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Impact of Mentoring Programme for Insulin Taking Techniques for Geriatric Diabetic Patients in Terms of HbA1C

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ABSTRACT

Effective patient education gradually improves knowledge, attitude, and practices leading to better glycemic control and is widely accepted as an integral part of comprehensive diabetes care for affected individuals and their families in primary care settings. Effective patient counselling improves patient compliance towards medicines. The aim of our study is to evaluate the impact of patient education in improving therapeutic outcomes of insulin therapy in geriatric patients in terms of HbA1c. Effective counselling improves knowledge, attitude, and practices, particularly with regard to lifestyle modifications and dietary management, culminating into better glycaemic control that can slow down the progression of diabetes and prevent downstream complications. So targeted individualized training in insulin taking is associated with improved glucose control and greater patient satisfaction with therapy. This retrospective study was conducted in the department of General Medicine in Believers church medical college hospital. The study was conducted on 200 diabetic subjects on all types of insulin therapy comprising of 100 cases and 100 controls. Cases were given education and training on insulin taking technique along with their disease, drugs, dietary, and lifestyle at first follow-up, while controls received neither of these. Subjects were assessed by giving questionnaire and for glycemic control by measuring glycated haemoglobin (HbA1c) at the end of the study. In this study, patient counselling showed significant increase from the baseline compared to controls, accompanied by significant reduction in HbA1C of cases at the end of the study compared to the control.

INTRODUCTION

Diabetes mellitus is a metabolic disorder of multiple etiology, characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. Diabetes is an important public health problem, one of four priority non communicable diseases (NCDs) targeted for action by world leaders. Both the number of cases and the prevalence of diabetes has been steadily increasing over the past few decades,[1] The global diabetes prevalence in 2019 is estimated to be 9.3% (463 million people), rising to 10.2% (578 million) by 2030 and 10.9% (700 million) by 2045. The prevalence is higher in urban (10.8%) than rural (7.2%) areas, and in high-income (10.4%) than low income countries (4.0%). One in two (50.1%) people living with diabetes do not know that they have diabetes.[2]

Patients with type 1 diabetes (T1DM) require insulin therapy for their lifetime; and the majority of patients with type 2 diabetes (T2DM) will require insulin therapy over time, due to the progressive decline in β-cell function. Diabetes education, especially in terms of proper insulin injection techniques, takes a great deal of time and effort. Without it, however, the right type of insulin at the right dose might not necessarily give the right results. As a consequence, marked glycemic excursions could occur and optimal blood sugar control could prove to be elusive.[3]

Therapeutic patient education is a patient-centered approach, focused on patients' needs, resources, values and strategies. The ultimate goal is to enable and empower patients to participate actively in their treatment and prevent avoidable complications while maintaining or improving the quality of life.[4] According to Diabetes Control and Complications Trial study in 1993[5] which demonstrated that strict metabolic control along with a structured diabetes education program prevented a considerable percentage of chronic complications from diabetes. Therapeutic Education should set educational objectives for each of these stages, facilitated by the continuous evaluation of both the process and the results between the healthcare team and the patients and families. This assessment should be systematic and permanent, with the purpose of optimizing the goals of metabolic control and therefore the patient's quality of life.[6]

Incorrect administration of insulin can result in transient and serious hypo- and hyperglycemia, wide glycemic excursions, and diabetic ketoacidosis. When glycemic control

is poor, patients and providers commonly assume that this is because of poor behavioural adherence (e.g., insulin omission), dietary indiscretions, difficulties using carbohydrate counting or sedentary lifestyle.[7] However, in an analysis of insulin errors that resulted in emergency department visits for hypoglycemia, in addition to "intentional" errors, the authors identified other insulin errors, including "unintentionally took wrong insulin product," "meal-related misadventure," "pump-related misadventure," and "other misadventure".[8] Untreated heart disease increases the risk of heart attack.[9] Proper injection technique is important to improve glycemic control, decrease the risk of hypoglycemia, and reduce lipohypertrophy.[10]

METHODOLOGY

Study Design: A hospital based Prospective Study was conducted at Believers Church Medical College Hospital (BCMCH), Thiruvalla in General Medicine Department.

Study duration: 6 months from November 2019 to April 2020

Sample Size: The study was conducted on 200 diabetic subjects on all types of insulin therapy comprising of 100 cases and 100 controls. Cases were given education and training on insulin taking technique along with their disease, drugs, dietary, and lifestyle at first follow-up, while controls received neither of these. Subjects were assessed by giving questionnaire and for glycemic control by measuring glycated haemoglobin (HbA1c) at the end of the study.

The sample size has been calculated by the formula n= ((z2*p(1-p))/e2)/1+((z2*p(1- p))/Ne2)

Study criteria: The study was carried out by considering the following criteria:

Inclusion Criteria:

- Patients on all types of insulin therapy.
- Patients with uncontrolled diabetes even after routine education.
- Patients who are highly motivated or those with highly motivated caregivers will be given intervention. Those unwilling for education on injection technique will be the controls.

Exclusion Criteria:

- Patients on insulin therapy for less than 1 month will be excluded.

Sources of data: All relevant and necessary data will be collected from

o Patient case notes

Materials: The materials required for this study are:

o Data collection performa

o Predesigned questionnaires

o Informed consent form

Study Procedure and Study Variables:

- The data will be collected by visiting the general medicine department and enter it in the predesigned data collection performa, thereby analyzing the current knowledge regarding insulin taking techniques. After assessing the patient's knowledge, the next aim is to provide counselling on Insulin taking techniques, Diet, Exercise.

- The final step is to evaluate the impact of patient education by assessing HbA1c, FBS & RBS level. Informed consent will be obtained from all participants prior to their inclusion into study.

- Demographic profile: Name, Age, Gender, Weight, Date of prescription.

- All details regarding diagnosis, comorbidities.

- Details of Insulin therapy: Name, Dose, Type of insulin, Type of device

The study is expected to complete in about 6 months. The proforma however is subject to modification if required, after initial study. Personal data of entire individual patient will be kept confidential. Informed consent will be obtained from all participants prior to their inclusion into study. All the participants will be given a brief description regarding the study procedure and confidentiality of data prior to obtaining written consent.

Data Collection Tool: Predesigned data collection form which has been validated (Annexure-

1).

Data Analysis: The data collected were entered in Microsoft excel -2010 version and results were presented in tabular form and presented as frequency and percentages.

RESULTS

EDUCATED GROUP

TABLE No. 1: DISTRIBUTION OF DRUGS

Distribution of patients who are taken only insulin

Table 1: Distribution of Insulin usage patterns

SL. No	Type	Frequency	Percentage (%)
1	Intermediate acting	1	50
2	Long acting	1	50
	Total	2	100

Table 1 demonstrates that the Intermediate acting Insulin and Long acting were used by the subjects in equal percentage.

Table 2: Distribution of lab parameters

SL.NO	Lab Parameters	Stages	Range	Before Counselling	After Counselling
1	PPBS	Normal	Less than 140mg/dl	0	2
		Pre-diabetes	140-199 mg/dl	2	23
		Diabetes	>/=200 mg/dl	88	65
2	FBS	Normal	Less than 100 mg/dl	0	3
		Pre-diabetes	100-125 mg/dl	1	26
		Diabetes	>/=126 mg/dl	89	61
3	HbA1c	Normal	Less than 5.7%	0	1
		Pre-diabetes	5.7% - 6.5%	1	15
		Diabetes	>/= 6.5%	89	74

Table 2 demonstrates that In the case of PPBS, after counselling the percentage of subjects who had normal range is increased to 2% and those who had diabetics is reduced to 65% from 88%.In the case of FBS, after counselling the percentage of subject who had normal range is increased to 3% and those who had diabetics is reduced to 61% from 89%.In the case of HbA1c, after counselling the percentage of subject who had normal range is increased to 1% and percentage of subjects who had diabetics is reduced to 74% from 89%.

Table 3: Sites of Injection.

SLNo	Sites of injection	Before Counselling	After Counselling
1	Stomach	15	72
2	Hand	5	5
3	Feet	2	0
4	Stomach and Hand	19	3
5	Stomach, Hand and Feet	7	7
6	Stomach and Feet	32	2
7	Hand and Feet	10	1

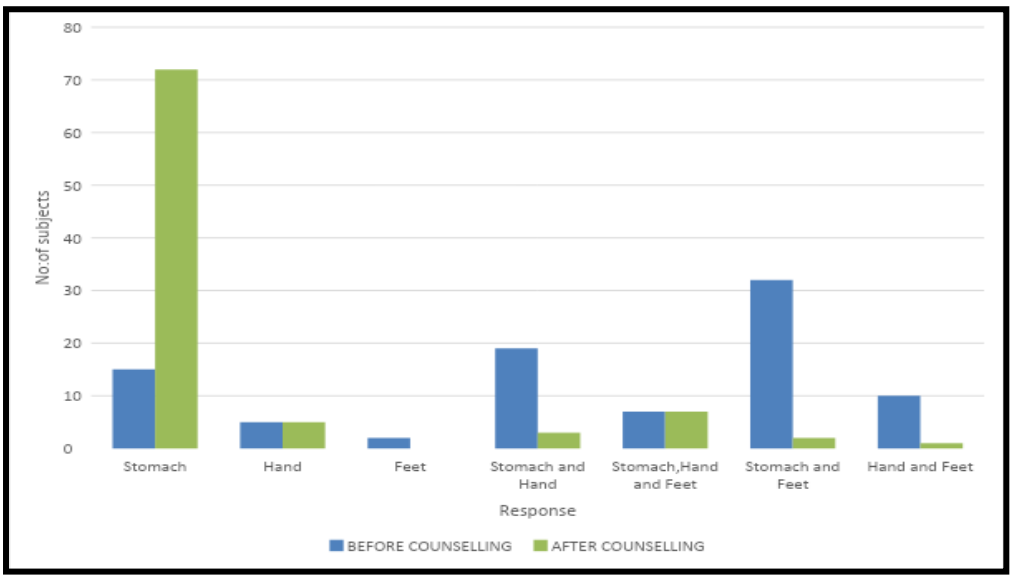

Figure No. 1: Sites of Injection

Fig 1 demonstrates that the stomach and feet were the most commonly used injection sites before counselling and the stomach was found to be the highest site after counselling.

TABLE NO. 4: WHEN DO YOU GIVE YOUR INJECTION?

SLNo	Response	Before Counselling	After Counselling
1	Morning	10	15
2	Afternoon	1	1
3	Night	4	3
4	Morning, Noon and Night	5	5
5	Morning and Night	70	66

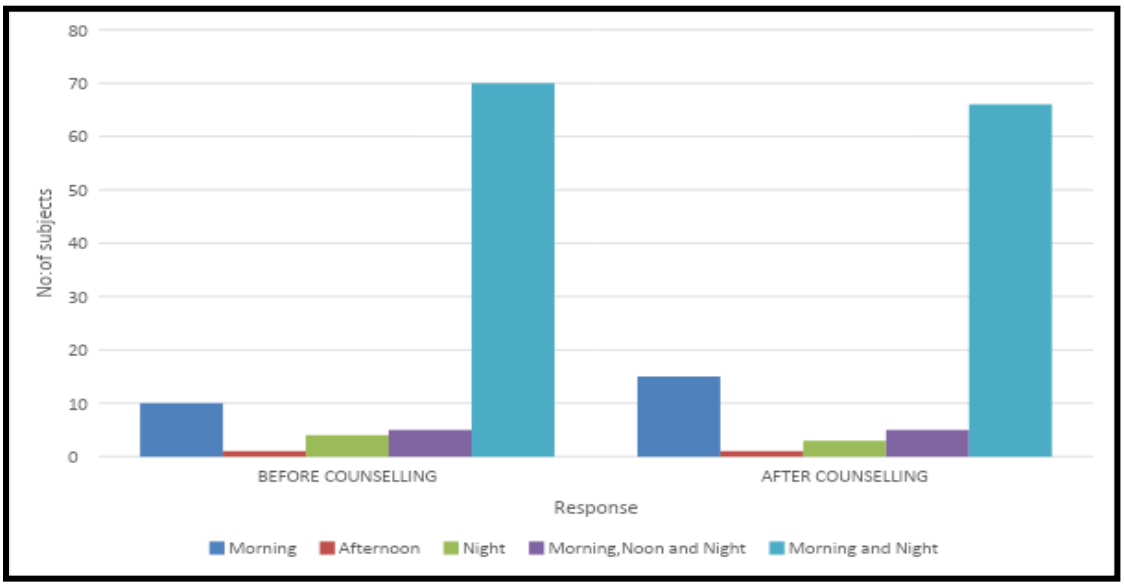

Figure No. 2: Time of injection

Fig 2 demonstrates that among 90 samples enrolled in the study, 66% of subjects were taking insulin both morning and night, and only 1% of subjects were taking in the afternoon.

TABLE NO. 5: HOW LONG DO YOU LEAVE THE NEEDLE IN THESKIN AFTER THE INJECTION?

SL.No	Response	Before Counselling	After Counselling
1	Nil	24	10
2	10 Seconds	38	35
3	20 Seconds	25	43
4	30 Seconds and above	3	2

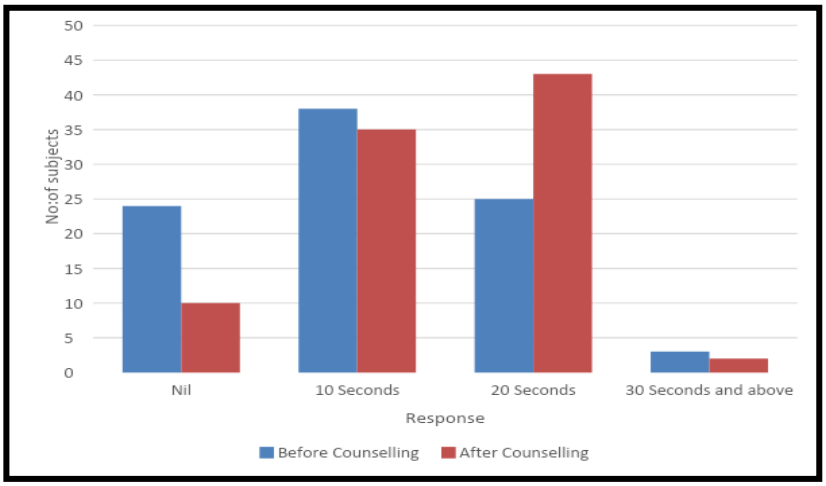

Figure No. 3: Duration of needle in the skin after injection.

Fig 3 shows that before counseling the number of patients who leave the needle correctly (20sec) in the skin was about 25 % and after counselling the number of patients who leave the needle in the skin were increased to 43%.

TABLE NO. 6: HOW OFTEN DO YOU USE THE SAMENEEDLE?

SLNo	Response	Before Counselling	After Counselling
1	Less than 1 week	24	45
2	1 week	28	39
3	2 week	31	3
4	3 week	16	3
5	1 month	1	0

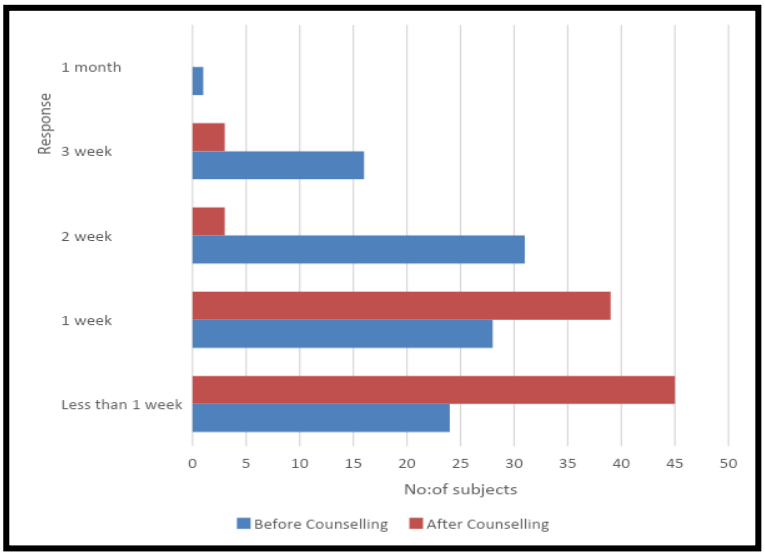

Figure No. 4: Repeated use of same needle

Fig 4 shows that before counseling out of 90 population only 24 % are changing needle correctly after injection but after counselling it has increased to 45%.

INSULIN TAKINGTECHNIQUES

TABLE NO. 7: STORAGE

SL.No	Storage	Before Counselling	After Counselling
1	Refrigerator	87	90
2	Outside	3	0

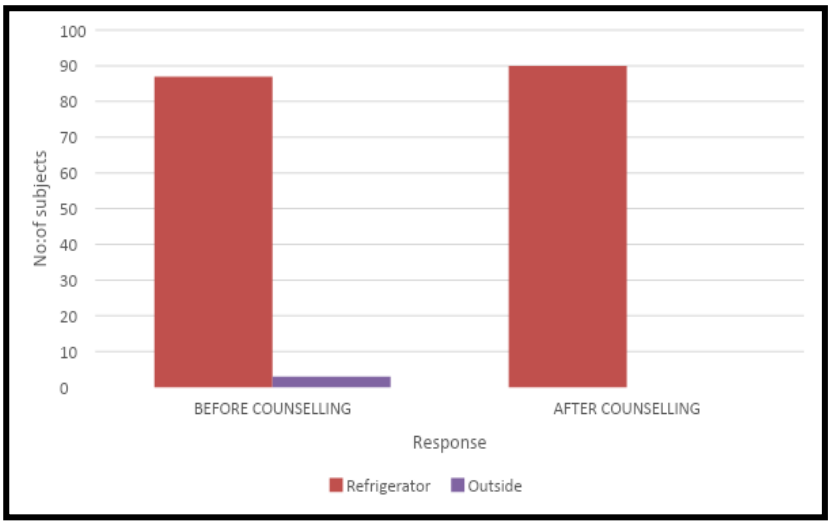

Figure No. 5: Storage of insulin

Among the 90 cases evaluated in the study, all 90 subjects followed the correct technique of storing the Insulin at refrigerator.

TABLE NO. 8: TIME INTERVAL BETWEEN INJECTION AND MEAL

SL. No	Time Interval	Before Counselling	After Counselling
1	Nil	15	2
2	10 minutes	18	1
3	20 minutes	20	9
4	30 minutes	24	76
5	Above 40 minutes	13	2

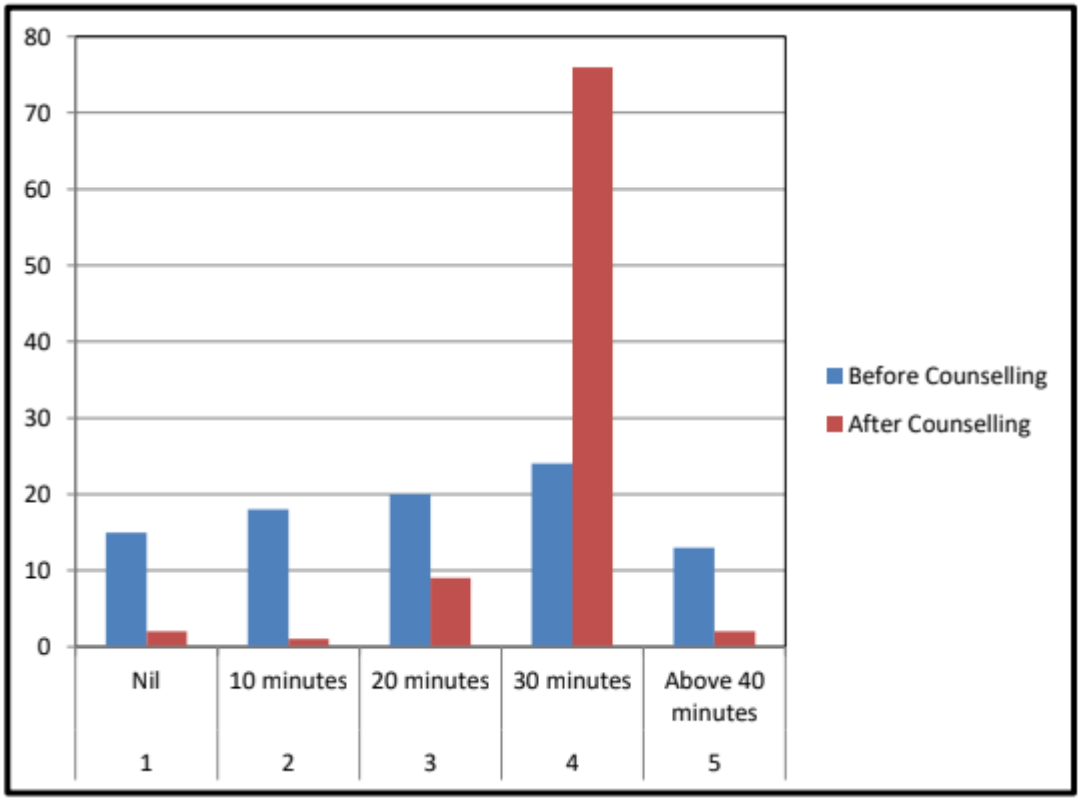

Figure No. 6: Time gap between injection and meal

Fig 6 demonstrates that the time interval between insulin injection and meal vary between 0 min, 45min and above, before counselling only 24% were maintaining proper 30 min interval, but after counselling it has increased to 76%.

TABLE NO. 9: CLEANING OF INJECTION SITE

SL.No	Cleaning of injection site	Before Counselling	After Counselling
1	Yes	26	80
2	No	64	10

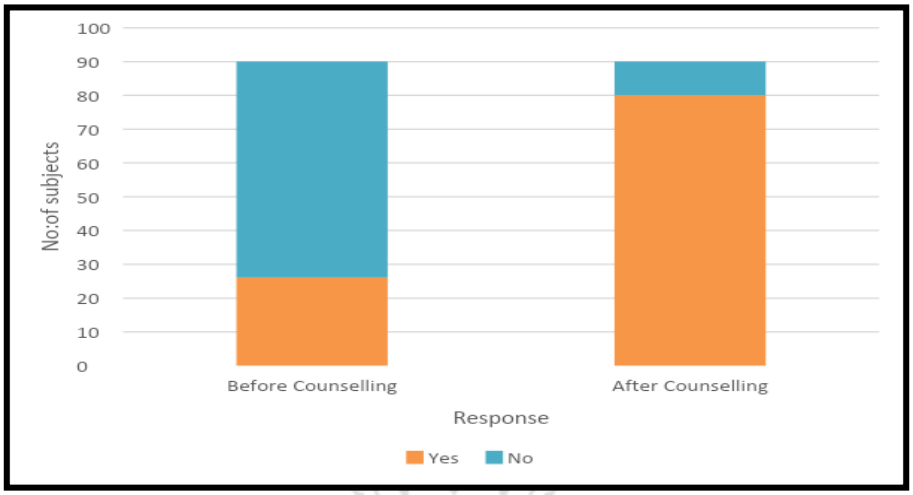

Figure No. 7: Cleaning of injection site

Fig 7 demonstrates that before counseling the number of patients who did cleaning of injection site was 26 and after counselling, it has increased to 80.

TABLE NO. 10: MIXING OF INJECTION AND PRIMING PRIOR TOUSE

SL.No	Mixing of injection and priming prior to Use	Before Counselling	After Counselling
1	Yes	54	79
2	No	36	11

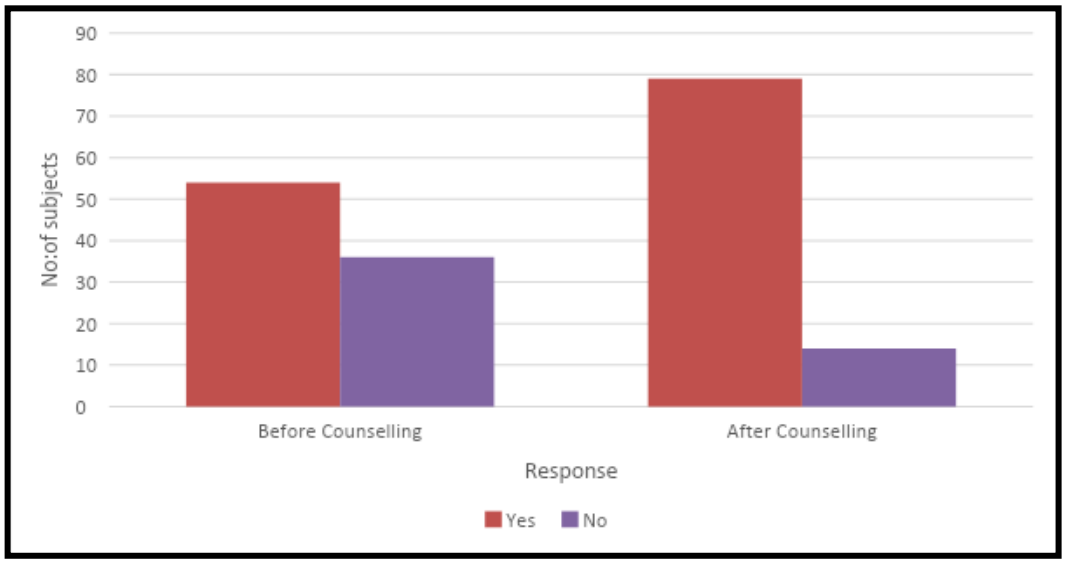

Figure No. 8: Mixing of injection and priming prior to use

Fig 8 shows that before counseling the number of patients who did mixing of injection and priming were 54 and after counselling it has raised to 79.

MEANS OF PRE-TEST AND POST-TEST

TABLE NO. 11: PRE TEST AND POST TEST

TEST	MEAN	SD	T Value	P value Sig
Pre-test	2.458	2.045	5.216	0.004(S)
Post –test	6.621	1.451	48.161	0.001(HS)

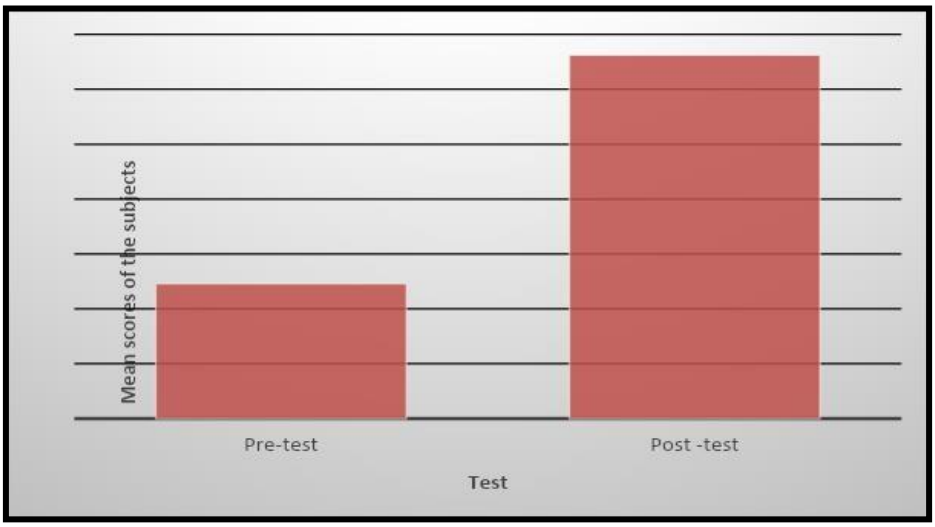

Figure No. 9: PRE TEST AND POST TEST

This fig shows that after counselling, a large variation experienced in the T value. ie. T value was 5.216 before counselling, but it has increased to 48.161 post test.

DISCUSSION

The primary objective of the study was to evaluate the impact of patient education in improving therapeutic outcomes of insulin therapy in geriatric patients in terms of HbA1c. According to the study done by **Chaudhary Muhammad Junaid Nazar et.al**, Better diabetic education and knowledge to control and treat diabetes at right time can minimize the chances to develop complications of diabetes and thus reduce morbidity and mortality in diabetics. The desired effect is able to achieve only after correct and proper insulin administration methods. If the patient is provided with right drug, the next step is the proper administration and handling methods. Our study aims at providing diabetic education in all aspects to control diabetes.[12]

As explained in the study done by **Nasir T Wabe**, **et.al**, According to Worldwide, patient's medication adherence rate varies from 36 to 93%. Adherence to prescribed medication is crucial to reach metabolic control as non-adherence with drugs can cause higher increase of HbA1c level with associated complications. The study was conducted in Southwest Ethiopia where Non Adherence was the first most problem. The main external challenge of Non Adherence was financial problem. The study have shown that majority of the patients with type 2 diabetes in Southwest Ethiopia are managed with OHA monotherapy. At the end of the study, only less than half of the patients achieved targeted glycemic level and majority are still not meeting the recommended blood glucose target.[13]

Our study was conducted on 200 diabetic subjects on all types of insulin therapy comprising of 100 cases and 100 controls. Cases were given education and training on insulin taking technique along with their disease, drugs, dietary, and lifestyle at first follow-up, while controls received neither of these. Subjects were assessed by giving questionnaire and for glycaemic control by measuring glycated haemoglobin (HbA1c) at the end of the study. In this study, patient counselling showed significant increase from the baseline compared to controls, accompanied by significant reduction in HbA1c of cases at the end of the study compared to the control. Majority of the people were following improper techniques in insulin administration which was rectified by counselling. Poor adherence with the prescribed drug regimen and poor knowledge and practice of successful self-management are

the main reasons for not achieving glycemic controls in majority of the patients. Geriatric patients are particularly at high risk especially those with low literacy and knowledge about insulin taking techniques and selfcare to control their blood glucose level. Poor glycemic controlling these patients may stem from lack of literacy, cognitive impairment, poor vision, and hearing defects.

Age and Gender

Among the 90 study subjects enrolled in the study, 50% were males and were within the age group of 60-80 years and females with equal range about 50%. The most important demographic change to diabetes prevalence across the world appears to be the increase in the proportion of people 65 years of age and the prevalence of diabetes is higher in men than women according to study conducted by **Sarah Wild et.al**.[14]

According to **Anna Nordström et al**, The prevalence of type 2 diabetes was 14.6% in men and 9.1% in women. Mean BMI was slightly higher in men than in women, with a greater difference in mean visceral fat mass.[15]

Medications

Among 100 patients, 95 subjects are taking OHA along with insulin. The most frequently prescribed OHA is metformin (71%), followed by sulfonylurea (7%), Teneligliptin (6%), Dapagliflozin (3%), Acarbose (1%). The distribution of combined use of drugs and the combination of metformin and pioglitazone was the most used one and Glibenclamide with metformin was the least. This is similar to that of the study done by **Nasir T Wabe** where Oral hypoglycemic agent were prescribed for majority of the patients while insulin & OHA was prescribed in 33 (8.6%) of the patient. Of the patient on OHA, 312(88.9%) where on monotherapy while 39 (11.1%) where on combination therapy. The most frequently prescribed combination therapy contain Metformin and Pioglitazone (62%) followed by Gliclazide & Metformin (19%). Of the patient on mono therapy with OHA 232(74.3%) were on Glibenclamide followed by Metformin 80 (25.7%). About 161 (41.9%) of the patient had adequate glycemic control. Majority of the patient with type 2 diabetes in the study are managed by Insulin since geriatric patients.[13]

Lab Parameters

Glycemic control in diabetes mellitus is a cornerstone in reducing morbidity and mortality of the disease. Achieving glycemic control or reducing hyperglycemia significantly decreases the microvascular and macrovascular complications of diabetes. Even though measurement of glycated haemoglobin (HbA1c) remains the gold standard for assessment of glycemic control, there is no consensus whether fasting or postprandial plasma glucose (PPG) is a better predictor of glycemic control in resource-poor settings when HbA1c is not available. According to study conducted by **Ezra Belay Ketema Et al**, the aim of this systematic review and meta-analysis was to summarize evidences on the significance of fasting and postprandial plasma glucose, and their correlation with HbA1c. Control of plasma glucose in patients with diabetes can be assessed by measurement of glycated hemoglobin (HbA1c), fasting plasma glucose (FPG), and postprandial plasma glucose (PPG). However, still measurement of HbA1c level remains the gold standard for assessment of glycemic control at follow up. The concentration of HbA1c predicts diabetes complications because it reflects more harmful glycation sequelae of diabetes, such as retinopathy and nephropathy, which are understood to be due to harmful advanced glycation end products.[16]

Insulin Injection Site

Among the 90 subjects enrolled in the study, 15% opted abdomen as their site of injection before counselling which increased to 72% after counselling. As explained in the study done by **ABM Kamrul-Hasan et.al**, abdomen was the most frequent site of injection, followed by arm (16.8% and 27.3%) thighs were less commonly.[17]

Duration of Needle in the skin

In our study, before counselling the number of patients who leave the needle correctly (20sec) in the skin was about 25 % and after counselling the number of patients who leave the needle in the skin were increased to 43%. This is similar to that of the study done by **ABM Kamrul-Hasan. et.al** where the dwell times of the needles after injections were <5 seconds in 34.7% (294/847), 5–10 seconds in 44.3% (375/847), and >10 seconds in 7.7% (65/847); 13.3% (113/847) of the study subjects were not aware of the duration of needle dwell time after injections.[17]

How often do you use the same needle

In our study, before counselling out of 90 population only 24 % are changing needle correctly after injection but after counselling it has increased to 45%. But the remaining 55% are reusing needle. This is similar to that of study conducted by **ABM Kamrul- Hasan.et.al,** whereas Most (98.8%) of the syringe users reused the syringes, the frequency of reusing pen needles was 98.5% among the pen users. A total of 40.7% of the syringe users and 38.9% of the pen users reused the needles >10 times. The reasons given for reusing needles were to save money (49.3%), for convenience (39.7%), not knowing how many times needles can be used (21.9%), to prevent excess waste (14.7%), and unavailability of another syringe/pen needle(3.0%).[17]

Storage

About 90% of subjects followed the correct technique of storing the Insulin at refrigerator. This is similar to that of the study done by **Poudel et.al**, where the assessment of insulin injection technique and insulin pen storage practice revealed that twenty (46.5%) patients were storing their insulin pen (insulin cartridge inside) at room temperature and an equal number of patients kept their insulin pen inside refrigerator.[11]

Time interval between injection and meal

About 76% of subjects follow correct time gap (20-30min) between injection and meal. This is similar to that of the study done by **Poudel et.al**, where the median (IQR) time gap between injection and meal was (15–30) minutes.[11]

Cleaning of injection site

About 80% of the patient enrolled in the study clean their injection site prior to the injection. This is similar to that of the study done by **ABM Kamrul-Hasan et.al**, whereas the frequencies of the subjects cleaning the injection sites always, often and sometimes were 43.2%, 3.3%, and 19.7%, respectively.[17)]

CONCLUSION

Diabetes mellitus is a lifelong condition that can be controlled with lifestyle adjustments and medical treatments. Keeping blood sugar levels under control can prevent or minimize

complications. Insulin treatment is one component of a diabetes treatment plan for people with type 1diabetes.

Diabetic Education is an integral part of insulin therapy. Patients should be educated about disease condition, diet, exercise, complications and information on storage of insulin, use of syringes, mixing of insulin, timing of injection and meals, selection of proper site and proper technique of injection. Patient education, proper evaluation, diet and lifestyle changes can help keep your blood sugar at a normal level and prevent other problems, such as blindness, kidney damage and even serious other complications.

LIMITATIONS

- Lack of patient compliance in filling the questionnaire.
- Due to short period of time, proper follow up could not be taken in some patients.
- Drug related problems such as Hypoglycemia, weight gain etc. were not appropriately measured due to the short period of time.

AREAS OF CONFLICT: NIL

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