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Review Article

Review on Comparison of Diabetic Drugs

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Abstract

Diabetes mellitus (DM) is a carbohydrate metabolic disorder that occurs when the blood glucose level is high. The pancreatic beta cells that produce insulin aid in the metabolism of glucose. Our body's inability to produce enough insulin or to utilize it effectively can occasionally lead to a variety of health problems. Anti-diabetic medications were created to regulate and stabilize blood glucose levels. This lowers liver glucose levels and increases the body's sensitivity to insulin, resulting in improved insulin utilization. Anti-diabetic medications come in a variety of forms, such as insulin injections, metformin, acarbose, pioglitazone, Glipizide, etc. In this article, the most popular and widely used anti-diabetic medications were examined with others in the same class.

Keywords: *Diabetes Mellitus; Antidiabetic Drugs; Blood Glucose; IDDM; NIDDM*

Introduction

Diabetes mellitus (DM) is a metabolic disorder that occurs when the blood glucose level is high. It may be brought on by an autoimmune attack on pancreatic beta cells, which results in a complete absence of insulin produced by beta cells, or it may be brought on by insulin resistance and a relative lack of insulin due to a complicated interplay between hereditary and environmental factors. The pancreas produces insulin that aids in the metabolism of glucose. Our body occasionally produces too little or does not utilize insulin as effectively. When left untreated or unchecked, this also leads to health issues like heart disease, stroke, kidney damage, nerve damage, and more [1].

There are five types of diabetes namely: Type 1 - Insulin-dependent diabetes mellitus (IDDM) in which the body does not make enough insulin and is usually diagnosed in children and young adults. Type 2 - Non-insulin-dependent diabetes mellitus (NIDDM) in which the liver does not make or use insulin, developed at any age often occurs in middle-aged and older people. It may also be caused due to genetics/lifestyle factors. Gestational - develops in women when pregnant due to insulin-blocking hormones produced by the placenta. Monogenic - An inherited form of diabetes. Prediabetes - is a condition in which blood sugar levels are elevated but not high enough to be classified as type 2 diabetes. Increased hunger and thirst, frequent urination, excessive exhaustion, impaired eyesight, and slowly healing wounds are among the most typical signs of diabetes [1,2].

Obesity, lack of exercise, prediabetes, high cholesterol, and polycystic ovarian syndrome (PCOS) are risk factors that make diabetes more likely to produce severe and catastrophic health issues. HbA1C levels and fasting plasma glucose tests are used to diagnose diabe-

tes. Several techniques and drugs are now employed to treat diabetes. The treatment used for type 1 diabetes is insulin shots, diet and exercise. Anti-diabetic drugs are prescribed to treat type 2 diabetes and are used to reduce the glucose in the liver thereby improving the body's sensitivity to insulin which makes the body use the insulin more effectively (Table 1 and figure 1) [1-6]. In this article, we attempted to compile the most popular and widely used anti-diabetic medications and compare them to other anti-diabetic medications in the same category. For the benefit of the researchers working in the relevant field, we also provided the mechanism of action, biological activity, use, dosage, precautions, contraindications, etc. (Table 2-9).

S. No	Treatment	Type 1 (IDDM)	Type 2 (NIDDM)	Diabetic cardiomyopathy (DCM)
1	Insulin (shots, pumps, pens)	Yes	-------	-------
2	Pancreatic islet transplantation	Yes	-------	-------
3	Diet management	Yes	Yes	Yes
4	Weight loss surgery	Yes	Yes	
5	Exercise and weight management	Yes	Yes	Yes
6	Oral antidiabetic agents		Yes	Yes
7	**Adjunct therapies**			
	Statin		Yes	Yes
	Angiotensin-converting enzyme inhibitors		Yes	Yes
	Aspirin		Yes	Yes

Table 1: *Treatment strategy used for diabetes and associated complications.*

Figure 1: *Treatment used for the management of diabetes.*

Methods

For a better understanding of the various aspects of drugs that fall under the same category, we gathered information from various scientific databases, including Google Scholar, Science Direct, NIH, Pubmed, Wikipedia, Healthline, Mayo Clinic, Cleveland Clinic, WebMD, Drug Bank, etc. We then compiled this information into a table and presented it.

Results

Type-2 diabetes mellitus is commonly treated with anti-diabetic medications, which are categorized according to their mechanism of action and site of action in patients [1-6].

This study compares anti-diabetic medications in the same class and concludes them to understand their effects and other factors detailed in table 2-9 [7-32].

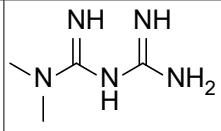
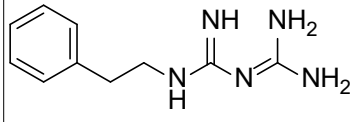
	Metformin	Phenformin	Ref.
Category	Biguanides	Biguanides	[7-10]
IUPAC name	*N*,*N*-Dimethylimidodicarbonimidic diamide	2-(N-phenethyl carbamimidoyl)guanidine	
Structure			
Brand Name	Fortamet, Glumetza	DBI	
Dosage form	Tablet, Suspension, Solution	Tablet	
Dose	500 mg twice a day/850 mg once a day.	200 - 400 mg	
Mechanism	• Reduces the amount of glucose made by the liver. • Decreases the amount of glucose the body absorbs. • Increases the effect of insulin inside the body.	• Binds at AMP-activated protein kinase which reduces glucose production. • Also inhibits ATP-sensitive potassium channels which work by delaying glucose absorption.	
Biological activity	• Lowers glucose production thereby increasing the utilization of glucose after a meal. • Reduces hypoglycaemia.	• Lowers glucose production. • Delays glucose absorption which increases insulin sensitivity.	
Uses	• Other than diabetes also used in the treatment of obesity, polycystic ovarian syndrome (PCOS), Complications of pregnancy, and Infertility. • Also used in the patient with • gestational diabetes.	Acts as an antineoplastic agent and Geroprotection.	
Precautions	• Not to be given to children under 10 years old. • Other drugs may make it, less effective or high risk of lactic acidosis. • Not recommended for patients with liver and kidney problems. • May stimulate ovulation.	• Not for patients with glycosuria, lactic acidosis. • May cause transitory myopia in older patients. • Not recommended during pregnancy.	
Toxicity	When used long causes nerve damage and has a high risk of causing anemia.	Lactic acidosis, impaired renal function.	
Adverse effects	Nausea, Diarrhoea, Loss of Appetite, stomach/abdominal pain, Risk of lactic acidosis.	Nausea, loss of appetite, Abdominal pain, Vomiting.	

Table 2: *Comparison of biguanides (Metformin and phenformin).*

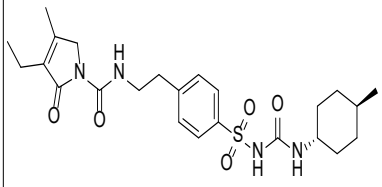
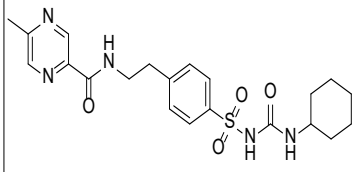
	Glimepiride	Glipizide	Ref.
Category	Sulfonylureas	Sulfonylureas	[11-13]
IUPAC name	3-Ethyl-4-methyl-N-[2-(4-{[(trans-4-methyl cyclohexyl)carbamoyl]sulfamoyl}phenyl) ethyl]-2-oxo-2,5-dihydro-1H-pyrrole-1-carboxamide	N-(4-[N-(cyclohexyl carbamoyl)sulfamoyl] phenethyl) -5-methyl pyrazine-2-carboxamide	
Structure			
Brand Name	Amaryl, Asoride, Glimcip	Glucotrol	
Dosage form	Tablet	Tablet	
Dose	Initial: 1 - 2 mg once a day Max: 8 mg a day.	2.5 mg - 5 mg - 10 mg	
Mechanism	• Stimulates the release of insulin from functioning pancreatic beta cells. • Binds to the sulfonylurea receptor on the surface of the beta cell. • Insulin secretagogue.	• Insulin Secretagogue works by increasing insulin production. • The receptor closes the ATP-sensitive potassium channel and reduces potassium conductance and thereby it influences the Calcium ion Influx. • Increases peripheral glucose utilization by the stimulation of Hepatic • Gluconeogenesis.	
Biological activity	Blocks ATP-sensitive potassium channels and causes depolarization in the pancreatic cell which increases the secretion of Insulin in the beta cell.	• Binds with serum protein with albumin plasma protein. • Major metabolites are formed from Aromatic hydroxylation.	
Uses	• Controls glucose level when used alone or with a combination drug. • Used when the pancreas does not produce insulin or does not use it well.	• Does not be cautious over dose adjustment when presence of renal Diseases. • Used when the pancreas does not secrete insulin.	
Precautions	• Not prescribed during pregnancy due to the drug may cause hypoglycemia in newborn. • Not approved for use by anyone under 18 years old. • May not work well when used with other medications.	• May cause hypoglycaemia. • Allergic reactions induced by Sulphonamide. • Not for patients with diabetic ketoacidosis. • Not in use for under 18. • Not recommended during breast feeding.	
Toxicity	Causes Liver disease leads to liver failure and has a risk of cardiovascular problems in diabetic patients.	May cause coma and other neurological impairments.	
Adverse effects	Low blood glucose level, Nausea, Weight gain, Dizziness, Weakness.	Seizures, Hypoglycaemia, Dizziness, Diarrhoea, Vomiting.	

Table 3: *Comparison of sulfonylureas (Glimepiride and glipizide).*

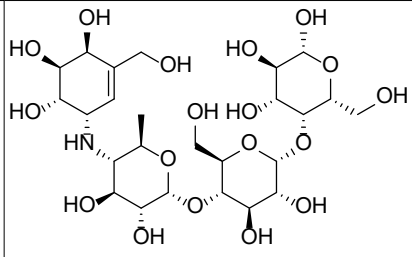
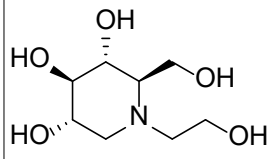
	Acarbose	Miglitol	Ref.
Category	α-glucosidase Inhibitors	α-glucosidase Inhibitors	[14]
IUPAC name	O-4,6-Dideoxy-4-[[(1S,4R,5S,6S)-4,5,6-trihydroxy-3-(hydroxymethyl)-2-cyclohexen-1-yl]amino]-α-D-glucopyranosyl-(1→4)-O-α-D-glucopyranosyl-(1→4)-D-glucopyranose	(2R,3R,4R,5S)-1-(2-Hydroxyethyl)--2-(hydroxymethyl) piperidine-3,4,5-triol	
Structure			
Brand Name	Precose	Glyset	
Dosage form	Tablet	Tablet film coated	
Dose	25 mg, 50 mg, and 100 mg based on 1-hour postprandial glucose by three times a day.	25 mg, 50 mg, and 100 mg	
Mechanism	Works by delaying the digestion of carbohydrates, and slows glucose absorption resulting in the reduction of post-prandial glucose blood concentrations.	• The Miglitol causes inhibition of intestinal enzymes which breaks complex sugars. • Reduces the rise in postprandial glucose levels.	
Biological activity	Acts by the inhibition of α-amylase from the pancreas and α-glucosidase enzymes which results in delayed absorption of glucose from the stomach and reduced postprandial increase in plasma glucose and insulin.	Miglitol has an anti-hyperglycemic activity which makes it enter the enzyme present at the border of the small intestine thereby it hydrolyses polysaccharides and disaccharides into simple single sugars.	
Uses	This drug helps in lowering the blood sugar level by preventing the breakdown of polysaccharides (starch) into sugar.	Used when the blood sugar is uncontrolled by the diet.	
Precautions	• Do not take if inflammatory bowel disease and intestinal ulcer are present. • Not prescribed for under 18 years old. • Do not take digestive enzymes such as pancreatin and amylase. • Lower the dose to minimize GI intolerance.	• There is a possibility of being allergic to inactive ingredients. • Not recommended for those with intestinal, Inflammatory bowel disease, or kidney problems. • Not to be taken with other medications.	
Toxicity	Increases the adverse effects on the Gastrointestinal tract.	Diarrhoea, abdominal pain, flatulence.	
Adverse effects	Causes bloating, diarrhoea, mild rashes or Itching of the skin.	Gas, bloating, diarrhoea, and abdominal pain.	

Table 4: *Comparison of α-glucosidase inhibitors (Acarbose and miglitol).*

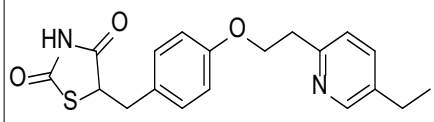
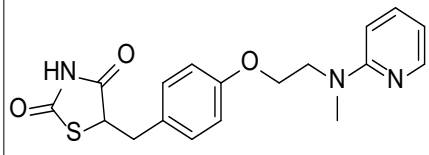
	Pioglitazone	Rosiglitazone	Ref.
Category	Thiazolidinediones	Thiazolidinediones	[15-17]
IUPAC name	(RS)-5-(4-[2-(5-ethylpyridin-2-yl)ethoxy]benzyl) thiazolidine-2,4-dione	(RS)-5-[4-(2-[methyl(pyridin-2-yl)amino]ethoxy) benzyl]thiazoli dine-2,4-dione	
Structure			
Brand Name	Actos	Avandia	
Dosage form	Tablet	Tablet (film coated)	
Dose	15 mg/30 mg a day with meal Max: 45 mg a day	4 mg/8mg	
Mechanism	Decreases insulin resistance in the periphery and the liver resulting in increased insulin-dependent glucose disposal and decreased hepatic glucose output.	• Activates intracellular receptor class of PPAR which transports and utilizes Glucose. • Thereby, increasing Insulin sensitivity in pancreatic cells.	
Biological activity	Stimulates nuclear receptors and modulates gene transcription to control the metabolism of glucose.	• Increases body sensitivity to insulin. • Decreases the free fatty acids. • Binds with nuclear receptors thereby it alters the gene expression.	
Uses	• Prescribed for diabetic patients with renal function abnormalities. • Also used in the patient with fatty liver.	May be used with other medications or alone to improve glycemic levels by reducing insulin levels.	
Precautions	• Do not take it when there is uncontrolled or severe heart failure. • May increase the risk of unintended pregnancy and stimulate ovulation. • Risk of breaking of bones in women. • Not for those under 18 years old. • Pioglitazone along with insulin may increase the risk of serious heart problems.	• Not for patients with cardiovascular problems and kidney problems. • Causes allergy. • Not recommended for 18 years old. • Not recommended during pregnancy and breast-feeding.	
Toxicity	Can cause heart failure in the patient with cardiovascular problems and also cause hepatotoxicity.	Congestive heart failure, fluid retention, bone fractures, anemia.	
Adverse effects	Weight gain, Headache, Increased Urination, Muscle pain, Weakness, Skin Allergy.	Risk of Bone fractures, Liver Abnormalities, Fatigue, Diarrhoea, and respiratory tract infections.	

Table 5: *Comparison of thiazolidinediones (Pioglitazone and rosiglitazone).*

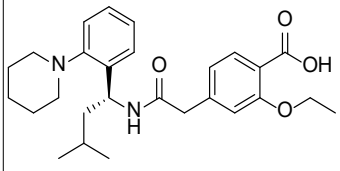
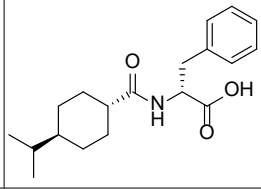
	Repaglinide	Nateglinide	Ref.
Category	Meglitinides	Meglitinides	[18-21]
IUPAC name	(S)-(+)-2-ethoxy-4-[2-(3-methyl-1-[2-(piperidin-1-yl)phenyl]butylamino)-2-oxoethyl] benzoic acid	(2R)-2-({[trans-4-(1-methylethyl)cyclohexyl]carbonyl} amino)-3-phenylpropanoic acid	
Structure			
Brand Name	Prandin	Starlix	
Dosage form	Tablet	Tablet	
Dose	0.5 mg, 1 mg, 2 mg (before meal)	60 mg-120 mg / 3 times a day	
Mechanism	• Decreases blood glucose level by stimulating beta cells in the pancreatic islets. • Insulin release is glucose-dependent and diminishes at low glucose concentrations.	• Acts by the effect of extracellular glucose on ATP reducing after-meal blood glucose by interacting with ATP-sensitive potassium channel of the beta cell of the pancreas. • Has insulinotropic effects which act by not increasing insulin release and stimulate when the glucose is in a high concentration level.	
Biological activity	Stimulates receptors on beta cells to increase the release of insulin.	• Has a link to causing acute liver injury. • It is a phenylalanine derivative. • The influx of calcium ions stimulates Exocytosis in insulin granules by the ATP-sensitive potassium channel. • Converts glucose to produce ATP.	
Uses	• Enhances insulin secretion. • Recommended for diabetic patients with kidney problems.	• Does not affect tissues of the skeletal or cardiac or thyroid. • Can be used alone or in combination with other type 2-Diabetic medications.	
Precautions	• May cause hypoglycaemia. • Not recommended for under 18 years old.	• Not for the patient with diabetic ketoacidosis. • Do not breastfeed when using this drug. • Not for use for those below 18 years old.	
Toxicity	Causes Hypoglycaemia, Seizures, and Extreme Fatigue condition when taken at Overdose and used for a prolonged period.	May cause glucose-lowering effects in patients.	
Adverse effects	Darkened Urine, Difficulty Breathing and Swallowing, Weakness, Pain in legs, Allergy in the skin.	Headache, Joint pain, Back pain, Constipation, Cough, Flu-like symptoms, Seizures, and Weight gain.	

Table 6: *Comparison of meglitinides (Repaglinide and nateglinide).*

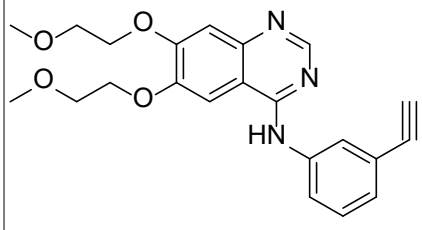
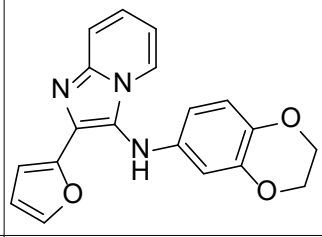
	Exenatide	Dulaglutide	Ref.
Category	Glucagon-like peptides	Glucagon-like peptides	[22-25]
IUPAC name	N-(3-ethynylphenyl)-6,7-bis(2-methoxyethoxy) quinazolin-4-amine	N-(2,3-dihydrobenzo[b][1,4]dioxin-6-yl)-2-(furan-2-yl) imidazo[1,2-a]pyridin-3-amine	
Structure			
Brand Name	Byetta	Trulicity	
Dosage form	Injection (subcutaneous)	Injection (subcutaneous)	
Dose	5 µg twice a day/ 10 µg a day within 6 hours or more apart.	1.5 mg, 3 mg, and 4.5 mg are used once weekly with the increase of dose to 1.5 mg.	
Mechanism	• Increase glucose-dependent insulin secretion from pancreatic beta cells, suppress glucagon secretion, delays gastric emptying, and reduce food intake. • The binding of the drug to the pancreatic GLP-1 receptor mediates these actions.	Increases insulin by slowing down digestion and by decreasing hormones which raises blood sugar by the activation of GLP-1 receptor in the pancreatic beta cell.	
Biological activity	GLP receptor agonist increases insulin secretion and decreases glycogen production and slows down the emptying of gastric juices and enzymes.	GLP receptor agonist increases insulin secretion and decreases glycogen production and slows down the emptying of gastric juices and enzymes.	
Uses	Increases Insulin secretion, Reduces appetite thereby suppressing Glucagon secretion.	• Used as single therapy. • Reduces the risk of adverse cardiovascular risk factors. • Increases insulin by slowing down of digestion of food molecules.	
Precautions	• Not for people with severe kidney disease or diabetic ketoacidosis. • Do not administer after the meal. • Makes birth control pills less effective. • Not approved for under 18 years old.	• Not for patients with GI diseases. • Not for patients with pancreatic diseases. • May cause serious Allergic conditions. • Not prescribed in patients with kidney diseases.	
Toxicity	Causes Hypoglycaemia	Causes Gastrointestinal disturbances, Risk of Thyroid Cancer cell tumors, and others.	
Adverse effects	Vomiting, Fatigue, Upset stomach, and Nausea, Cause C-Cell formation.	Diarrhoea, Stomach pain, Fatigue, Loss of appetite, Hypoglycaemia, and Risk of thyroid cancer cell tumors.	

Table 7: *Comparison of glucagon-like peptides or GLP1 agonists (Exenatide and dulaglutide).*

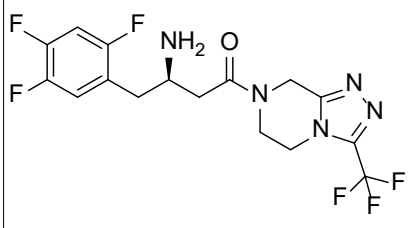
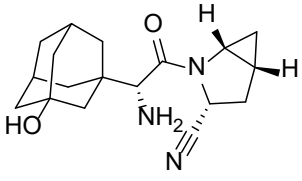
	Sitagliptin	Saxagliptin	Ref.
Category	DPP IV Inhibitors	DPP IV Inhibitors	[26-29]
IUPAC name	(R)-4-oxo-4-[3-(trifluoromethyl)-5,6-dihydro[1,2,4] triazolo[4,3-a]pyrazin-7(8H)-yl]-1-(2,4,5-trifluorophenyl) butan-2-amine	(1S,3S,5S)-2-[(2S)-2-amino-2-(3-hydroxy-1-a-damantyl)acetyl]-2-azabicyclo[3.1.0]hexane--3-carbonitrile	
Structure			
Brand Name	Januvia	Onglyza	
Dosage form	Tablet	Tablet (film coated)	
Dose	25 mg/50 mg/100 mg per day	2.5 mg, 5 mg	
Mechanism	• Inhibition of dipeptidyl peptidase-4. • Increases post-meal insulin secretion by enhancing the postprandial GLP-1 response in a glucose-dependent manner.	• Increases the amount of insulin produced after a meal. • Improves glycemic control by incretin hormones. • Decreases the glycogen secretion in pancreatic alpha cells.	
Biological activity	• This forms proteolytic activity, responsible for glucose homeostasis. • Shows hepatoprotective activity.	GLP-1 prevented and increases the secretion of insulin and decreases Glycogen.	
Uses	Used for patients who cannot manage blood sugar through exercise and proper diet management.	• The Drug starts to work within some hours. • Increases the amount of insulin by decreasing the level of glycogen in the pancreas.	
Precautions	• Not safe during breastfeeding. • Not for 18 years old. • Restrictions on food, and beverages. • May not work as well when used with other medications.	• May cause hypoglycemia when used with other diabetes medications. • Not prescribed when presence of pancreatitis, high cholesterol, and kidney diseases.	
Toxicity	High risk of GI problems.	Upper Respiratory tract Infection and urinary tract infections.	
Adverse effects	Upper Respiratory tract problems, Swelling in hands and legs, Upset stomach, Sore throat.	Headache, Vomiting, Skin peeling, Loss of Appetite, Joint pain, Tiredness, cough, and weight gain.	

Table 8: *Comparison of DPP IV Inhibitors (Sitagliptin and Saxagliptin).*

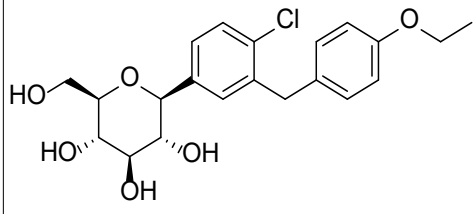
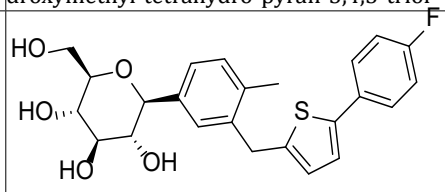
	Dapagliflozin	Canagliflozin	Ref.
Category	SGLT2 Inhibitors	SGLT2 Inhibitors	[30-32]
IUPAC name	(2S,3R,4R,5S,6R)-2-[4-Chloro-3-(4-ethoxybenzyl)phenyl]--6-(hydroxymethyl)tetrahydro-2H-pyran-3,4,5-triol	(2S,3R,4R,5S,6R)-2-{3-[5-[4-Fluoro-phenyl)--thiophen-2-ylmethyl]-4-methyl-phenyl}-6-hydroxymethyl-tetrahydro-pyran-3,4,5-triol	
Structure			
Brand Name	Farxiga, Edistride, Qtern	Invokana	
Dosage form	Tablet (film coated)	Tablet	
Dose	5 mg per day can be increased to 10 mg.	100 mg, 300 mg	
Mechanism	• Inhibits SGLT2 which blocks the reabsorption of filtered glucose in the kidney. • Increasing urinary glucose excretion and reducing blood glucose levels.	• Increases glucose excretion in urine by reducing the rate of reabsorption of filtered glucose by inhibiting SGLT2. • Increases serum creatinine and decreases the renal threshold for glucose which releases glucose into urine thereby reducing the concentration of glucose in the blood.	
Biological activity	Decreases the Rate of Reabsorption of glucose. Increases urinary glucose excretion. Stimulates insulin.	Works in the kidney to prevent Glucose absorption thereby also reducing the risk of heart attack, Stroke, or death in patients with type-2 diabetes.	
Uses	Lowers the risk of heart disease and also prevents failure of the heart.	Prevents cardiovascular diseases. Used to lower the risk of end-stage kidney diseases. May Induce weight loss.	
Precautions	• Increases risk of dying due to heart and kidney diseases. • Not to use during 2nd and 3rd trimesters of pregnancy. • Not for children under 18 years. • Other drugs may increase or decrease the effect of Dopamine.	• Not for pregnant women in the 2nd and 3rd Trimester. • May cause genital yeast infections in men and women. • May induce allergic reactions. • Not for patients under 18.	
Toxicity	Causes acute kidney injury, Liver damage.	Can cause breast cancer. liver toxicity when overdosed.	
Adverse effects	Reduces blood sugar levels by decreasing the release of insulin causing hypoglycaemia, causes yeast infections in the vagina and penis, back pain, skin allergy, Nausea, and Flu-like symptoms.	UTI, Hypotension, Ketoacidosis, Bone Fractures.	

Table 9: *Comparison of SGLT2 inhibitors (Dapagliflozin and canagliflozin).*

Discussion

For the benefit of scientists working in this area, anti-diabetic medications from the same category are compared in this study, and their benefits, mechanisms, precautions, side effects, etc. are inferred. The categories of drugs include biguanides, sulfonylureas, alpha-glucosidase inhibitors, thiazolidinediones, meglitinides, GLP-1 agonists, DPP IV inhibitors, and SGLT 2 inhibitors. The mechanism of drugs belonging to the same class was stated below: Biguanides are used to lower the glucose that the liver makes; sulfonylureas are used to stimulate the pancreas to release insulin; alpha-glucosidase inhibitors are used to slow down or block the breakdown of carbohydrates; thiazolidinediones act to help insulin to work better; meglitinides stimulate the pancreas to release more insulin; Glucagon-like peptides or GLP1 agonists change the way that the body produces insulin; DPP IV inhibitors act by improving the blood sugar level without causing hypoglycemia, otherwise called weight-neutral drugs and SGLT 2 inhibitors help in releasing more glucose into the urine. The drugs that are prescribed to patients totally depend on the type of diabetes that they are managing or experiencing. Every drug of each category has advantages and disadvantages of its own. According to the description above, metformin is the most popular medication administered as a first-line treatment. It can be used with other oral anti-diabetic medications, has a higher potency, and has fewer adverse effects than other medications.

Conclusion

Diabetes can be prevented to some extent by maintaining a healthy weight, lifestyle modification, exercise, and diet management. In the case of genetic and environmental factors, diabetes cannot be prevented but can be treated to some extent by anti-diabetic drugs and prevents developing complementary diseases. The anti-diabetic drugs help to lower the chance of developing diabetes to more extent, stabilize blood glucose levels, and also prevent diabetes associated with cardiovascular diseases. Therefore the drugs used for diabetes are not a permanent cure for treating diabetes. Drugs used for diabetes have their precautions and side effects but these drugs are prescribed according to the type of diabetes and cause of its occurrence with minimizing the adverse effects and also treating the cause of diabetes [1-6]. Metformin is the most prescribed oral drug for diabetes and the widely used brands are Zomet 500 mg and Glumet 500 mg tablets [7-9]. Insulin shots are commonly used for type-1 diabetes, Levemir flexpen [5]. Dipeptidyl peptidase- IV (DDP-IV) inhibitors [26-29] with Sulfonylurea [11-13] act as second-line treatment. SGLT 2 Inhibitors are used as 3rd or 4th line drugs for type-2 diabetes [30-32]. In India, Sulfonylureas (Glimepiride, Glipizide) is the most used drug for diabetes mellitus [11-13].

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