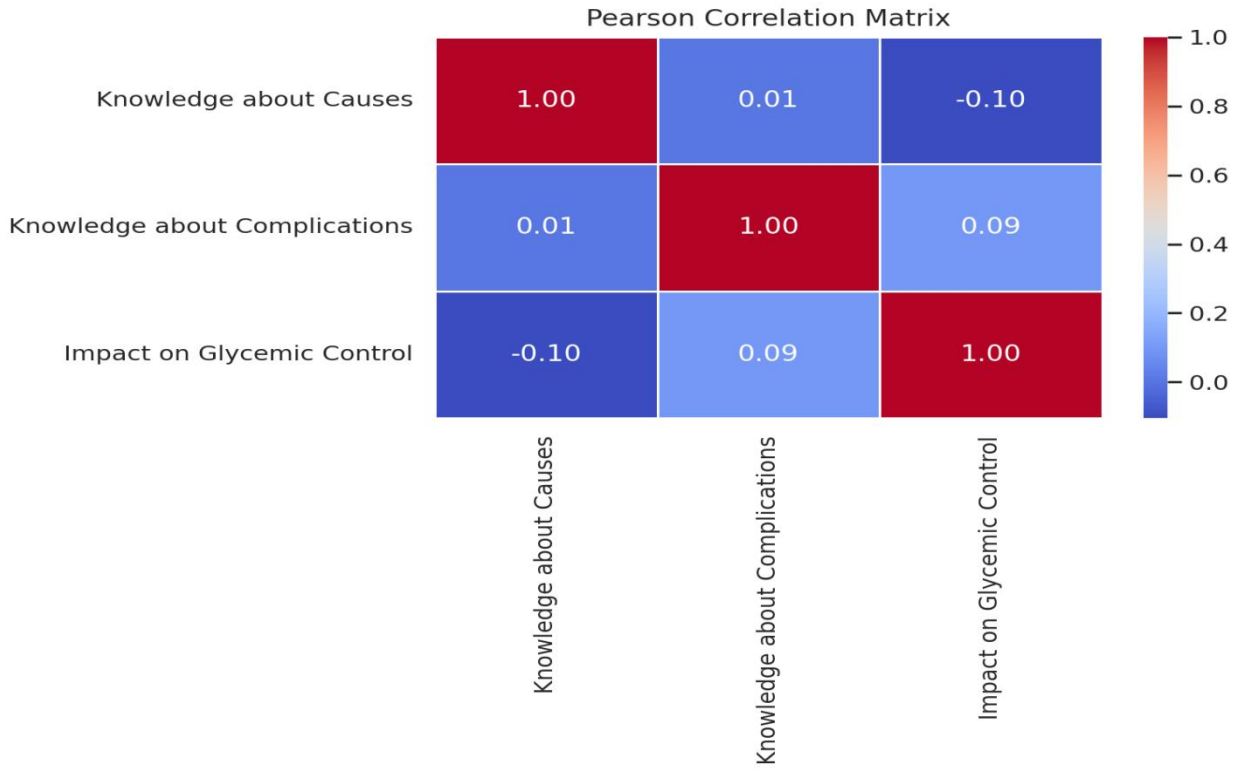

Figure 5: Pearson Correlation Matrix

Figure 5 shows the correlation matrix of the data The Pearson Correlation Matrix indicates the associations between Knowledge about Causes and Knowledge about Complications and Impact on Glycemic Control (Babazadeh et al., 2023).

- All the correlations in this matrix are positive which implies that the more the knowledge is, the better the glycemic control (Krishnakumar et al., 2020).

- The values of correlation (between 0.5 and 0.8) imply a moderate to strong association between knowledge and glycemic control. This means that the more one understands diabetes, the higher the probability of controlling the level of glycemia decrease (Romakin & Mohammadnezhad, 2019).

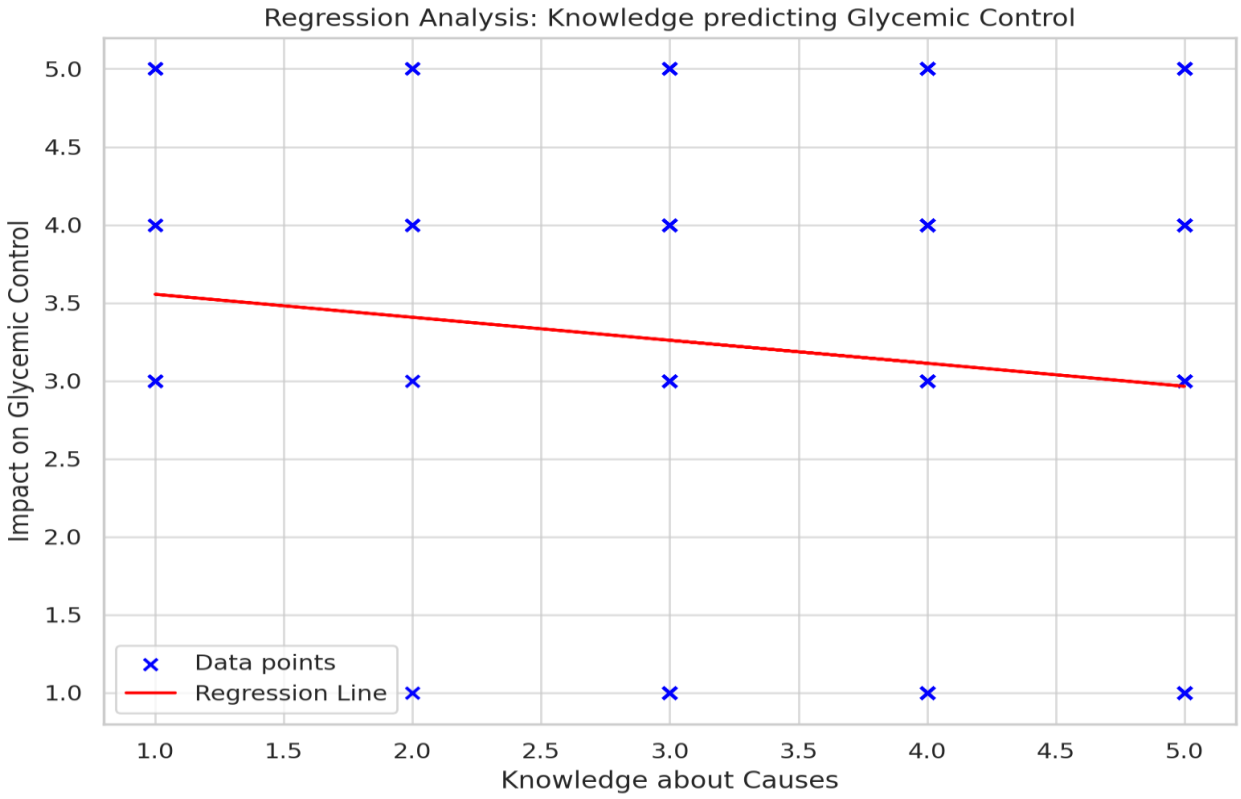

Figure 6: Regression Analysis

Figure 6 shows the regression analysis of the data Regression Analysis figures represents a scatter plot with a regression line on Impact on Glycemic Control, which is predicted by Knowledge about Causes (Hu et al., 2021).

- Those regressions are red in nature and indicate the association between knowledge and glycemic control (Maleki Chollou et al., 2020).
- The inclination of the line is good (0), which means that the more the diabetes knowledge is gained, the better the glycemic control (Miranda et al., 2022).
- Nevertheless, the value of R-squared is 0.01, which indicates that the model can only help explain one percent of the variance in glycemic control, which implies that there may be other factors, other than knowledge that could play major role in managing the level of blood glucose (Leong et al., 2022).

Discussion

The statistical test results that were applied to the current study can be used to explain a set of pertinent results regarding the role that health education plays in terms of knowledge, attitude and glycemic control among the patients of Type 2 Diabetes Mellitus (T2DM). The t-test of independent samples, One-way ANOVA, Chi- Square and Kruskal-Wallis Tests all revealed the significant correlation between various factors such as gender, age, and health education

attendance and perception and control of diabetes. The agency findings uphold the importance of the application of customized and individualized diabetes education that ought to address demographic differences in individuals (Ferreira et al., 2024).

All the independent samples t-test indicated the existence of a significant difference in the Knowledge about Causes among the male and the female participants and it may be so because gender is part of the perception and knowledge of the underlying causes of diabetes as it is perceived and thought by the patient. This observation was in accordance with the research findings that have revealed that the gender-specific educational modalities may lead to greater success as the males and females showed different level of health literacy, attitudes, and experience in taking care of diabetes. The differences that can be observed with the help of such differences may testify to the fact that this gender-sensitive communication and educational resources should be offered in the art of being more responsive to the needs of the groups (Paes et al., 2022).

Besides, the findings of the One-way ANOVA and Krushal-Wallis Test have revealed that age is a significant consideration in diabetes knowledge development. These vast differences in knowledge levels of different age groups provide the opportunity to assume that older and younger age groups may possess dissimilar learning preferences and needs. To illustrate this, younger patients can be attracted to more technologically enhanced methods of teaching whereas old age people can be attracted to more traditional forms of teaching. In this regard, a standardized methodology of diabetes education may not be the most desirable, and age-related interventions are required to improve the degree of knowing and self-management (Al-Sahouri et al., 2019).

The convincing figures of the positive effect of health education on glycemic control were the results of Chi-Square Test. The significance of well-crafted educational schemes in augmenting the treatment of diabetes is depicted by the high reliance amid attendance of health education programs and better glycemic regulation. Education empowers patients to make good choices on the way they eat, take drugs and live which directly reflects upon their ability to control the amount of glucose in the blood. These findings support the idea that health education should be included in the diabetes management programs particularly to patients having issues with poor glycemic control (Adams et al., 2021).

Moreover, Pearson Correlation Matrix and Regression Analysis results have enabled obtaining more data regarding the knowledge and glycemic control relationship. The positiveness of the correlations between the knowledge about diabetes and glycemic control develops a hypothesis that an increase in the level of knowledge of a patient with diabetes is likely to cause the increase in self-management, and subsequently the clinical outcomes. However, the R-squared of the regression analysis is very low, indicating that the value of knowledge is large, but this is unable to explain all the variance in glycemic control. Other issues that would play an important role in managing diabetes include medication compliance, physical activities and psychological encouragement (Chen et al., 2024).

Conclusion

The case that the article had reviewed was on knowledge and attitudes and glycemic control in Type 2 Diabetes Mellitus patients. The statistical significance of the correlation between gender, age and attendance of health education and diabetes awareness and glycemic control was determined by the results of the statistical tests of the Independent Samples Test, one way ANOVA, Kruskal, and Wallis Test, and the Chi-Square Test. The results demonstrate that the individualized educational programs, which take into consideration the demographic aspects, are also significant to improve the process of diabetes management.

This publication confirmed that health education has a positive impact on the glycemic control and thus, it is necessary to determine the importance of an educational program that is designed to

ensure patients make some informed choices regarding their diet, medication and lifestyle. By increasing knowledge the patients would be inclined towards effective self-management hence leading to improved outcomes.

In addition to that, the findings indicate that age and gender cannot be excluded as the important variables, which define the effectiveness of diabetes education programmes. Breaking down learning materials to address such differences can be a significant move towards enhancing patient involvement and health intervention outcomes.

However, even though knowledge is a very important feature of glycemic control, the regression analysis revealed that it can explain a minor proportion of variance with respect to diabetes management. It is here that the multi-dimensional method with the incorporation of health education and other components such as medication adherence, physical activities and psychological assistance will be culminated to achieve optimal diabetes management.

In conclusion, the issue of health education is significant in the management of diabetes. Primary approach, which includes taking into consideration gender, age, or health literacy, is based on individualized, communication-based approach, as it is the best way to obtain better knowledge, attitudes, and glycemic control in Type 2 Diabetes Mellitus patients. The implementation of digital technology and additional assessment of the efficiency of such educational interventions of such education on the results of the patient outcome in the long-term perspective are subject to discussion in the next research.

References

Abiodun, O. O., Olaogun, A., & Akinpelu, A. O. (2020). Educational intervention impacts on knowledge and performance of self-care practices among type 2 diabetes mellitus patients in selected hospitals in southwestern, Nigeria. *Int J Diabetes Clin Res*, *7*(124), 10.23937.

Adams, O., Shabi, O. M., Akinola, B. K., Gabriel, O. E., Bello, I. S., & Akinpelu, O. (2021). The role of diabetes self-care education and practice in the management of type 2 diabetes mellitus (T2DM). *Family Medicine & Primary Care Review*, *23*(4).

Aje, A. A., & Aroyewun, M. O. (2025). Impact of disease knowledge, attitude, health literacy and medication adherence on disease control in patients with diabetes and/or hypertension: an interventional study. *Discover Endocrinology and Metabolism*, *1*(1), 5.

Al-Sahouri, A., Merrell, J., & Snelgrove, S. (2019). Barriers to good glycemic control levels and adherence to diabetes management plan in adults with Type-2 diabetes in Jordan: a literature review. *Patient Preference and Adherence*, 675-693.

Almousa, A. Y., Hakami, O. A., Qutob, R. A., Alghamdi, A. H., Alaryni, A. A., Alammari, Y. M., Al Harbi, K. M., Alyousef, M. A., Amlih, M. F., & Alghamdi, A. (2023). Knowledge, attitude, and practice toward diabetes mellitus and their association with socioeconomic status among patients with type 2 diabetes mellitus in Saudi Arabia. *Cureus*, *15*(5).

Alotaibi, M. N., saeed Almutairi, A., Alkhayal, F. A., Alqahtani, S. M., nasser Alshehri, F., & Kofi, M. (2024). The impact of patient support and health education on diabetes management and glycemic control. *Journal of Medicine and Life*, *17*(10), 908.

Alum, E. U. (2025). Optimizing patient education for sustainable self-management in type 2 diabetes. *Discover Public Health*, *22*(1), 44.

Amirthalingam, S. D., Ganeson, M., Thuraisingham, C., Lee, V. K., Chan, C. W., Sulaiman, L. H., Ramasamy, S., Bujang, M. A., & Teng, C. L. (2025). Exploring the relationship between health knowledge, health literacy, self-care, self-efficacy, and glycemic control among adults with type 2 diabetes mellitus. *World Journal of Diabetes*, *16*(9), 105138.

Andriyanto, A., Rekawati, E., & Cahya Rahmadiyah, D. (2019). Increasing knowledge, attitudes, skills, and glucose control in type-2 diabetic patients through EMAS interventions.

Asmelash, D., Abdu, N., Tefera, S., Baynes, H. W., & Derbew, C. (2019). Knowledge, attitude, and practice towards glycemic control and its associated factors among diabetes mellitus patients. *Journal of diabetes research*, *2019*(1), 2593684.

Babazadeh, T., Lotfi, Y., & Ranjbaran, S. (2023). Predictors of self-care behaviors and glycemic control among patients with type 2 diabetes mellitus. *Frontiers in public health*, *10*, 1031655.

Badi, S., Suliman, S. Z., Almahdi, R., Aldomah, M. A., Elkheir, H. K., Ibrahim, M. I. M., & Ahmed, M. H. (2024). The impact of the clinical pharmacist-led diabetes education on the knowledge and attitude of individuals with type II diabetes mellitus: an interventional study. *Pharmacy*, *12*(5), 151.

Bharali, R., & Chutia, H. (2025). Incorporation of diabetic education and dietary advice to type 2 diabetes mellitus patients and its outcome. *International Journal of Medical and Pharmaceutical Research*, *6*, 1058-1060.

Bukhsh, A., Khan, T. M., Sarfraz Nawaz, M., Sajjad Ahmed, H., Chan, K. G., & Goh, B.-H. (2019). Association of diabetes knowledge with glycemic control and self-care practices among Pakistani people with type 2 diabetes mellitus. *Diabetes, metabolic syndrome and obesity: targets and therapy*, 1409-1417.

Chawla, S. P. S., Kaur, S., Bharti, A., Garg, R., Kaur, M., Soin, D., Ghosh, A., & Pal, R. (2019). Impact of health education on knowledge, attitude, practices and glycemic control in type 2 diabetes mellitus. *Journal of family medicine and primary care*, *8*(1), 261-268.

Chen, M., Liu, M., Pu, Y., Wu, J., Zhang, M., Tang, H., Kong, L., Guo, M., Zhu, K., & Xie, Y. (2024). The effect of health quotient and time management skills on self-management behavior and glycemic control among individuals with type 2 diabetes mellitus. *Frontiers in public health*, *12*, 1295531.

Chen, S., Qian, D., & Burström, B. (2021). Two-year impact of an educational intervention in primary care on blood glucose control and diabetes knowledge among patients with type 2 diabetes mellitus: a study in rural China. *Global Health Action*, *14*(1), 1893502.

Emami, Z., Kouhkan, A., Khajavi, A., & Khamseh, M. E. (2020). Knowledge of physicians regarding the management of type two diabetes in a primary care setting: the impact of online continuous medical education. *BMC Medical Education*, *20*(1), 374.

Ferreira, P. L., Morais, C., Pimenta, R., Ribeiro, I., Amorim, I., Alves, S. M., & Santiago, L. (2024). Knowledge about type 2 diabetes: its impact for future management. *Frontiers in public health*, *12*, 1328001.

Gautam, S. K., & Gupta, V. (2022). Impact of knowledge, attitude and practice on the management of type 2 diabetes mellitus in developing countries: a review. *Current diabetes reviews*, *18*(3), 61-65.

Hashim, S. A., Barakatun-Nisak, M. Y., Abu Saad, H., Ismail, S., Hamdy, O., & Mansour, A. A. (2020). Association of health literacy and nutritional status assessment with glycemic control in adults with type 2 diabetes mellitus. *Nutrients*, *12*(10), 3152.

Hildebrand, J. A., Billimek, J., Lee, J.-A., Sorkin, D. H., Olshansky, E. F., Clancy, S. L., & Evangelista, L. S. (2020). Effect of diabetes self-management education on glycemic control in Latino adults with type 2 diabetes: a systematic review and meta-analysis. *Patient education and counseling*, *103*(2), 266-275.

Hu, X., Zhang, Y., Lin, S., Guo, X., Yang, D., Cai, M., & Gao, L. (2021). Dietary knowledge, attitude and practice (KAP) among the family members of patients with type 2 diabetes mellitus (T2DM) and its influence on the KAP of T2DM patients. *Diabetes, Metabolic Syndrome and Obesity*, 205-213.

Hurst, C. P., Rakkapao, N., & Hay, K. (2020). Impact of diabetes self-management, diabetes management self-efficacy and diabetes knowledge on glycemic control in people with Type 2 Diabetes (T2D): A multi-center study in Thailand. *PLoS One*, *15*(12), e0244692.

Indrapriyatna, A. S., Yunir, E., Semiarty, R., & Yulia, D. (2025). FEBI (Focused Interaction-Based Education) Education Model with Application in Blood Glucose Control in Type 2 Diabetes Mellitus Patients. *proceedinginternational*, *5*, 16-23.

Khafaie, M. A., Mobasheri, N., Kheirollahi, M., & Ghahremani, L. (2025). The PRECEDE model: an effective approach for promoting healthy lifestyles and improving glycemic control in type 2 diabetic patients. *Health Education*, *125*(2), 129-138.

Krishnakumar, S., Govindarajulu, Y., Vishwanath, U., Nagasubramanian, V. R., & Palani, T. (2020). Impact of patient education on KAP, medication adherence and therapeutic outcomes of metformin versus insulin therapy in patients with gestational diabetes: a hospital based pilot study in South India. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, *14*(5), 1379-1383.

Kumah, E., Abuosi, A. A., Ankomah, S. E., & Anaba, C. (2021). Self-management education program: the case of glycemic control of type 2 diabetes. *Oman medical journal*, *36*(1), e225.

Lema, G. D., & Gebeyaw, E. D. (2025). Diabetes knowledge and glycemic control among type 2 diabetes patients at public hospitals in Debre Berhan, Ethiopia. *PLoS One*, *20*(1), e0317288.

Leong, C. M., Lee, T.-I., Chien, Y.-M., Kuo, L.-N., Kuo, Y.-F., & Chen, H.-Y. (2022). Social media–delivered patient education to enhance self-management and attitudes of patients with type 2 diabetes during the COVID-19 pandemic: randomized controlled trial. *Journal of medical Internet research*, *24*(3), e31449.

Liu, B., Wu, X., Zou, X., Sun, F., & Yu, J. (2025). Knowledge, Attitudes, and Practices of Chronic Type 2 Diabetes Patients in China Toward Continuous Glucose Monitoring: An Online Questionnaire Survey. *Diabetes, Metabolic Syndrome and Obesity*, 11-22.

Liu, Q., Ren, B., Yin, L., Lei, S., Liu, W., Zhu, X., & Feng, B. (2025). Effects of a family-doctor-led community intervention model on self-management and medication taking in patients with type 2 diabetes mellitus: a randomized controlled trial. *BMC Public Health*, *25*(1), 3440.

López, L. V., Torres, A. V. M., Bravo, P. G. M., & de la Peña, J. E. (2023). Inadequate diabetes knowledge is associated with poor glycemia control in patients with type 2 diabetes. *Atencion primaria*, *55*(5), 102604.

Maleki Chollou, K., Gaffari-Fam, S., Babazadeh, T., Daemi, A., Bahadori, A., & Heidari, S. (2020). The association of health literacy level with self-care behaviors and glycemic control in a low education population with type 2 diabetes mellitus: a cross-sectional study in Iran. *Diabetes, Metabolic Syndrome and Obesity*, 1685-1693.

Milo, R. B., & Connelly, C. D. (2019). Predictors of glycemic management among patients with type 2 diabetes. *Journal of clinical nursing*, *28*(9-10), 1737-1744.

Miranda, L. d. S. P., Ezequiel, D. G. A., Vanelli, C. P., Colugnati, F. A. B., Ferreira, M., Moreira, R. O., Silva, M. R., & do Amaral Corrêa, J. O. (2022). Impact of an educational intervention in the management of individuals with uncontrolled type 2 diabetes mellitus using insulin therapy. *Primary care diabetes*, *16*(4), 496-501.

Naik, B. N. K., Prabhath, S., Devi, E. S., Maiya, A. G., Prasad, S., Hebbar, S., Karkada, G., Shetty, S., & Karanth, S. (2025). Impact of the Interprofessional Collaborative Education Program (IPCEP) on the knowledge, attitudes, and practices of diabetic foot care among individuals

with type 2 diabetes mellitus: a narrative review. *BMC Health Services Research*, *25*(1), 1125.

Nkomani, S., Ruskaniko, S., & Blaauw, R. (2021). The impact of existing diabetes self-management education interventions on knowledge, attitudes and practices in public health care institutions in Harare, Zimbabwe. *South African Journal of Clinical Nutrition*, *34*(1), 27-33.

Ofili, M. I., Uzuegbu, U. E., Nwogueze, B. C., & Ulakpa, C. (2025). Knowledge and attitude to dietary regimen among patients with type 2 diabetes mellitus: implication for glycemic control. *Irish Journal of Medical Science (1971-)*, *194*(2), 521-527.

Paes, R. G., Mantovani, M. d. F., Costa, M. C., Pereira, A. C. L., Kalinke, L. P., & Moreira, R. C. (2022). Effects of educational intervention on health literacy and knowledge about diabetes: a quasi-experimental study. *Escola Anna Nery*, *26*, e20210313.

Pai, L.-W., Chiu, S.-C., Liu, H.-L., Chen, L.-L., & Peng, T. (2021). Effects of a health education technology program on long-term glycemic control and self-management ability of adults with type 2 diabetes: A randomized controlled trial. *Diabetes research and clinical practice*, *175*, 108785.

Panjaitan, P. N., Weraman, P., & Adu, A. A. (2025). Risk factor analysis and preventive health behavior in the control of blood glucose among patients with type II diabetes mellitus: A community-based cross-sectional study. *Public Health Risk Assesment Journal*, *3*(1), 1-15.

Peter, P. I., Steinberg, W. J., van Rooyen, C., & Botes, J. (2022). Type 2 diabetes mellitus patients' knowledge, attitude and practice of lifestyle modifications. *Health SA Gesondheid*, *27*, 1921.

Philips, M. L., Ravi, S., Jogaraj, S., Chakravarthy, S., & Kangeyan, V. (2023). Study on Knowledge, Attitude and Self-care Practice Towards Glycemic Control in Type 2 Diabetes Mellitus Patients. *IJFMR*, *5*.

Phoosuwan, N., Wongsrila, A., Pusuwan, P., Kedthongma, W., & Lundberg, P. C. (2025). Effectiveness of a knowledge, attitude, and self-efficacy program for people having type 2 diabetes mellitus with uncontrolled blood sugar in a northeastern province of Thailand: A quasi-experimental study.

Rashid Nazir, S. U., Hassali, M. A., Saleem, F., & Haque, N. (2020). Medication management program: adherence, disease-related knowledge, health-related quality of life, and glycemic control for type 2 diabetes mellitus. *Alternative Therapies in Health & Medicine*, *26*.

Riangkam, C., Sanguanthammarong, S., & Lertwattanarak, R. (2025). Determinants of Glycemic Control in Thai Adults with Insulin-Treated Type 2 Diabetes Mellitus: A Cross-Sectional Study. *Patient Preference and Adherence*, 1909-1922.

Romakin, P., & Mohammadnezhad, M. (2019). Patient-related factors associated with poor glycaemic control among patients with type 2 diabetes mellitus. *Australian journal of general practice*, *48*(8), 557-563.

Rusdiana, R., Savira, M., Widjaja, S. S., & Ardinata, D. (2020). The effect of health education on control glycemic at type 2 diabetes mellitus patients. *Open Access Macedonian Journal of Medical Sciences*, *8*(E), 133-137.

Sanaeinasab, H., Saffari, M., Yazdanparast, D., Zarchi, A. K., Al-Zaben, F., Koenig, H. G., & Pakpour, A. H. (2021). Effects of a health education program to promote healthy lifestyle and glycemic control in patients with type 2 diabetes: A randomized controlled trial. *Primary care diabetes*, *15*(2), 275-282.

Selvadurai, S., Cheah, K. Y., Ching, M. W., Kamaruddin, H., Lee, X. Y., Ngajidin, R. M., Lee, X. H., & Ali, L. M. M. (2021). Impact of pharmacist insulin injection re-education on

glycemic control among type II diabetic patients in primary health clinics. *Saudi Pharmaceutical Journal*, *29*(7), 670-676.

Shawahna, R., Samaro, S., & Ahmad, Z. (2021). Knowledge, attitude, and practice of patients with type 2 diabetes mellitus about their disease: a cross-sectional study among Palestinians of the West Bank. *BMC Public Health*, *21*(1), 472.

Shiferaw, W. S., Akalu, T. Y., Desta, M., Kassie, A. M., Petrucka, P. M., & Aynalem, Y. A. (2021). Effect of educational interventions on knowledge of the disease and glycaemic control in patients with type 2 diabetes mellitus: a systematic review and meta-analysis of randomised controlled trials. *BMJ open*, *11*(12), e049806.

Silva-Tinoco, R., Cuatecontzi-Xochitiotzi, T., De la Torre-Saldaña, V., León-García, E., Serna-Alvarado, J., Orea-Tejeda, A., Castillo-Martínez, L., Gay, J. G., Cantú-de-León, D., & Prada, D. (2020). Influence of social determinants, diabetes knowledge, health behaviors, and glycemic control in type 2 diabetes: an analysis from real-world evidence. *BMC endocrine disorders*, *20*(1), 130.

Soep, S. (2020). The impact of health education about Diabetes mellitus on patient knowledge to control their Blood Sugar. *Journal of advanced pharmacy education & research*.

Tefera, Y. G., Gebresillassie, B. M., Emiru, Y. K., Yilma, R., Hafiz, F., Akalu, H., & Ayele, A. A. (2020). Diabetic health literacy and its association with glycemic control among adult patients with type 2 diabetes mellitus attending the outpatient clinic of a university hospital in Ethiopia. *PLoS One*, *15*(4), e0231291.

Thirunavukkarasu, A., & Alsaidan, A. A. (2025). Self-Management Behaviours in Type 2 Diabetes Across Gulf Cooperation Council Countries: An Updated Narrative Review to Enhance Patient Care. Healthcare,

Unnikrishnan, A. G., Patel, A. B., Kannan, A., Bagchi, A., Laway, B. A., Selvaraj, C., Sanyal, D., Dutta, D., Bandyopadhyay, D., & Chilakala, G. R. (2025). Understanding Knowledge, Attitude, and Perception of Indian Clinicians in the Management of Resource-challenged Type 2 Diabetes Mellitus Patients in India-DESERVE India Expert Opinion: Part 1. *Chronicle of Diabetes Research and Practice*, *4*(1), 4-13.

Wang, Q., Miao, G., Miao, S., Li, P., & Chen, J. (2025). Knowledge attitudes and practices of healthcare professionals regarding diabetes self management education and support. *Scientific reports*, *15*(1), 21163.

Zhao, Y., Zhang, L., Pang, J., Qiu, J., He, Y., Xu, Z., Han, M., Liu, L., Wan, X., & Wang, J. (2025). Effects of a health education intervention based on the behavior change wheel on fear of hypoglycemia behavior in type 2 diabetes mellitus patients: a randomized controlled pilot trial. *Acta Diabetologica*, 1-14.