

Effect of Structured Educational Program on Diabetic Patients' Knowledge Attitude, and Practices Regarding Self-Administration of Insulin Injection

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Abstract

Background: Diabetes Mellitus is an endocrine disorder, characterized by hyperglycemia that is, high blood sugar levels. Insulin is one of the oldest valuable anti-diabetic medications available and also the most effective agent in dropping hyperglycemia when used in appropriate doses. Better insulin self-administration is associated with good knowledge and a positive attitude of a patient on insulin self-administration. So, **the present study aimed to** explore the effect of structured educational program on diabetic patients' knowledge attitude, and practices regarding self-administration of insulin injection.

Research design: To achieve the goal of this study, one group pretest post-test using a quasi-experimental research design was employed.

Setting: The study was conducted in the Diabetic Outpatient Clinic at Sohag University Hospital.

Sample: Within six months a convenient sample of one hundred diabetic patients who were on insulin therapy was included in the current study.

Tools: Four tools were used: Tool (I) Structured interview questionnaire included two parts as follows Part (1) Patients' demographic data and Part (2) Patients' medical history, Tool (II) (3) Patients' knowledge about self-administration of insulin injection, Tool (III) Patients' attitude regarding self-administration of insulin injection, and Tool (IV) Patients' practice about self-administration of insulin injection.

Results: The study indicated that there was a statistically significant improvement in patient's knowledge, attitude, and practices regarding self-administration of insulin injection among diabetic patients post- structured educational program than pre- structured educational program. A statistically significant correlation was observed between patients' knowledge, attitude, and practices post- post-structured educational program.

Conclusion: The findings of the study concluded that a **structured educational program** was effective in enhancing the patients' knowledge and improving their attitude regarding self-administration of insulin injections among diabetic patients. **Recommendations:** With the right instruction and an insulin injection demonstration, the gaps surrounding the self-administration of insulin injections should be filled. There should be widespread access to comprehensive insulin usage education programs that emphasize empowering insulin use among individuals with diabetes mellitus and related information as crucial components of diabetes mellitus management programs.

Key word: Diabetes mellitus, Patient' Knowledge, attitude, and practices, Self-administration of insulin injection.

Introduction

Diabetes is a chronic illness that is very common, progressive, and incapacitating. Over the past 20 years, there has been a sharp increase in the global prevalence of diabetes; the International Diabetes Federation estimates that 463 million people have diabetes globally. By 2030, this figure is predicted to rise to 578 million, and by 2045, it is predicted to reach 700 million. The Middle East and North Africa are expected to have 55 million

people with diabetes between the ages of 20 and 79 in 2019, according to data from the International Diabetes Federation. By 2024, that figure is expected to rise to 108 million, a 96% increase (**International Diabetes Federation, 2022**).

Diabetes has a serious negative impact on a patient's health and quality of life and can result in chronic organ failure. Cardiovascular disease is the leading cause of death, and it can reduce life expectancy by up to 15 years. In addition, it places a

heavy financial strain on communities, healthcare systems, and individuals. Prescription prices and the price of the medical services rendered are examples of direct costs. Reduced performance at work, higher unemployment as a result of long-term incapacity, and early mortality are examples of indirect costs (**Kamath et al., 2020**).

An accumulation of metabolic disorders collectively known as diabetes mellitus is marked by elevated blood sugar levels brought on by deficiencies in either insulin production or action, or both. The condition is widespread in both industrialized and developing nations, making it a public health concern. Worldwide, it is acknowledged as a primary cause of early illness, mortality, and disability. According to estimates, the prevalence of it will increase from 171 million in 2000 to 366 million in 2030, with estimates for all age groups worldwide indicating that it will be 2.8% in 2000 and 4.4% in 2030. The sub-Saharan Africa (SSA) region has a diabetes prevalence of 2.1-6.7%, with an estimated 14.2 (9.5-29.4) million persons aged 20-79 having the disease (**Rhodes et al., 2020**).

When administered in the recommended dosages, insulin is the most effective agent for lowering hyperglycemia and is among the oldest and most important antidiabetic drugs available. Insulin administered subcutaneously continuously or in several doses is the treatment of choice for people with type 1 diabetes mellitus. Patients must follow doctor's orders and take insulin therapy to control the burden. One of the most often overlooked areas where mistakes might occur is the administration of insulin. For patients to make a significant contribution to their care, they must have a solid understanding of self-insulin administration and a positive attitude (**Motilal, 2019**).

Improved insulin self-administration is linked to a patient's positive attitude and level of understanding about the process. In terms of attitudes towards insulin self-administration, it was

discovered that 68.0% of Ethiopians, 50.3% of Turks, 98% of Ethiopians, and 60.1% of Egyptians had positive opinions. Understanding diabetes was a strong predictor of attitudes toward self-management. Several variables, such as age, sex, marital status, educational attainment, occupation, city of residence, length of illness, length of insulin use, and family history of diabetes mellitus, can affect an individual's knowledge and attitude towards insulin self-administration (**Endale A, Teni, 2020**).

Patients with type 2 diabetes may get insulin therapy alone, or, depending on the patient's current hemoglobin A1C (HbA1c) level, insulin therapy may be used in conjunction with other antidiabetic drugs. Insulin helps people reach their glycemic goals and lowers their HbA1c levels. Even yet, several things could interfere with a patient's acceptance of and adherence to insulin therapy: inadequate information, a hectic schedule, travel, missing meals, tension or worry, or humiliation (**Peyrot et al., 2019**). According to recent data, patients with type 1 or type 2 diabetes who use insulin skip their dose an average of 3.3 days per month for comparable reasons. Therefore, insulin therapy patients with type 2 diabetes need to be informed about the indications for this kind of treatment, adverse effects, and self-administration techniques. Diabetes is becoming more commonplace worldwide, carrying a heavier medical burden, exacerbating long-term problems, and making type 2 diabetic patients less likely to take their medication as prescribed (**American Association of Diabetes Educators, 2022**).

Patients' attitudes and level of knowledge about self-administering insulin may improve their quality of life and help them control their diabetes more effectively. However, in the management of type 1 diabetes mellitus, there is a knowledge and attitude gap that prevents patients from taking their medications on their own to lower the morbidity and mortality linked to diabetes2 (**Netere et al., 2020**). Even though patients in Ethiopia are just as likely as patients elsewhere to experience treatment-related problems, there is a significant lack of research regarding their attitude and level of understanding regarding insulin self-administration (**Davies et al., 2018**). To close the knowledge gap and create chances for future research, the study's assessment of type 1 diabetes patients' knowledge, attitudes, and related factors about insulin self-administration was significant to close the gaps left by the study. The best care for patients with diabetes mellitus involves

teaching them self-management techniques, such as how to inject insulin and monitor their blood sugar levels at home. Furthermore, the right way to mix insulin and administer it with a syringe. There are various approaches to managing diabetes mellitus, including developing better medications, making dietary and activity changes, preventing obesity, and controlling blood pressure (UnitedHealth Group, Diabetes in the United Arab Emirates, 2020).

Significance of the study:

Diabetes is one of the main causes of death and disability in the globe, as is well known. The global health community is now seriously threatened by diabetes. To encourage behavioral changes and adherence to diabetes care, it is now essential to evaluate the knowledge, attitudes, and practices of patients with type 2 diabetes about insulin therapy. Numerous research on the prevalence of type 2 diabetes and the knowledge, attitudes, and habits of individuals with this illness have been carried out in Egypt. To the best of our knowledge, however, no research has evaluated practices, attitudes, or knowledge related to insulin therapy. Several international studies found that good knowledge of insulin self-administration was possessed by 52.5% of people in India, 50.3% in Turkey, 46% in Nepal, 98.7% in Ethiopia, and 33.3% in Egypt (Zhang et al., 2020).

According to the "Fear of Injecting and Self-Testing Questionnaire," glycemic control and emotional health may be jeopardized by an intense dread of self-injecting insulin, or injection phobia. Many obstacles to using insulin have been documented by Cramer & Pugh in their study, "The Influence of Insulin Use on Glycemic Control." These include anxiety about self-injections and hypoglycemia situations, the inconvenience of injections, scheduling of injections about meals, and other issues (American Diabetes Association, 2022). So, the researchers did this study to explore the effect of structured educational program on diabetic patients' knowledge attitude, and practices regarding self-administration of insulin injections.

Aim of the study:

To explore the effect of structured educational program on diabetic patients' knowledge attitude, and practices regarding self-administration of insulin injection **through:**

- To assess the knowledge of patients regarding self-administration of insulin injections.
- To assess the attitude of patients regarding self-administration of insulin injections.
- To assess the practices of patients regarding self-administration of insulin injection.
- To correlate the knowledge, attitude, and practices of Diabetic patients regarding self-administration of insulin injection.
- To associate the knowledge attitude, and practices with selected demographic variables.

Hypothesis

H1: There are significant improvements in diabetic patients' knowledge attitude, and practices regarding self-administration of insulin injection.

H2: There is a significant correlation between diabetic patients' knowledge attitude, and practices regarding self-administration of insulin injection.

H3: There is a significant association between levels of diabetic patients' knowledge with selected demographic variables.

H4: There is a significant association between the levels of attitudes of diabetic patients with selected demographic variables.

H5: There is a significant association between the practices of diabetic patients with selected demographic variables.

Subjects and Method:

Research design:

To achieve the goal of this study, one group pretest post-test using a quasi-experimental research design was employed.

Setting:

The study was conducted in the Diabetic Outpatient Clinic at Sohag University Hospital.

Sample:

Within six months a convenient sample of one hindered diabetic patients who were on insulin therapy was included in the current study.

Data collection tools:

Four tools were used:

Tool (I): Structured interview **questionnaire:** It was designed by the researchers after reviewing related literature and translated into the Arabic language it consisted of two parts as the following:

Part (1): Patients' demographic data: It included 3 questions such as age, sex, educational level, and occupation.

Part (2): Patients' medical history: It included items used to assess patients' medical history regarding self-administration of insulin injection, such as duration of illness, Type of insulin used, Duration of diabetes, Frequency of follow-up, and duration of insulin use.

Tool (II) Patients' knowledge about self-administration of insulin injection:

It was developed by the researcher after reviewing the recent literature to collect the required data. It consisted of 15 questions divided into two sections: the first section asked six questions concerning the patients' knowledge of diabetes mellitus, including definition, risk factors, causes, early symptoms, latent signs, and complications. The second section included five questions about the role in caring for patients with diabetes mellitus: Prevention of complications, nutrition, and prevention of infection. The follow-up, practicing exercise, measurement of diet balance, allowed and forbidden food, physical activity, High blood sugar is a symptom of diabetes mellitus, Know about insulin, Insulin vials are kept cool or in the refrigerator, Insulin injections are administered either right before or right after meals, The abdomen, thigh, glutei, and deltoid are the injection sites for insulin, The insulin administration angle is 45, One thumb's worth of rotation is required on the same location, Avoid reusing the same location, apply pressure to the skin, and do not move the needle once it is inserted are all strategies to lessen pain during insulin injections, Insulin resistance, low blood sugar, and subcutaneous tissue loss are the

side effects of insulin therapy, Rotating the injection site helps to prevent subcutaneous tissue atrophy and lessen pain, Insulin regulates HbA1c, preventing consequences from diabetes, Insulin functions superior to medications, The complications of insulin therapy include low blood sugar, insulin allergy, weight gain and wasting of subcutaneous tissue, Insulin is typically recommended as a last resort in medical care, Once you begin taking insulin, you must do so for the rest of your life. Insulin self-administration has the advantages of being time-efficient, affordable, and simple to take on oneself when traveling, Once you start taking insulin, your dosage needs to be increased, The insulin vial needs to be kept chilled or in the refrigerator, and the Insulin injection locations include the thigh, belly, glutes, and deltoid muscles (**American Association of Diabetes Educators, 2022; Kamath et al., 2020, Peyrot et al., 2019; Ebrahim et al., 2014**).

Scoring system of knowledge:

The total score for knowledge was 20 points; questions were either correct or incorrect, with one point awarded for correct answers and zero for incorrect answers and I don't know. Patients' knowledge was divided into three categories: poor knowledge (> 50% of total score), fair knowledge (50 % to 70% of total score), and good knowledge (greater than 70%) (**Abd-Elkodoos et al., 2018**).

Tool (III) Patients' attitude regarding self-administration of insulin injection:

It was developed by the researcher after reviewing the recent literature to collect the required data. It consisted of 15 questions such as Other health issues are brought on by insulin, Insulin self-administration lowers blood sugar levels and doesn't need much effort, Self-administration of insulin does not carry a social stigma, Self-administration of insulin is advantageous If I take insulin, I worry that people will find out that I have diabetes, Insulin injection is embarrassing, and I'm afraid someone will see me injecting, Insulin injections hurt, therefore I'm afraid that would affect my work, limit my activities, and make me regress, I'm concerned that I won't have enough time to inject insulin and that I'll have to conduct at-home blood sugar monitoring, Other health issues are brought on by insulin, Insulin self-administration lowers blood sugar levels and doesn't need much effort, Self-administration of insulin does not carry a social stigma, and The idea of injecting insulin is overwhelming (**American Association of Diabetes Educators, 2022; Ebrahim et al., 2014**).

Scoring system of attitude:

The overall number of items is (12) and they are measured at three points Likert scale ranging from 3, 2, and 1 for responses: agree, disagree, and don't know respectively, Score of items is summed up with the total score divided by the number of items giving the mean score for the attitude. The attitude was considered positive if the score of total attitudes >60% and negative if it was <60%.

Tool (IV) Patients' practice about self-administration of insulin injection:

It was developed by the researcher after reviewing the recent literature to collect the required data such as Can you inject yourself in a precise position?, Do you use a 45° needle to inject yourself?, Do you keep vials of insulin in the refrigerator or another cold place?, Do you re-inject in the same areas often? Do you administer insulin right before or right after a meal?, Do you inject insulin into your gluteus, deltoid, thigh, or abdomen? Verifies the brand and kind of insulin, confirms the insulin's expiration date, and modifies the dosage as necessary, Can you inject yourself in a precise position?, Hands are cleaned before an injection before injecting, remove any air bubbles from the insulin syringe., Single usage of the syringe and needle head, Used insulin needles should be disposed away at home in a designated receptacle, frequently rotates injection sites, consistently administers insulin injections at the scheduled intervals; monitor blood sugar levels at home, Hands are cleaned before injection (**American Association of Diabetes Educators, 2022; Ebrahim et al., 2014**).

Scoring system of reported practice:

The total score was 16 points, with one point for each statement. The checklist's answers were either done or not done, with one mark for done and zero for not done. Each component was added together and converted to a percentage.

Scoring system:

Scoring system for each of the practice items, a correct response was scored "one", and an incorrect "zero". For each area of the practices of patients were categorized

as poor practice (> 50% of total score), fair practice (50 % to 70% of total score), and good practice (greater than 70% of total score)

Validity of the tools:

Clarity, comprehensiveness, appropriateness, and relevancy of the tool content were evaluated. Five knowledgeable professors from Sohag University who have more than ten years of expertise in medical-surgical nursing reviewed and updated the tools' content validity to make sure the questionnaire was understandable and pertinent to the self-administration of insulin injections. In reaction to the panel's recommendation, nothing was altered. Upon analysis, the content validity index (CVI) yielded a value of 89%.

Reliability of the tools:

The reliability of the tools was tested using Cronbach's Alpha for the tool (II) was 0.876, tool (III) was 0.819, and tool (IV) was 0.817.

Fieldwork:

Data collection was carried out in three phases:

Preparatory phase:

As part of the data gathering process, create the study questionnaire. This entails looking through the literature that is available in the different sections of the review using journals, textbooks, publications, studies, and the internet. Permission to conduct the study was given to the health directors by Sohag University's Faculty of Nursing Dean.

Pilot study:

A pilot study including 100 patients, or 10% of the total sample, was carried out before the start of data collection. The purpose of this study was to evaluate the clarity of the instruments and estimate the completion time of the questionnaire by utilizing the pilot study's results; no modifications were made to the instruments. Included in the study was a pilot study.

Ethical consideration:

The patients were given the assurances that they would not be at risk during the trial, that they could refuse to participate at any time, and that they had the right to do so. Data collecting procedures

respected the study participants' privacy. The patients were also consulted by the researcher, who sought their consent to participate in the study and to explain its goals. They received guarantees that the data collected would remain confidential and private and that it would only be used for scientific study. Subjects could withdraw from the study at any moment.

Implementation phase:

Three days a week, from November 2023 to April 2024, data were gathered for the patients under investigation. Completing the questionnaire took thirty to thirty-five minutes. A verbal agreement was obtained from each patient before research enrollment, and the study's objectives were carefully considered. The researchers created an educational package based on the pre-test results for determining the patient's actual needs which focused on improving knowledge, attitude, and practice.

The subject contents have been sequenced through 6 sessions (4 sessions for the theoretical part and 2 sessions for the practical part). Four theoretical lectures were part of the structured educational program. **The first online lecture** covered an overview of diabetes mellitus including definition, risk factors, causes, early symptoms, latent signs, and complications. **The second and third lectures** focused on the role of caring for patients with diabetes mellitus: Prevention of complications, nutrition, and prevention of infection. The follow-up, practicing exercise was covered in **the fourth online lecture**. **The fifth online lecture** focused on the measurement of diet balance, allowed and forbidden food, and physical activity. **The sixth online lecture** focused on follow-up of blood sugar measurement at home and self-administration of insulin injections.

A simplified booklet was used as a supportive resource and delivered to the mothers in the Arabic language to cover all elements of the understanding and practice of self-administration of insulin injections. This structured educational program was delivered to the patients. To attract the studied patients, PowerPoint presentations,

brainstorming, questioning, and responses were employed as teaching methods during each lecture.

Evaluation phase:

After one month of completing the structured educational program, a post-test was administered. The patients were reassessed using the same pre-test tools.

Administrative Design:

An official letter requesting permission to conduct the study was directed from the dean of the faculty of nursing at Sohag University to the directors of the previously selected setting to obtain their approval to carry out this study.

Statistical Design:

The collected data were coded and entered into a social science statistical package (SPSS Version 23.00). At the coding and data entry stages, quality control was performed. For categorical variables, descriptive statistics were used in the form of frequencies and percentages, whereas for continuous quantitative variables, means and standard deviations were used. The Chi-square (X^2) test was used to compare qualitative category data, with the hypothesis that the row and column variables are independent, but without revealing the degree or direction of the link. The chi-square test, T-test, and F-test were used to compare qualitative variables. When the P-value was less than 0.05 and the difference was $p < 0.001$, statistical significance was evaluated.

Results:

From **Table 1**: it was noticed that of the 100 patients who were enrolled, (56%) were male. and the patients' mean age was 52.33 ± 12.55 years. Of the participants, 30% of them was a Secondary educational level, 22% were Government inquiry, (and 78% lived in urban areas.

Table 2: illustrates that (47%) of the studied patients were using long-acting, while a high percentage of patients had from more than 10 years with a mean of 8.97 ± 2.3 . The insulin therapy that patients had was 6.66 ± 1.7 for more than five years, while the median time that patients used insulin was 8.77 ± 2.19 .

Figure (1): Shows that the main source of knowledge among nearly two-thirds of the studied

patients regarding self-administration of insulin injection was doctors

Table (3) Demonstrates that statistically significant improvements in all knowledge items were observed pre and post-application of the structured educational program ($P < 0.05$).

Figure (2): Reveals that post structured educational program application, 100% of the studied patients had good total knowledge level, compared to no one having good total knowledge level scores during the pre-test phase.

Table 4 portrays that the patients' total attitude scores regarding self-administration of insulin injection have positively improved post the application of the structured educational program, with a highly significant difference ($p < 0.000$).

It's clear from **Table (5)** that there was a highly statistically significant difference ($p < 0.000$) and improvement in the studied patients' attitude mean scores regarding self-administration of insulin injection pre and post-structured educational program implementation.

Figure (3): Illustrates that (81%) of the studied patients had negative total attitude scores in the pre-test phase, while 94 % of them had total positive attitude scores post-structured educational program.

Table 6 reveals that the patients' total practice scores regarding self-administration of insulin injection have improved post the structured educational program application, with a highly significant difference ($p = < 0.000$).

Figure (4): Reveals that post structured educational program application, the majority (88%) of the studied patients had good total practice levels, compared to no one who had good total practice level scores during the pre-test phase.

The association between the studied patients' educational level and total knowledge, attitude, and practices across all phases of the instructional guidelines was statistically significant, as demonstrated by **Table (7)** at $p < 0.01$.

Table (8) demonstrated that, at $p < 0.001$, there was a statistically significant correlation between the scores for total practices, attitude, and knowledge, as well as between the scores for total knowledge and practice.

Table 1. Demographic data among the studied diabetic patients (n-100)

Variable	Frequency	(%)	
Sex	Male	56	56.0
	Female	44	44.0
Age (years)	Below 30	6	6.0
	30–55	70	70.0
	Above 55	24	24.0
(Mean±SD)	52.33 ±12.55		
Educational level	No formal education	15	15.0
	Can read and write	20	20.0
	Primary level	25	25.0
	Secondary level	30	30.0
	Higher education	20.0	6.0
Occupation	Housewife	6	4.0
	Farmer	4	8.0
	Government inquiry	22	22.0
	Employ	18	18.0
	Private business	12	12.0
Residence	Urban	78.0	78.0
	Rural	22.0	22.0

Table 2. Medical data among the studied diabetic patients (n=100)

Medical data	Items	(Mean±SD)
Duration of DM	10 years or less	6.55±2.3
	More than 10 years	8.97±2.3
Duration of insulin therapy	5 years or less	6.72±1.8
	More than 5 years	6.66±1.7
	Once every month	6.05±1.8
Frequency of follow-up	Once every 3 months	6.77±1.4
	Once every 6 months	6.79±1.8
	Irregular	5.22±1.5
Type of insulin used	Short-acting	5.0
	Long-acting	47.0
	Both	42.0
Duration of insulin use		8.77±2.19

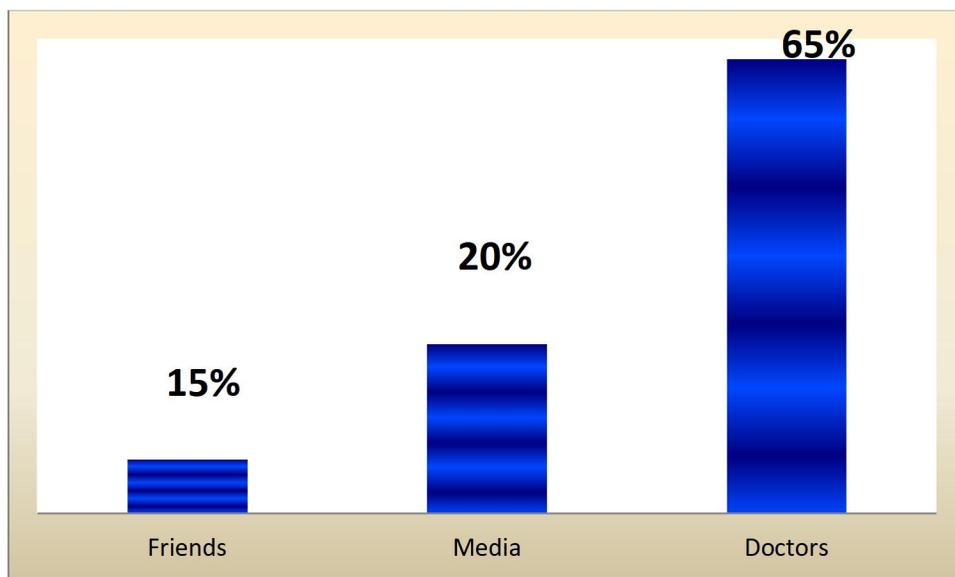


Figure (1): Source of knowledge among the studied patients regarding self-administration of insulin injection (n=100)

Table (3) Diabetic patients' satisfactory knowledge regarding self-administration of insulin injection pre and post-structured educational program application

Knowledge items	Pre-structured educational program	Post-structured educational program	P-value
Diabetes mellitus definition	29%	95%	<0.001*
Diabetes mellitus risk factor	35%	94%	<0.001*
Diabetes mellitus causes	22%	91%	<0.001*
Diabetes mellitus symptoms	24%	88%	<0.001*
Diabetes mellitus latent symptoms	32%	90%	<0.001*
Diabetes mellitus complications	28%	83%	<0.001*
Role in caring for patients with diabetes mellitus	27%	82%	<0.001*
Prevention of complications of diabetes mellitus	31%	86%	<0.001*
Adequate nutrition	25%	92%	<0.001*
High blood sugar is a symptom of diabetes mellitus.	23%	93%	<0.001*
Know about insulin	20%	80%	<0.001*
Insulin vials are kept cool or in the refrigerator.	38%	89%	<0.001*
Insulin injections are administered either right before or right after meals.	39%	97%	<0.001*
The abdomen, thigh, glutei, and deltoid are the injection sites for insulin.	34%	85%	<0.001*
The insulin administration angle is 450.	33%	84%	<0.001*
One thumb's worth of rotation is required in the same location.	37%	94%	<0.001*
Avoid reusing the same location, applying pressure to the skin, and not moving the needle once it is inserted are all strategies to lessen pain during insulin injections.	27%	95%	<0.001*
Insulin resistance, low blood sugar, and subcutaneous tissue loss are the side effects of insulin therapy.	36%	96%	<0.001*
Rotating the injection site helps to prevent subcutaneous tissue atrophy and lessen pain.	20%	97%	<0.001*
Insulin regulates HbA1c, preventing the consequences of diabetes.	19%	87%	<0.001*
Insulin functions are superior to medications.	34%	80%	<0.001*
The complications of insulin therapy include low blood sugar, insulin allergy, weight gain, and wasting of subcutaneous tissue	22%	96%	<0.001*
Insulin is typically recommended as a last resort in medical care.	25%	96%	<0.001*
Once you begin taking insulin, you must do so for the rest of your life.	30%	92%	<0.001*
Insulin self-administration has the advantages of being time-efficient, affordable, and simple to take on oneself when traveling.	28%	90%	<0.001*
Once you start taking insulin, your dosage needs to be increased.	27%	98%	<0.001*
The insulin vial needs to be kept chilled or in the refrigerator.	30%	80%	<0.001*
Insulin injection locations include the thigh, belly, glutes, and deltoid muscles.	35%	80%	<0.001*

** Highly Statistical significant ($P \leq 0.001$)

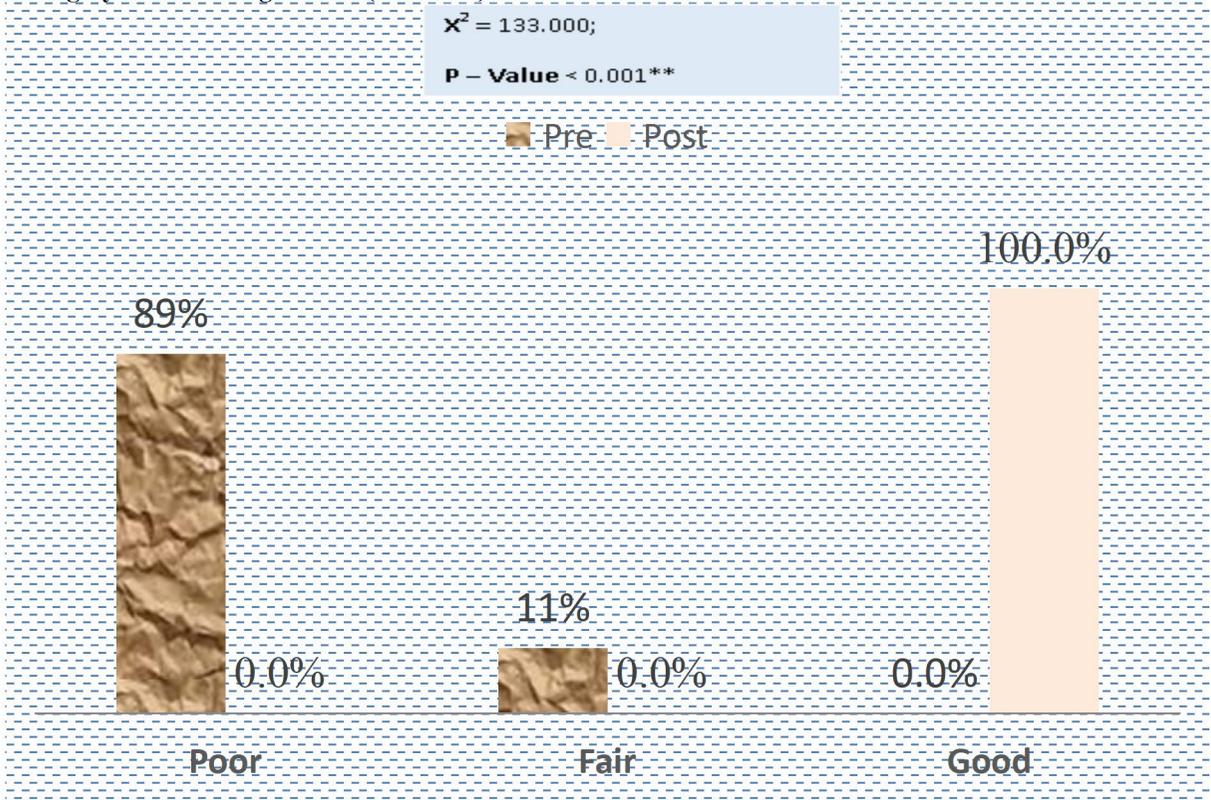


Figure (2): Total Knowledge Level among the Studied patients regarding self-administration of insulin injection pre and post-structured educational program application (n= 100).

Table 4. Diabetic patients' positive attitude regarding self-administration of insulin injection pre and post-structured educational program (n=100)

Attitude items	Pre-structured educational program	Post-structured educational program	P-value
Other health issues are brought on by insulin.	30%	96%	<0.001*
Insulin self-administration lowers blood sugar levels and doesn't need much effort.	40%	96%	<0.001*
Self-administration of insulin does not carry social stigma.	26%	92%	<0.001*
Self-administration of insulin is advantageous.	31%	90%	<0.001*
If I take insulin, I worry that people will find out that I have diabetes.	29%	98%	<0.001*
Insulin injection is embarrassing, and I'm afraid someone will see me injecting.	35%	80%	<0.001*
Insulin injections hurt, therefore I'm afraid that would affect my work, limit my activities, and make me regress.	33%	80%	<0.001*
I'm concerned that I won't have enough time to inject insulin and that I'll have to conduct at-home blood sugar monitoring.	32%	96%	<0.001*
Other health issues are brought on by insulin.	20%	96%	<0.001*
Insulin self-administration lowers blood sugar levels and doesn't need much effort.	26%	92%	<0.001*
Self-administration of insulin does not carry social stigma.	30%	90%	<0.001*
The idea of injecting insulin is overwhelming	38%	98%	<0.001*

** Highly Statistical significant ($P \leq 0.001$)

Table (5): Comparison mean scores of the studied patients' attitudes related to self-administration of insulin injection pre and post-structured educational program (n=100)

Items	Pre-structured educational program	Post-structured educational program	X ²	P-value
Positive $\geq 60\%$	14.68 \pm 0.49	30.04 \pm 1.64	18.67	<0.000
Negative less than 60%	26.68 \pm 1.49	7.04 \pm 1.64		

(*) Statistically significant at $p < 0.05$

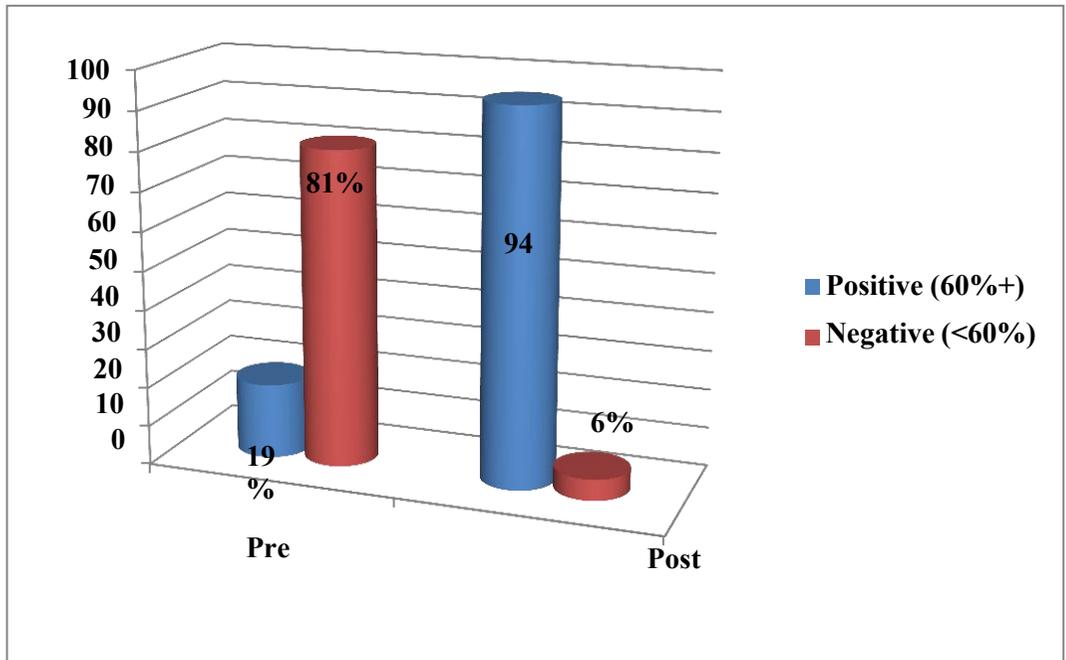


Figure (3): Total attitude scores of the studied patients through pre/post structured educational program phases (n=100).

Table 6. Diabetic Patients' good practice regarding self-administration of insulin injection pre and post-structured educational program in injection (n=100)

Patients' practice	Pre-structured educational program	Post-structured educational program	P-value
Can you inject yourself in a precise position?	30%	96%	<0.001*
Do you use a 45° needle to inject yourself?	40%	96%	<0.001*
Do you keep vials of insulin in the refrigerator or another cold place?	26%	92%	<0.001*
Do you re-inject in the same areas often?	30%	90%	<0.001*
Do you administer insulin right before or right after a meal?	48%	98%	<0.001*
Do you inject insulin into your gluteus, deltoid, thigh, or abdomen?	38%	80%	<0.001*
Verifies the brand and kind of insulin	34%	80%	<0.001*
confirms the insulin's expiration date and modifies the dosage as necessary	30%	96%	<0.001*
Can you inject yourself in a precise position?	40%	96%	<0.001*
Hands are cleaned before an injection	26%	92%	<0.001*
before injecting, remove any air bubbles from the insulin syringe.	30%	90%	<0.001*
A single usage of the syringe and needle head	48%	98%	<0.001*
Used insulin needles should be disposed away at home in a designated receptacle.	38%	80%	<0.001*
frequently rotates injection sites	34%	80%	<0.001*
consistently administers insulin injections at the scheduled intervals; monitors blood sugar levels at home	38%		<0.001*
Hands are cleaned before an injection	36%		<0.001*

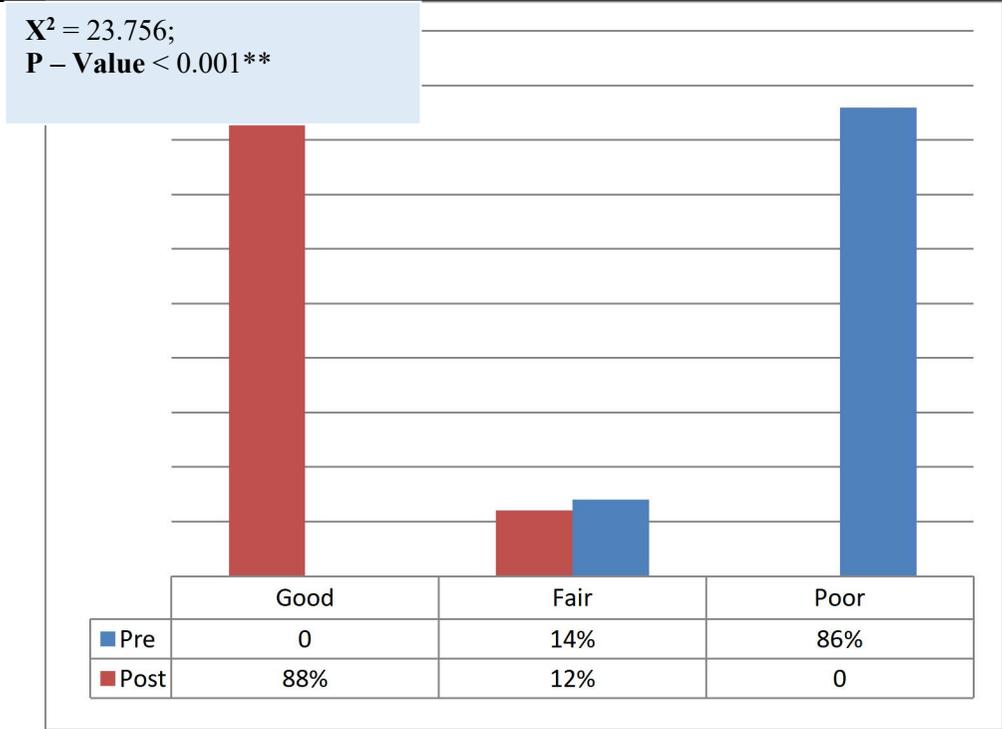


Figure (4): Total practice level of the studied patients regarding self-administration of insulin injection pre and post-structured educational program (n=100)

Table (7): Correlations between the studied patients' knowledge, attitude, and practices, toward self-administration of insulin injection and demographic data (n=100).

Scores	Spearman's rank correlation coefficient (r)		
	Knowledge	Attitude	Practices
Pre-intervention			
Age	-.136	.013	.069
Education	.138	.049	.198
Gender	-.104	-.105	-.165
Post-intervention			
Age	-.204	-.007	-.255*
Education	.306**	.006	.357**
Gender	-.139	.058	-.043
Overall			
Age	-.091	-.002	-.091
Education	.178*	.342**	.197*
Gender	-.072	-.026	-.0.85

(*) Statistically significant at $p < 0.05$ (**) statistically significant at $p < 0.01$

Table (8): Correlation matrix of total knowledge, attitude, and practice scores (n=100)

Items	Pre-test		Post-test	
	r	p	r	p
Knowledge VS practice	0.369**	<0.001*	0.305 **	<0.001*
Knowledge VS attitude	0.346*	0.005*	.703**	<0.001*
Practice VS attitude	.443**	<0.001*	608**	<0.001*

(*) Statistically significant at $p < 0.05$ (**) statistically significant at $p < 0.01$

Discussion:

Diabetes mellitus of both types 1 and 2 is frequently managed with insulin. Hypoglycemia and other insulin-related issues could arise from improper insulin self-administration practices and insufficient understanding, though (El-Kebbi et al., 2021). Thus, the purpose of this investigation was to explore the effect of structured educational program on diabetic patients' knowledge attitude, and practices regarding the self-administration of insulin injections.

The results of the current study revealed that more than half of the studied patients were male. and the patients' mean age was 52.33 ± 12.55 years. It may explained by old age and dependency on caregivers may be the cause of knowledge deficit.

The findings of the current study showed that the main source of knowledge among nearly two-thirds of the studied patients regarding self-administration of insulin injections was doctors. From the researchers' point of view, this confirmed that the studied patients seek health issues the right way. This result was matched with the studies conducted by Surendranath et al., (2022) found that participants' mean score indicated an overall knowledge of more than three-fifths, which is comparable to a study done in India that found the majority. The outcome, however, was lower than that of Bangalore, in India a study by Namita, (2020), and greater than that of Mekelle Referral Hospital, Ethiopia (Gerensea et al., 2019). The observed disparities may be ascribed to variations in the degree of literacy, availability of the best possible education, and medical professionals' demonstration of insulin self-administration.

On the other hand, the results of this study nearly exactly match those of a study carried out in India to evaluate diabetes patients and their carers' knowledge, attitudes, and practices around insulin administration. The study discovered that patients' HbA1c levels were inadequately controlled but did not find any significant association between HbA1c levels and scores for knowledge, attitude, and practices among type 2 diabetes patients receiving insulin therapy (Sunny et al., 2021).

according to the present study finding demonstrated that statistically significant improvements in all knowledge items were observed pre and post-application of the structured educational program. From the researchers' point of view, this confirmed the regent's need to apply a structured educational program and its positive effects on patients' knowledge post-application.

The findings of the present study revealed that in post-structured educational program applications, all of the studied patients had good total knowledge levels compared to no one having good total knowledge level scores during the pre-test phase. From the researchers' point of view, this demonstrated the beneficial impact of structured educational program application. Therefore, patients should receive the best available counseling regarding the potential outcomes of insulin therapy as well as instructions on how to administer insulin. Compared to a similar study conducted at Fellegehiwot Hospital in Ethiopia, where one-third of patients correctly answered that diabetes mellitus is defined as elevated blood sugar, more than half of the patients answered this properly (Tewabe et al., 2019).

The results of the present study illustrated that the patients' total attitude scores regarding self-administration of insulin injection have positively improved post the application of the structured educational program, with a highly significant

difference. It can be explained by when the structured educational program was applied for the studied patients, it was accompanied by knowledge improvement which was reflected in their attitude improvement also. This result is supported by **Yosef, (2019)** who found the same results. Research by **Das Choudhury et al. (2020)** and **Lafta et al. (2019)** indicated that patients undergoing insulin therapy for type 2 diabetes had a positive attitude and good knowledge. Participants in the study showed positive attitudes towards insulin therapy, which may be connected to spiritual, social, and cultural factors that affect how well patients accept and cope with chronic illnesses. Cultural norms around the sharing of personal narratives may contribute to a greater acceptance of insulin therapy and a more positive outlook on insulin in general, which may aid patients in comprehending and managing their illness this may have been due to the patients' consistent attendance at follow-up appointments and commitment to their educational program. The longer insulin therapy has been delivered, the greater the level of understanding, according to **Shetty et al. (2019)**, revealed that the people there had a good understanding of insulin therapy. This was explained by the long history of diabetes treatment in the nation, which allowed patients to gain knowledge from their interactions with other patients and from their own experiences.

The results of the current study revealed that there was a highly statistically significant difference and improvement in the studied patients' attitude mean scores regarding self-administration of insulin injection pre and post-structured educational program implementation. This concluded that structured educational program implementation can improve outcomes in diabetic patients. Compared to a study conducted in Bangalore, the majority in India, has an overall positive attitude towards insulin self-administration (**Namita, 2020**). However, the current result exceeded the previous finding in India, as shown in (**Surendranath et al., 2022**). This discrepancy could be attributed to

sociocultural factors, health literacy, and accessibility to information on insulin therapy-related health promotion. Patients had a good opinion that insulin self-administration is stigmatized. Suboptimal insulin utilization behavior may result from this, which will impact blood sugar regulation. Therefore, healthcare professionals should prioritize advocating for health education and raising public knowledge about the use of insulin. Furthermore, our study demonstrated a strong correlation between knowledge level and insulin administration practice. The results of our investigation are consistent with a study conducted in southern Taiwan by **Huang et al. (2021)**. Many variables, such as patient knowledge, educational attainment, disease duration, insulin dosage duration, and self-care routines, can be linked to appropriate management.

According to the patients' practice scores, The results of the current study revealed that the patients' total practice scores regarding self-administration of insulin injection have improved post the structured educational program application, with a highly significant difference. Also, in post structured educational program application, the majority of the studied patients had good total practice levels, compared to no one who had good total practice level scores during the pre-test phase. From the researchers' point of view, it confirmed the success of structured educational program application which is associated with improvement of all items of knowledge, and attitude, and reflected positively on their practices.

The current study results found that a statistically significant correlation between patients' educational level and total knowledge, attitude, and practices across all phases of the instructional guidelines was statistically significant. Patients who were younger, educated and employees had more knowledge. A study carried out in Ethiopia's Hawasa Referral Hospital revealed a similar conclusion (**Solomon & Getachew, 2019**).

The results of the current study suggest that a patient's level of education may influence their knowledge of insulin therapy; the more educated a patient is, the more knowledgeable they are about insulin. The aforementioned results are consistent with a cross-sectional study conducted in India to assess the knowledge, attitudes, and insulin delivery practices of diabetic patients and their caretakers

People with diabetes who are illiterate or just have an undergraduate degree are claimed to know much less about insulin therapy than individuals who hold doctoral or postgraduate degrees (Sunny et al., 2021). A plausible explanation for this result could be that patients with greater educational attainment may encounter fewer barriers in their pursuit of knowledge, given their convenient access to information through the Internet.

In a similar vein, patients who lived in urban areas, finished elementary school, and pursued higher education all knew and were more than that of their comparators. A study carried out at the Hawasa Referral Hospital revealed a similar conclusion (Solomon & Getachew, 2019). One possible explanation for this could be that patients with at least an elementary education stand a greater possibility of being exposed to various forms of communication, such as books, periodicals, and leaflets. Aside from their ability to understand what has already been said, individuals might also have a few obstacles when speaking with the medical staff (Shah et al., 2019).

A study that evaluated DM knowledge generally and was carried out in Nepal revealed the same results (Shrestha et al., 2019). Consistent with our findings, a survey carried out in the United Arab Emirates revealed a noteworthy correlation between educational level and knowledge level (Al-Maskari et al., 2021) During patient care, consultation, or health education sessions, it is imperative to promote the synchronization of insulin administration with mealtime.

The results of this study nearly exactly match those of a study carried out in India to evaluate diabetes patients and their carers' knowledge, attitudes, and practices around insulin administration. The study discovered that patients' HbA1c levels were inadequately controlled but did not find any significant association between HbA1c levels and scores for knowledge, attitude, and practices among type 2

diabetes patients receiving insulin therapy (Sunny et al., 2021).

The current study results found that there was a statistically significant correlation between the scores for total practice, attitude, and knowledge, as well as between the scores for total knowledge and practice. According to the researchers, it validated the effectiveness of using structured educational programs, which were linked to improvements in all areas knowledge and attitude and had a good impact on their practices. According to the study, patients with higher knowledge scores exhibited better practices in certain practice criteria. This suggests that educational programs are necessary to raise awareness of the practical understanding of insulin therapy.

Conclusion:

Based on the findings of the current study, the results of this study concluded that a structured educational program was effective in enhancing the patients' knowledge and improving their attitude regarding self-administration of insulin injections among diabetic patients. There was a statistically significant correlation between the scores for total practice, attitude, and knowledge, as well as between the scores for total knowledge and practice.

Recommendations:

The following suggestions are made in light of the findings of the current study:

- With the right instruction and an insulin injection demonstration, the gaps surrounding the self-administration of insulin injections should be filled.
- There should be widespread access to comprehensive insulin usage education programs that emphasize empowering insulin use among individuals with diabetes mellitus and related information as crucial components of diabetes mellitus management programs.
- For results that can be applied to other situations, it is advised to repeat the current study with a bigger probability sample.
- Patients should have access to a reference pamphlet with simplified illustrations explaining self-administration of insulin injections.

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