Effects Of Oral And Oral With Injectable Therapy In Type 2 Diabetes Mellitus

1st Aditya Nayak, 2nd Mahadevamma L, 3rd Sha Abbas Mollah, 4th Ashish B singh, 5th Swathi Ramesh

1 Student, 2 Associate professor & HOD of Pharmacy Practice department, 3 Student, 4 Student, 5 Assistant professor

1 East West College of Pharmacy, Bengaluru, Karnataka, India.

Abstract: Diabetes mellitus (DM), commonly known as just diabetes, is a group of metabolic disorders characterized by a high blood sugar level. Type 2 diabetes begins with insulin resistance, a condition in which cells fail to respond properly. Effectiveness of oral and oral with injectable therapy in patients with type 2 DM for more than 10 years. This was a prospective and comparative study in which 200 subjects were enrolled based on the criteria from Sagar Hospitals and was evaluated by a suitable statistical method. A total of 200 patients were involved, out of which 74 were females and 126 were males, giving 37% and 63% respectively. During monotherapy, 27.5% of the studied patients had their diabetes under control, and during combination therapy, 23.0% of the patients had their diabetes under control. Injectable therapy was prescribed to 93 (46.5%) patients out of 200, and it was found that 40.0% had their diabetes under control. The P-value for oral therapy was found to be 0.078 and that of oral with injectable therapy was found to be 0.05. This indicates that oral with injectable therapy was significantly effective as compared to oral therapy. The study concluded that oral with injectable therapy was the more effective therapy as compared to oral therapy. This study will facilitate adequate treatment therapy and counselling for patients given by physicians and clinical pharmacists.

Keywords used: Type 2 DM, GRBS, HbA1C, glucose control.

I. INTRODUCTION

Diabetes mellitus is a group of metabolic disorders characterized by an increased blood sugar level. Symptoms of this disorder include frequent urination, increased thirst and increased appetite. If left untreated, diabetes can cause various other health complications. Commonly seen diabetes are type 1, Type 2, and gestational diabetes. Type 2 diabetes begins with insulin resistance, a condition in which cells fail to respond to insulin. As the disease progresses, a lack of insulin may also develop. Type 2 diabetes may be treated with oral anti diabetic medications and insulin. It include agents that increase the amount of insulin secreted by the pancreas, increase the sensitivity of target organs to insulin, decrease the rate at which glucose is absorbed from the gastrointestinal tract, and increase loss of glucose through urination. Several groups of drugs, mostly given by mouth, mono or in combination, are effective in type 2 DM. The therapeutic combination in type 2 may include insulin in search of a desired combination of effects.

Various anti diabetic agents used are Sulfonylureas, biguanides, thiazolidinediones, dipeptidyl dipeptidase 4 (DPP-4) inhibitors, alpha glucosidase inhibitors SGLT-2 receptor agonist, GLP-1 receptor agonist or exinatide. Hypoglycemia can occur with any insulin secretagogue. Biguanides reduce the production of glucose by the liver and make peripheral tissues more sensitive to insulin, but it's not recommended for patients with chronic or acute kidney problems, and should be stopped when creatinine levels reach a certain point. Metformin has been shown to prevent the progression from impaired glucose tolerance to type 2 diabetes. Thiazolidinediones enhance insulin sensitivity in peripheral tissues and reduce glucose production by the liver. Incretin hormones boost insulin secretion while suppressing glucagon secretion, slowing gastric emptying, and reducing appetite. Exenatide helps to lower blood glucose levels and promote weight loss by slowing gastric emptying and inducing satiety. DPP-4 inhibitors do not affect body weight, and the impact of these medications on cardiovascular events is not yet known.

This study is done to show the glycemic control of oral and oral with injectable hypoglycemic agents in patients with type 2 diabetes mellitus with history of more than 10 years and to compare the same by using the parameters such as GRBS, FBS, HbA1c, PPBS etc. This helped the patient to better control their diabetic conditions along with other physiological conditions such as diabetic neuropathy, nephropathy, ketoacidosis etc. Importantly, glycemic control should be optimized for the patients, attaining the necessary control but done in a safe, monitored manner.

II. METHODOLOGY

Study Site:

The study was conducted in the Endocrinology department of Sagar multi speciality hospital and research center, Bengaluru.

Study Design:

This study was a Prospective and Longitudinal study

Sample Size:

A total of 200 patients from the Endocrinology department of Sagar Multi specialty Hospital and Research Center who met the study criteria and consented for the study were enrolled.

Study Period:

The study was conducted over a period of 06 months from January 2022 to July 2022.

Ethical Approval:

Ethical committee clearance was obtained by the Institutional Ethical Committee of Sagar Multi specialty Hospital and Research Center, Bengaluru.

Study Criteria:

Inclusion Criteria:

1. Patients prescribed with oral hypoglycemic
2. Patient prescribed oral with injectable hypoglycemic both in-patients and out-patients
3. Patient only with more than 10 years of history

Exclusion Criteria:

1. Treatment given for type 1 DM
2. Pregnant and lactating women

Study Material and Source of Data:

Materials

1. Data collection form
2. Patient consent form

Source of Data:

The main sources for the collection of data were through:

Patient's case sheets

Treatment charts

Laboratory reports

Patient interview

Study Procedure:

Patient Enrolment:

A hospital based prospective study was conducted in Endocrinology department of sagar hospital. The study was conducted in 200 patients who suffered from Diabetes for more than 10 years. Patients who were unwilling to participate and who did not meet the inclusion criteria were excluded from the study.

Method of Data Collection:

A Prospective and Longitudinal study was conducted in the Endocrinology department of Sagar Hospital. The patient who meets all the inclusion criteria and exclusion criteria was enrolled for study. Therapeutic related data such as name of drugs, dose and route of administration, duration of therapy was collected from the case sheet of the patient. The efficacy of oral and oral with injectable hypoglycemic, treatment chart, patient interaction, diet and lifestyle, laboratory parameters such as GRBS, HbA1c, etc. were used and other physiological complication were also seen. The efficacy of oral therapy was assessed by collecting various

parameters along with past medication history and the same was done for oral with injectable therapy as well. Various physiological conditions were observed. The comparison between oral and oral with injectable was done on the basis of parameters like GRBS, HbA1C, etc. To assess the efficacy of oral and oral with injectable hypoglycemic for the treatment of type 2 Diabetes mellitus with the help of interaction with the patients, physician, progress note, laboratory parameters, follow up, and the standard references like MICROMEDEX software was used. These data's were collected and documented in a suitably designed data collection form. Data's were evaluated by using suitable statistical tools.

Determination of Efficacy:

The laboratory values like HbA1C, GRBS were collected at the time of administration and time of discharge from laboratory report and followed up the changes after hypoglycemic agents during the study. The changes in these parameters before and after the therapy were recorded and efficacy of oral and oral with injectable hypoglycemic agent's efficacy were analyzed.

Statistical Methods:

Descriptive statistical analysis has been carried out in the present study. Mean and standard deviation has been used to measure the central tendencies of the given data. Chi-square test, paired sample t test, frequency and percentage were drawn and charts were used to represent the data. Microsoft Word and Excel are used to generate tables and graphs respectively. Chi-square test significance was shown with a p-value <0.05 i.e., at a 5% level of significance.

Statistical Software:

The statistical software namely IBM SPSS version 28 was used for the analysis of the data and the drawn charts.

III. RESULTS

**Fig. 1: Distribution of subjects according to gender**
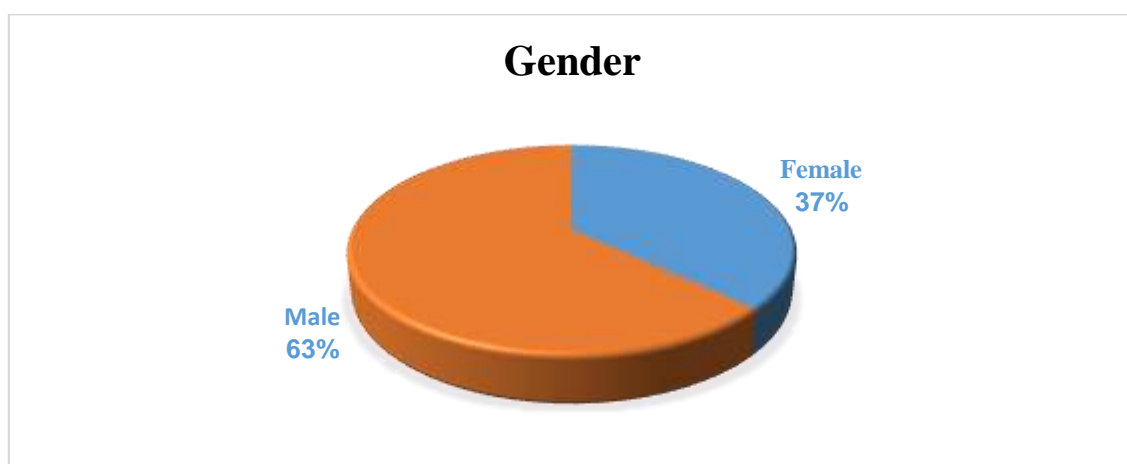
Gender:

Fig. 01 represents that in the current study, a total of 200 patients were involved out of which 74 were females and 126 were males giving 37% and 63% respectively. This represents that, males predominated over females in type 2 diabetes mellitus, hence prevalence of type 2 diabetes mellitus was higher in males according to our study due to reasons like visceral fat deposition, stress and obesity, and it is also due to their occupational status. Similar findings were found in study conducted by Anna Nordstrom, Jenny Hadrevi, Tommy Olsson, Paul W. Franks and Peter Nordstrom where males were more prone to type 2 diabetes mellitus.

**Fig. 2: Distribution according to age group**
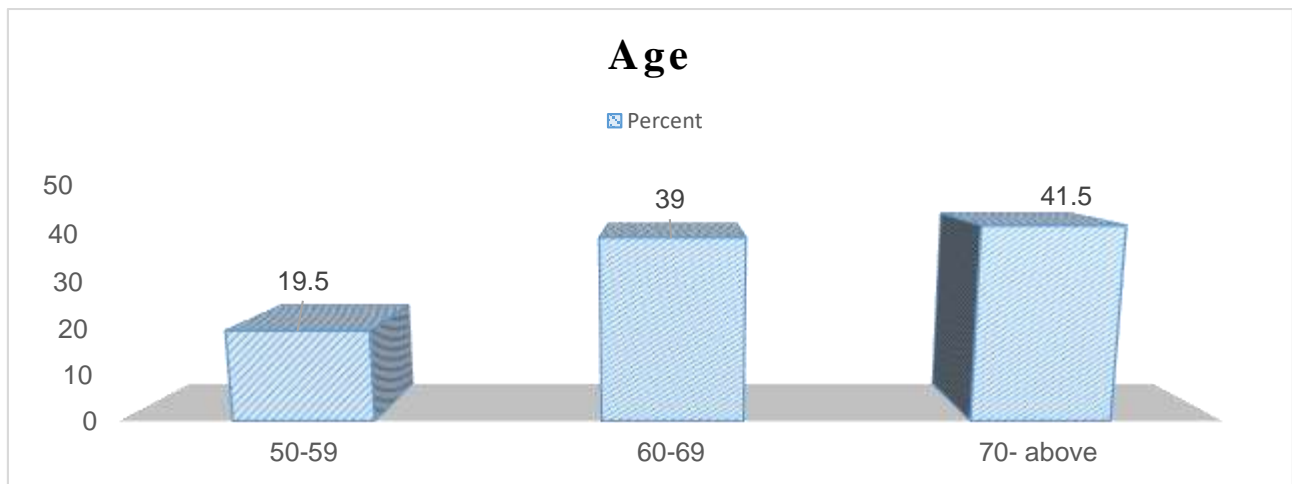
Age:

 Fig. 02 represents that the age distribution of the given population showed that 19.5% of patients belong to the age group from 50-59 years, 39.0% in the age group of 60-69 years, and 41.5% in the age group of 70 and above years. This implies the higher incidence of type 2 DM was found in patients which are 70 and above. This was due to lack of testosterone production and increased insulin resistance with age. Similar findings were found in study conducted by Helard Manrique, Jeffrey Halter and Leonor Corsino where estimated 33% of adults aged 65 or older have DM due to higher risk of developing complications like hypoglycaemia, kidney failure and heart disease.

Fig. 3: Distribution of subject according to monotherapy based on gender
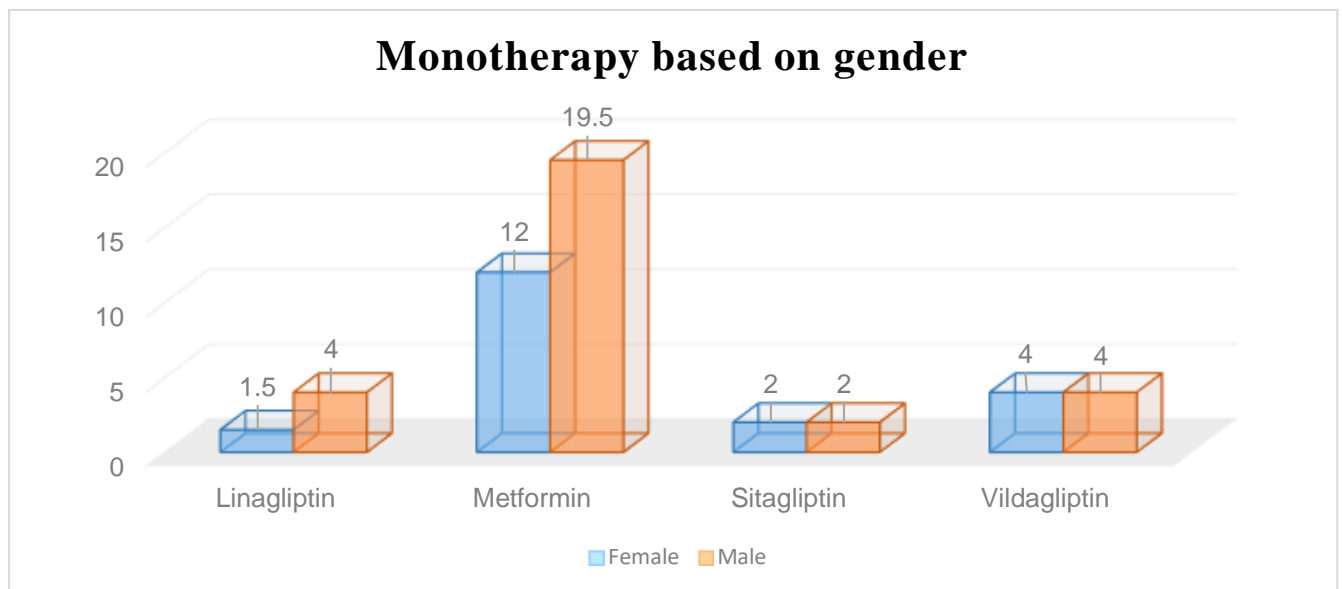
Monotherapy based on gender:

Fig. 03 represents that metformin was most prescribed monotherapy in both male and female i.e., 19.5% and 12.0% respectively. Metformin helps to control obesity which is a direct risk factor for diabetes progression in both male and female patient on long term basis. Vildagliptin was prescribed for both male and female as 4.0% in each. Followed by linagliptin which was prescribed for male (4.0%) and for female (1.5%). Followed by sitagliptin for male and female 2.0% each. Similar findings were found in study conducted by Hamid Nasri and Mahmoud Rafieian-Kopaei where metformin was prescribed more due to various benefits in the patients with type 2 DM such as decreased hyperinsulinemia, weight reduction, improved lipid profiles, etc

**Fig. 4: Distribution of subject according to monotherapy based on age**
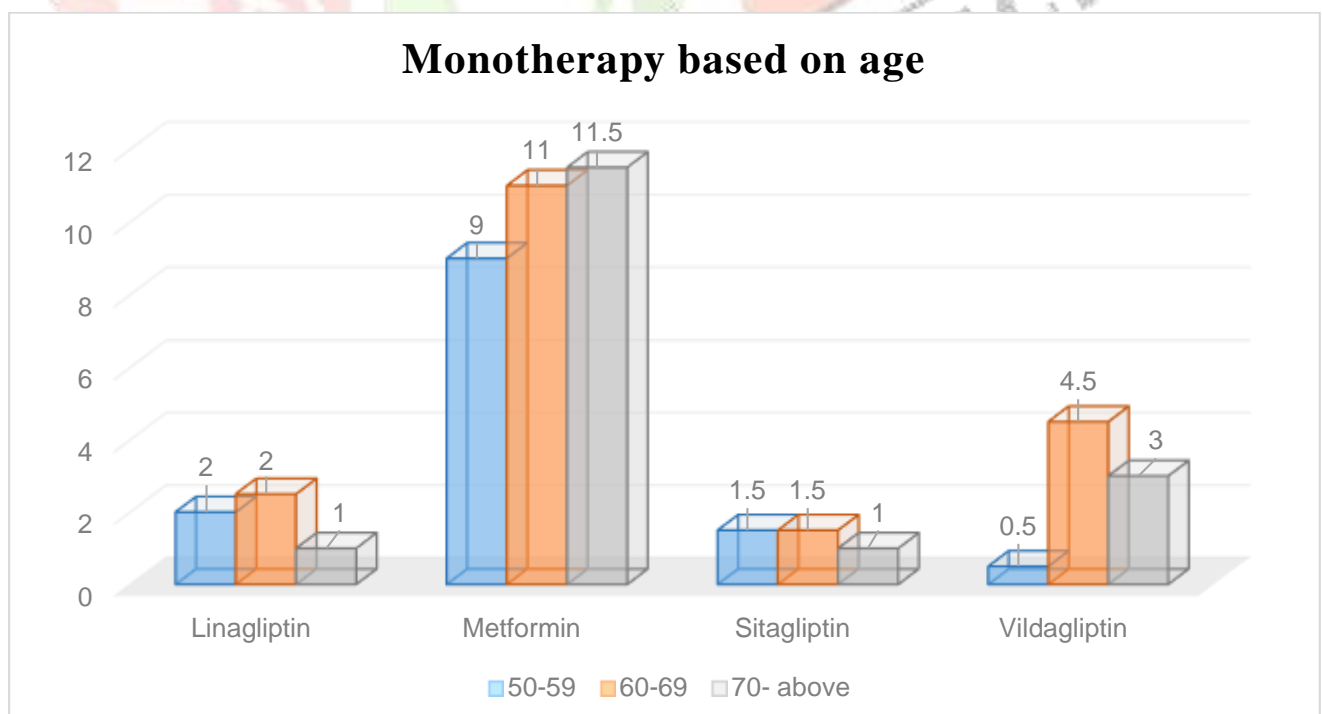
Monotherapy based on age:

Fig. 04 represents that metformin was identified as most prescribed monotherapy in all the age group 50 to 59 (9.0%), 60 to 69 (11.0%) and 70 and above (11.5%)., vildagliptin 4.5% was prescribed in age group 60-69 years, followed by linagliptin was prescribed as 2.5% in 60-69 years of age, and sitagliptin as 1.5% in the age group of 60-69 years. Metformin was found to be the safest drug for geriatric patients and it also reduces the insulin resistance.

Insulin therapy based on gender and age:

Novo rapid (4.5%) was the most prescribed insulin in female and H actrapid (8.0%) was prescribed in male. Both novo rapid and H actrapid belongs to rapid acting insulin, they were used in most number of patient as they can reduce blood glucose level more quickly than any other class but they last only for 3 – 5 hours, along with this other oral hypoglycemic agents are used to maintain the blood glucose level. H actrapid (1.5%) and lantus (1.5%) in the age group of 50 to 59, H mixtard (4.5%) and (5.5%) in the age group of 60 to 69 and 70 and above respectively.

Fig. 5: Distribution of subjects according to insulin class
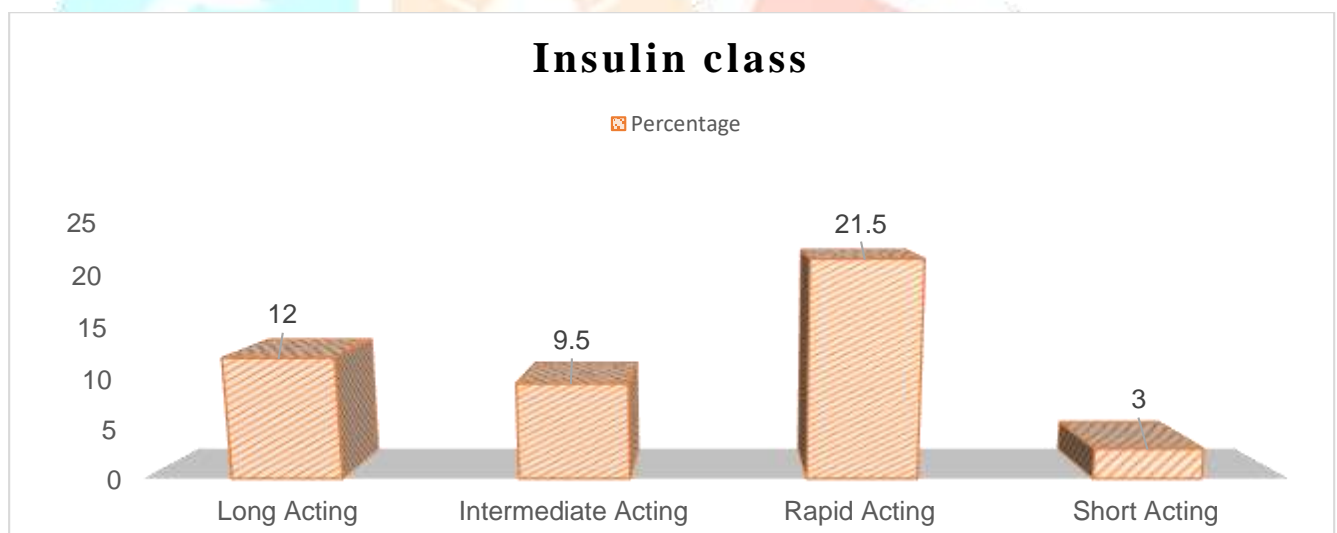
Insulin class:

Fig. 05 represents that out of 93 patients of the studied population rapid acting insulin (21.5%) was the most prescribed class of insulin in the studied population. Rapid acting insulin were used in most number of patient as they can reduce blood glucose level more quickly than any other class but they last only for few hours, along with this other oral hypoglycemic agents were used to maintain the blood glucose level. Followed by long acting (12.0%), followed by intermediate acting (9.5%), where short acting (3.0%) was found to be least prescribed insulin in the studied population.

Table No.1: GRBS control with oral therapy

Therapy		GRBS Control			
		Controlled	Not Controlled	Partially Controlled	Total
Oral therapy	Combination Therapy	32	45	25	102
		16.0%	22.5%	12.5%	51.0%
	Mono Therapy	38	41	19	98
		19.0%	20.5%	9.5%	49.0%
Total		70	86	44	200
		35.0%	43.0%	22.0%	100.0%

Table No.2: GRBS control with injectable therapy

Therapy		GRBS Control			
		Controlled	Not Controlled	Partially Controlled	Total
Injectable therapy	No	12	74	21	107
		6.0%	37.0%	10.5%	53.5%
	Yes	58	12	23	93
		29.0%	6.0%	11.5%	46.5%
Total		70	86	44	200
		35.0%	43.0%	22.0%	100.0%

GRBS control:

Table no. 01 and table no. 02 represents that out of 200 patients 35.0% patient had their GRBS under control and 22.0% patient were partially controlled. Among them when they were prescribed with monotherapy 19.0% patient were controlled and 9.5% were partially controlled and for combination therapy 16.0% were controlled and 12.5% were partially controlled. Out of 200 patients 93 patients were prescribed with injectable therapy and it was found that 29.0% patient had their GRBS under control and 11.5% patient were partially controlled.

Table No.3: HbA1C control with oral therapy

| Therapy | | HbA1c control | | | |
		Controlled	Not Controlled	Partially Controlled	Total
Oral therapy	Combination Therapy	28	55	19	102
		14%	22.5%	8.5%	51.0%
	Mono Therapy	31	43	24	98
		15.5%	21.5%	12.0%	49.0%
Total		59	98	43	200
		29.5%	49.0%	21.5%	100.0%

Table No.4: HbA1C control with injectable therapy

| Therapy | | HbA1c control | | | |
		Controlled	Not Controlled	Partially Controlled	Total
Injectable therapy	No	07	85	15	107
		3.5%	42.5%	7.5%	53.5%
	Yes	52	13	28	93
		26.0%	6.5%	14.0%	46.5%
Total		59	98	43	200
		29.5%	49.0%	21.5%	100.0%

HbA1C control:

Table no. 03 and table no. 04 represents that out of 200 patients 29.5% patient had their HbA1C under control and 21.5% patient were partially controlled. Among them when they were prescribed with monotherapy 15.5% patient were controlled and 12.0% were partially controlled and for combination therapy 14.0% were controlled and 8.5% were partially controlled. Out of 200 patients 93 patients were prescribed with injectable therapy and it was found that 26.0% patient had their HbA1C under control and 14.0% patient were partially controlled.

Table No.5: Efficacy of oral therapy

| Therapy | | Outcome | | |
		Controlled	Not Controlled	Total
Oral therapy	Combination therapy	46	56	102
		23.0%	28.0%	51.0%
	Monotherapy	55	43	98
		27.5%	21.5%	49.0%
Total		101	99	200
		50.5%	49.5%	100.0%

Table No.6: Efficacy of injectable therapy

Therapy		Outcome		
		Controlled	Not Controlled	Total
Injectable therapy	Not given	21	86	107
		10.5%	43.0%	53.5%
	Given	80	13	93
		40.0%	6.5%	46.5%
Total		101	99	200
		50.5%	49.5%	100.0%

Efficacy comparison of oral and oral with injectable therapy:

Table no. 05 and table no. 06 showed the effectiveness of oral and oral with injectable therapy. 200 patients were included in this prospective study and it was found that during monotherapy 27.5% of the studied patients had their diabetes under control and during combination therapy 23.0% patients had their diabetes under control. Injectable therapy was prescribed to 93 (46.5%) patients out of 200 and it was found that 40.0% had their diabetes under control and 6.5% were not under control. P- Value for oral therapy was found to be 0.078 and that of oral with injectable therapy was found to be <0.05. This indicates that oral with injectable therapy was significantly effective as compared to oral therapy. Similar findings was found in the study conducted by David SH, Fernando Ovalle where triple oral therapy was found more effective. Whereas Maria Juliana Soto-Chavez, Ana Maria Gomez-Media conducted a study and found that oral along with injectable was more effective as well as safe in management of type 2 DM.

IV. CONCLUSION:

A total of 200 patients were enrolled in this study, the medication history of these patient were assessed and evaluated. From the study conducted it was observed that the most frequently prescribed oral hypoglycemic were metformin, vildagliptin, sitagliptin, glimepiride etc. out of which metformin was found to be the most effective oral hypoglycemic agent that effectively reduced both GRBS and HbA1C. During monotherapy with metformin it was observed that 31.5% of patients got recovered. However it was seen that when an injectable is added along with oral therapy 86% of total 93 patients had their diabetes under control as compared to only oral therapy where 19.6% of total 107 patients had their diabetes under control. Most commonly prescribed insulin observed was rapid acting insulin including H actrapid (10.5%), insugen (5%.0) and novorapid (5.5%). However some other class were also prescribed such as long acting including lantus (8.5%) and basalog (3.5%), intermediate acting including H mixtard (10.5%) and short acting including insulin R (3.0%).

The study revealed that oral with injectable therapy was more effective therapy as compared to oral therapy. This study will help the patients for better control their diabetes and improve their quality of life and will also facilitate adequate treatment therapy and counselling for patients given by physicians and clinical pharmacists.

V.   REFERENCE

- Irwin RS, Rippe JM. Irwin and Rippe's intensive care medicine. 6 th ed. USA: Lippincott Williams & Wilkins; 2008.

- Thomas D, Sudipa S. Insulin – Pharmacology, Therapeutic Regimens, and Principles of Intensive Insulin Therapy [Internet]. Baltimore: MDText.com, Inc; 2019 [cited 2022 Mar 10]; Available from: https://www.ncbi.nlm.nih.gov/books/NBK278938/

- Singh AK, Singh R, Misra A. Oral semaglutide in type 2 diabetes mellitus: Comprehensive review, critical appraisal and clinical consideration of its use in India [Internet]: Diabetes Metab Syndr; Clinical Research & Reviews; 2022 [cited 2022 Mar 10]; 1024-36. Available from PubMed: https://pubmed.ncbi.nlm.nih.gov/35245858/

- Ripsin CM, Kang H, Urban RJ. Management of blood glucose in type 2 diabetes mellitus [Internet]: Am Fam Physician; 2009 [cited 2022 Mar 11]; 79(1):29-36. Available from PubMed: https://pubmed.ncbi.nlm.nih.gov/19145963/