A Review on Diabetes Mellites (DM)

Mr. Dhawale Tanmay Sandip, Prof. Priyanka Vitthal Jadhav, Dr. Sanjay Ingale
Dharmaraj Shaikshanik Pratishthan College of pharmacy Walki, Ahilaya Nagar, Maharashtra, India

Abstract*: A person with diabetes mellitus (DM), sometimes known as simply diabetes, has excessive blood sugar due to either insufficient insulin production by the body or poor cell response to insulin that is produced. The traditional signs and symptoms of this elevated blood sugar are polydipsia (increased thirst), polyphagia (increased appetite), and polyuria (frequent urination). Diabetes is typically classified into three categories, which are as follows: Insulin-dependent diabetes type 1 diabetes mellitus (IDDM), a condition where the body is unable to manufacture insulin and necessitates the either use an insulin pump or inject insulin. Another name for this is "juvenile diabetes".Type 2 DM or non insulin-dependent diabetes mellitus (NIDDM), results from insulin resistance, a condition in which cells fail to use insulin properly, with or without an absolute insulin deficiency. This type was previously referred to as or "adult-onset diabetes". The third main type is gestational diabetes which occurs when women without a previous history of diabetes develop a high blood glucose level during her pregnancy. It may precede development of type 2 DM. Currently available pharmacotherapy for the treatment of diabetes mellitus includes insulin and oral hypoglycemic agents Such drugs acts by either increasing the secretion of insulin from pancreas or reducing plasma glucose concentrations by increasing glucose uptake and decreasing gluconeogenesis. However these current drugs do not restore normal glucose homeostasis for longer period and they are not free from side effects such as hypoglycemia, kidney diseases, GIT problems, hepatotoxicity, heart risk problems, insulinoma and they have to take rest of life. Various herbal drugs have been also proved effective due to their beneficial contents in treatment of diabetes. The present review therefore is an attempt to focus on the physiological aspects of diabetes, its complications, goals of management, and synthetic and herbal treatment of diabetes.*

Keywords: Insulinoma, hyperinsulinemia, adiponectin, Momordica charantia.

I. INTRODUCTION

The most prevalent endocrine condition, diabetes mellitus (DM), affects about 100 million people globally (6% of the population). It is brought on by the pancreas' inability or lack of ability to produce enough insulin, which causes variations in blood glucose levels. It is discovered to cause harm.numerous bodily systems, including the heart, kidney, eyes, blood vessels, and nerves. Type 1 diabetes has been divided into two categories: Type I insulin-dependent diabetes (IDDM) and Type II non-insulin diabetes mellitus with dependents (NIDDM, Type II). An autoimmune condition called type I diabetes is defined by by a selective breakdown of insulin that is followed by a localized inflammatory response in and around the islets Secreting cells are the hallmark of Type II diabetes, while peripheral insulin resistance and decreased secretion of insulin2. Diabetes mellitus increases the risk of numerous consequences, including peripheral and cardiovascular illnesses, stroke, neuropathy, renal failure, retinopathy, blindness, and amputations3.Mostly, drugs are used to treat symptoms and preserve lives. The secondary goals are to prolong longevity by removing different risk factors and to prevent long-term diabetic problems. For patients with type 1 diabetes, insulin replacement therapy is the cornerstone of care, but for type 2 diabetes, food and lifestyle changes are the cornerstones of management. 4. For the treatment of diabetes, a variety of hypoglycemic medications are also available, including biguanides and sulfonylureas. However, none of these drugs are perfect because of their harmful side effects, and long-term usage might occasionally result in a reduction in response. The primary drawback of the medications that are already on the market is that they have adverse effects and must be taken continuously.

Worldwide, medicinal plants and their bioactive components can be used to treat diabetes, particularly in nations with limited access to traditional anti-DM medications3. Additionally, a number of experimental models are available to evaluate plant's antidiabetic efficacy.

Family History:
The elevated risk of type 2 diabetes because of familial history.

Age:
As you age, your risk of developing diabetes rises, particularly after age 45.

Blood glucose monitoring:
A person's blood glucose levels may need to be monitored and recorded periodically or, if they are receiving insulin treatment, multiple times, depending on their treatment plan. few times each day. Numerous things can obstruct blood glucose levels, therefore taking precautions is the best course of action. in order to maintain blood sugar levels within their typical range.Two issues with blood glucose levels that need to be addressed right away are,

High blood glucose (hyperglycemia):
An excessive blood glucose level can be caused by overeating or by not taking enough diabetes medication. Hyperglycemia is a potentially fatal illness, that necessitates hospitalization right away to avoid problems and the patient's demise.

Low blood glucose (Hypoglycemia):
A blood sugar level of less than 70 mg/dL is defined. Numerous factors, such as skipping meals, taking diabetic medicine, or increasing physical activity, might cause blood glucose levels to fall. more than normal. The likelihood of hypoglycemia increases when taking insulin or drugs for diabetes that encourage the insulin secretion. Eating or drinking A low blood glucose level can be corrected with sweets.

Insulin Therapy:
Individuals with type 1 diabetes require insulin therapy . Blood sugar maintenance or control is the aim of insulin therapy. It is used subcutaneously. utilizing an insulin pump, pen, or syringe Insulin treatment is the most crucial component. Your doctor will discuss three key points when discussing insulin:
Beginning
Highest period
Length

Islet Replacement Therapy:
Traditional in vitro treatments like insulin injections are ineffective at curing diabetes mellitus. Islet replacement therapy serves as a substitute for individuals with diabetes. In this treatment, insulin-producing Pancreatic or islet cells are used in place of beta cells. transplants. It is occasionally utilized due of low rate of success.Rather, there are certain obstacles to this significant switch from conventional/traditional insulin to islet transplants, including a shortage of donors, appropriate Long-term survival and islet graft function etc.

Epidemiology:
By 2030, there will have been 552 million persons with DM, up from an estimated 366 million in 2011. Type 2 diabetes is becoming more common worldwide, with 80% of cases occurring in low- and middle-income nations. 20118 saw 4.6 million deaths attributed to DM. By 2030, type 2 diabetes is predicted to affect 439 million people world wide.Because of environmental and lifestyle risk factors, the incidence of type 2 diabetes varies significantly between geographical regions. By 2030, 439 million individuals are predicted to develop type 2 diabetes.Type 2 diabetes is not as common in some geographical areas than in others due to lifestyle and environmental risk factors9. It's forecast that type 2 diabetes, which is becoming more common in adults, will become more common in the next 20 years, with the majority of the growth expected to happen in emerging nations where most The patients range in age from 45 to 64.

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Diabetes in India:

Recent estimates indicate that 285 million people (6.6% of the global population) are between the ages of 20 and 79. group in 2010 and 438 million adults (7.8% of the total adult population) by 2030 are predicted to have diabetes. India holds the dubious title of being the "diabetes capital of the world" as it has the highest percentage of diabetic patients worldwide. The Diabetes Atlas 2006, released by the International Diabetes Federation, projects that 69.9 million Indians will have diabetes by 2025, up from the present estimate of 40.9 million. This is unless immediate preventive measures are taken are occupied. A number of distinct clinical and biochemical anomalies specific to Indians are referred to as the "Asian Indian Phenotype." These anomalies include elevated insulin resistance, increased abdominal adiposity, or a larger waist circumference despite a lower body mass index, decreased adiponectin, and elevated high-sensitive C-reactive protein amounts of protein. Changes in eating habits and a decline in physical activity are common causes of higher prevalence diabetes mellitus in urban populations11. With over 62 million people in India already diagnosed with the condition, diabetes is quickly becoming recognized as a possible epidemic.12, 13. India topped the globe in 2000 with the greatest number of persons living with diabetes mellitus (31.7 million). China (20.8 million) is in first place, followed by the United States (17.7 million) in second and third correspondingly.

Pathophysiological aspects:

Insulin insensitivity, which results from insulin resistance, decreased insulin production, and ultimately pancreatic beta-cell loss, is a hallmark of type 2 diabetes. As a result, there is less glucose transported into the adipose, muscle, and liver tissues. Hyperglycemia causes an increase in the breakdown of fat 15, 16. Patients with type 1 diabetes are typically not obese when they initially develop and are instead young (children or adolescents). signs. A genetic tendency exists, with a 10-fold higher frequency in first-degree substantial correlations with specific histocompatibility antigens (HLA) and index case relatives kinds). Research involving identical twins has demonstrated that genetically predisposed people also need to experience environmental factors like viral infection. A viral infection has the potential to harm pancreatic B cells and reveal antigens that set off an autoimmune reaction that is self-replicating. The sufferer turns into only until over 90% of the B cells are gone is a person declared obviously diabetic. This kind of insulin Deficiency may cause learning and memory problems and reduce long-term potentiating effects. Sort 2 Insulin resistance and decreased insulin production are two conditions associated with diabetes that are significant to its etiology. These patients are typically obese and appear in adulthood, with an increasing prevalence as B-cell activity progressively declines with age. In this case, tau hyperphosphorylation and Aβ plaque development are caused by insulin resistance. Insulin and Aβ compete to degrade insulin during hyperinsulinemia. enzyme, resulting in the buildup of Aβ and the development of plaque. A reduction in insulin receptor Signaling causes GSK-3β to be dephosphorylated (activated), inhibits Akt, and produces tau over-phosphorylation.
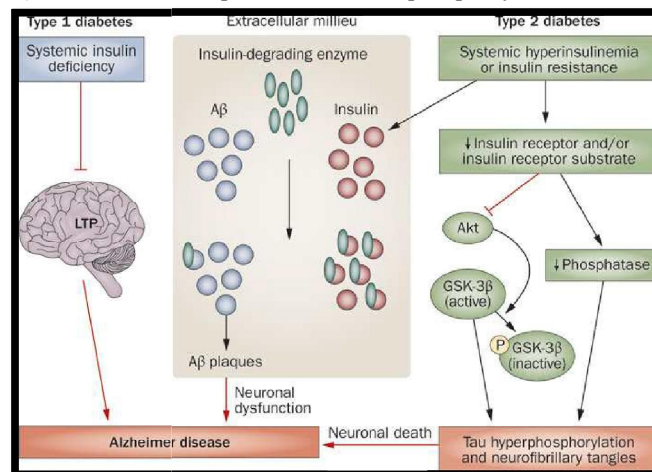

Fig .: Pathophysiology of Type I and Type II diabetes. Abbreviations: Aβ- Amyloid- β, GSK-3β-glycogen synthase kinase 3β, LTP- long term potentiation, P- Phosphate

Complications:

As the condition worsens, tissue or vascular damage develops, which can result in serious diabetes consequences such as ulceration, neuropathy, retinopathy, and nephropathy. Patients with type 1 diabetes for an extended period of time are vulnerable to macrovascular disease (coronary disorders of the heart, arteries, and peripheral vessels Large artery atherosclerosis, which is frequently linked to obesity, hypertension, and hyperlipidemia, is a major risk factor for type 2 diabetes. End-stage renal disease and cardiovascular problems account for the majority of type 2 diabetes deaths.

Diagnosis:

The American Diabetes Association (ADA) states that regular diabetes screening should be based on fasting glucose concentration; however, other methods of measuring blood sugar include postprandial blood sugar, random blood sugar, and glucose tolerance tests. In order to diagnose diabetes, at least one requirement needs to be met Apply:

Polyurea, polydipsia, inexplicable weight loss, and other diabetes symptoms, in addition to a casual plasma glucose content of 11.1 mmol/L (200 mg/dL).

Plasma glucose while fasting: It typically ranges from 70 to 110 mg/dl after 8 hours of no calorie consumption. The World Health Organization (WHO) categorization takes into account the etiological categories of diabetes as well as clinical stages such as impaired glucose tolerance/impaired fasting glucose (IGT/IFG), diabetes, and normoglycemia. diabetes mellitus, which is the same as the ADA except that the WHO group also includes the previously recognized Fasting glucose levels in GDM and gestational impaired glucose tolerance (GIGT) are 7.0 mmol/L (126 mg/dL). and/or after a 75-g OGTT, 2-h glucose = 7.8 mmol/L (140 mg/dL).

Goals of management:

The major goal of primary prevention is to stop diabetes from developing in vulnerable people or the broader population. A key element in the management and prevention of type 2 diabetes is regular physical activity. Studies using prospective cohorts have demonstrated that greater physical Activity prevents the development of type 2 diabetes regardless of other risk factors.diabetes [21–22, 23]. The primary objectives of treatment and care for are dietary and lifestyle adjustments for diabetes type 2. Most type 2 diabetics are overweight, and they typically have additional metabolic illnesses associated with the insulin resistance syndrome, Therefore, improving glycemic control, lowering the risk of coronary heart disease (CHD), which accounts for 70% to 80% of fatalities among persons with diabetes, and reducing weight are the main goals of dietary and lifestyle modifications 24. Insulin replacement treatment is the staple for those with type 1 diabetes, however dietary and lifestyle changes are thought to be the foundation for type 2 diabetes care and treatment. In type 2 diabetes, insulin is also crucial when It is not possible to manage blood glucose levels with diet, exercise, weight loss, or oral drugs. Verbal Type 2 diabetes can also benefit from the usage of hypoglycemic medications.Alpha glucosidase inhibitors, biguanides, thiazolidenediones, and sulphonylureas are examples of oral hypoglycemic medications. Restoring normal metabolic disorders, such as insulin resistance and insufficient insulin production, is their primary objective. pancreas. The goals of diet and lifestyle modifications are to lower body weight, enhance glycemic control, and lower the risk of cardiovascular problems, which cause between 70% and 80% of diabetic deaths.

Treatment

Insulin and oral hypoglycemic drugs:

The goal of insulin therapy should be to emulate nature, which has remarkable efficacy in preventing hypoglycemia in between meals and controlling postprandial hyperglycemia26. Insulin injection sites can be intramuscular or intravenous, and both are crucial for the optimal and safe functioning of the drug. path. There are various forms of insulin available, including human, cow, and hog insulin. There are drawbacks and dangers to insulin therapy. The primary negative effects are gaining weight and low blood sugar when an insulin dosage is administered incorrectly and when there is a mismatch between eating and administering an insulin shot. Increased adipose tissue and muscle mass cause weight gain, an expected side effect of beginning insulin therapy for uncontrolled diabetes. Reduced energy losses from glycosuria are another reason for this. Glutamine-containing ureas, such glibenclamide, Oral biguanides like phenformin and metformin as well as glipizide are hypoglycemic medications. Sulfonylure as produce

hypoglycemia by inducing the release of insulin from the pancreatic ß-cells. The cell membrane depolarizes as a result of their binding to sulfonylurea (SUR) receptors on the ß-cell plasma membrane, which closes ATP-sensitive potassium channels. Voltage-gated channels are then opened as a result, permitting the entry of calcium ions and the consequent release of produced insulin granules. When type 2 diabetic patients receive sulfonylureas acutely, their pancreas releases more insulin. and may possibly raise insulin levels even more by lowering the hormone's hepatic clearance. preliminary research demonstrated that the hypoglycemic effects of sulfonylureas required a functioning pancreas. Metformin and other biguanides are antihyperglycemic, not hypoglycemic. Even at high dosages, it doesn't induce the pancreas to secrete insulin or result in hypoglycemia[33]. It has been demonstrated to raise peripheral glucose absorption and decrease hepatic glucose production by 20–30%. administered orally as opposed to intravenously. Moreover, impaired glucose absorption from the stomach has been proposed as a means of operation.

Herbal treatment of diabetes:

With the growing research in traditional medicine over the past few decades, plant-based medications that are eco-friendly, bio-friendly, affordable, and generally safe have made a transition from the fringe to the mainstream. Numerous authors have reviewed the evidence on herbal remedies that can prevent diabetes, however Atta-ar-Rahman's review, which has more than 300 plant species documented, is the most informative. acknowledged for their hypoglycemic characteristics The plants in this review have been categorized based on their botanical name, place of origin, parts used, and type of active substance. Momordica charantia (Family: Cucurbitaceae) is one such plant. According to the WHO, 21,000 plants are used medicinally. objectives worldwide. 150 of these 2500 species are used, with the majority occurring in India. commercially and on a significant scale. India is known as the country that produces the most medicinal herbs. The World Botanical Garden.

Sign and Symptoms of Diabetes Mellitus

Sign	Symptoms
Extreme Hunger (Polyphagia)	Dry Skin & Mouth
Excessive Thirst (Polydipsia)	Foot Pain
Frequent Urination (Polyuria)	Yeast Infection
Slow Wound Healing	Genital & Skin Infection
Acanthosis Nigricans	Fatigue
Weight Loss	Nausea
Dehydration	Pain in Stomach
Headache	Vomiting
Flushed Face	Blurry Vision

Diabetes Mellitus Classification:
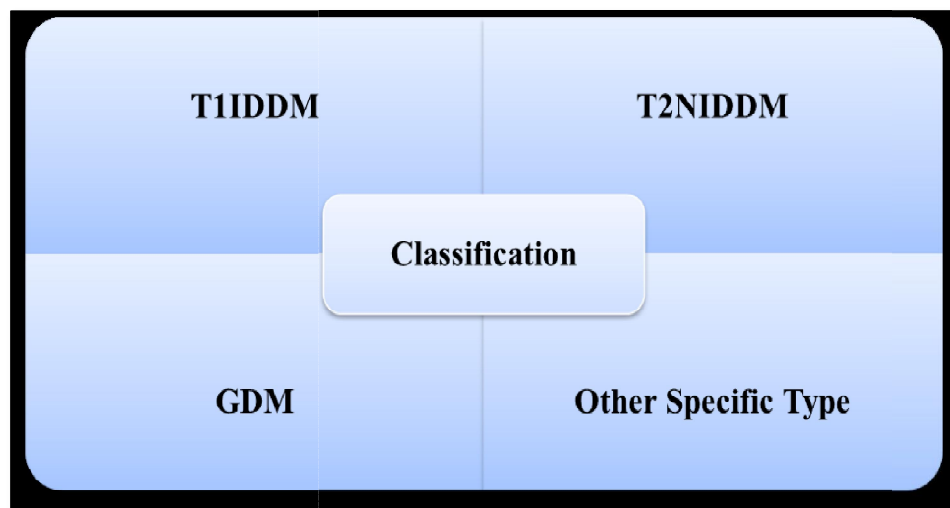
Diabetes Mellitus Dependent on Insulin (T1IDDM)

Previously known as juvenile onset diabetes, this form of diabetes mellitus is also referred to as autoimmune diabetes. Another name for it is a polygenic condition that is susceptible to ketosis. The disease strikes quickly in teenagers and can be fatal. It primarily affects children and adults and manifests before the age of 40. Insulin can be used to manage or treat type 1 diabetes, but there is no known cure. Previously, this condition was referred to as "Insulin-Dependent Diabetes Mellitus."

Blood sugar levels that are too high might cause both immediate and long-term issues. The chronic metabolic condition known as type 1 diabetes is characterized by an inability to produce insulin. Because glucose from food cannot reach cells, its concentration in the blood rises. Approximately 10% of individuals have type 1 diabetes. It is unknown what specifically causes type 1 diabetes. Insulin is essential for those with type 1 diabetes. Because of beta-cell loss and death, the pancreas is unable to produce enough insulin, which leads to type 1 diabetes.

Non-Insulin Dependent Diabetes Mellitus(T2NIDDM)

Another name for T2NIDDM is adult-onset diabetes.Insulin Resistance (IR) is a result of abnormalities in insulin secretion found in type 2 diabetes. Previously, this type was referred to as "non-insulin-dependent diabetes mellitus." It is brought on by insulin resistance and beta cell abnormalities as a result of bloodstream glucose accumulation. The illness progresses over time and manifests in phases. Hyperglycemia and FFA happen when cells do not react to insulin as they should or when the amount of insulin in the blood is decreased. Figure 1 illustrates the phases of type 2 diabetes. Blood arteries, the heart, and the patient's disease and mortality are all observed in type 2 diabetes. The most frequent reason is a mix of being overweight and not exercising. First, pre-diabetes has developed. Long-term consequences in type 2 diabetes arise in the kidney.

Gestational Diabetes Mellitus (GDM)

Pregnant women with this diabetes are classified as having GDM. Class A2 is the most prevalent heritable form of monogenic disease, and women who have experienced it require insulin or other medications. The third major form, gestational diabetes, affects pregnant women who have never had diabetes mellitus before. GDM is typically identified in the latter stages of pregnancy and frequently affects women who have never had diabetes mellitus before. An increased risk of obesity and type 2 diabetes is associated with a fetus born with diabetes mellitus. Class A1 and Class A2 are GDM's two classes. It happens in roughly 4% of pregnancies . Diet and exercise are addressed in Class A1. Globally, there is a projected 18% increase in gestational diabetes.

Other Specific Type of Diabetes Mellitus (Monogenic Types)

It focuses on endocrinopathies, LADA, and MODY. It is also brought on by genetic anomalies in the hormone insulin's internal secretion.One to five percent of those who have experienced it go on to get mutations. This covers pancreatic disorders, certain surgeries, beta cell genetic abnormalities, cancer treatments, drugs, and infections, among other things. Certain medications are used or combined with organ transplantation or HIV/AIDS treatment . Its subtypes included endocrinopathies, LADA, and MOODY.

II. CONCLUSION

The word "diabetes mellitus" refers to a group of metabolic diseases that, if untreated, all cause the blood to have excessively high levels of the sugar glucose. When the pancreas stops producing a sizable amount of the hormone insulin, it is known as diabetes mellitus type 1. This is typically caused by the autoimmune death of the pancreatic beta cells that create insulin. On the other hand, it is now believed that insulin resistance and/or pancreatic autoimmune assaults cause diabetes mellitus type 2. A person with type 2 diabetes may have normal or even abnormally high insulin production from their pancreas. Restoring a normal state of glucose metabolism is the primary objective of diabetic therapy.

People who have a complete insulin shortage need insulin replacement therapy, which is administered as injections or pills, in order to accomplish this aim. On the other hand, dietary changes and physical activity can help improve insulin resistance. Additional objectives for managing diabetes are help avoid or manage the numerous side effects that the

illness and its treatment may cause. Diabetes can become a patient's buddy by maintaining blood sugar control, and he or she can Live life to the fullest.

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REFERENCES

[1]. Ismail, Mohammad Yaheya Mohammad, and M. Yaheya. "Clinical evaluation of antidiabetic activity of Trigonella seeds and Aegle marmelos leaves." World Applied Sciences Journal 7.10 (2009): 1231-1234

[2]. Arora, Sachin, Shreesh Kumar Ojha, and Divya Vohora. "Characterisation of streptozotocin induced diabetes mellitus in swiss albino mice." *Global Journal of Pharmacology* 3.2 (2009): 81-84

[3]. Jothivel, Nandhakumar, et al. "Anti-diabetic activity of methanolleaf extract of Costus pictus D. Don in alloxan-induced diabetic rats." *Journal of Health Science* 53.6 (2007): 655-663.

[4]. Bastaki, Salim. "Diabetes mellitus and its treatment." *International journal of Diabetes and Metabolism* 13.3 (2005): 111-134.

[5]. Dixit, V. P., and S. C. Joshi. "Antiatherosclerotic effects of alfalfa meal ingestion in chicks: a biochemical evaluation." *Indian J Physiol Pharmacol* 29.1 (1985): 47-50.

[6]. Kahn, C. Ronald. "Insulin action, diabetogenes, and the cause of type II diabetes." *Diabetes* 43.8 (1994): 1066-1085.

[7]. Eshrat, M. Halim. "Effect of Coccinia indica (L.) and Abroma augusta (L.) on glycemia, lipid profile and on indicators of end-organ damage in streptozotocin induced diabetic rats." *Indian Journal of Clinical Biochemistry* 18 (2003): 54-63.

[8]. Grover, N., P. A. Bafna, and A. C. Rana. "Diabetes and methods to induce experimental diabetes." *International Journal of Pharmacy and Biological Sciences* 1.4 (2011): 414-419.

[9]. Olokoba, Abdulfatai B., Olusegun A. Obateru, and Lateefat B. Olokoba. "Type 2 diabetes mellitus: a review of current trends." *Oman medical journal* 27.4 (2012): 269.

[10]. Kumar, A., Goel, M.K., Jain, R.B., Khanna, P., Chaudhary, V. India towards diabetes control: Key issues. *Australas Med J.* **6(10):** 524–31 (2013)

[11]. Zimmet, P., Alberti, K.G., Global and societal implications of the diabetes epidemic, *Shaw J Nature*, **414(6865):**782-787 (2001)

[12]. Wild, S., Roglic, G., Green, A., Sicree, R., King, H. Global prevalence of diabetes: estimate for the year 2000 and projections for 2030. *Diabetes Care,* **127(5):**1047-1053 (2004)

[13]. Ramchandran, R., Das, A.K., Joshi, S.R.., Current status of diabetes in India and need for novel therapeutic agents, *Suppliment to Japi*, **58:** 7-9 (2010)

[14]. Joshi, S.R., Parikh, R.M.. India - diabetes capital of the world: now heading towards hypertension. *J Assoc Physicians India*. **55:** 323–4 (2007)

[15]. Whiting, D., Guariguata, L., Weil, C., Shaw, I.D.F., Diabetes atlas: Global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes Res Clin Pract*., **94:** 311–21 (2011)

[16]. World Health Organization. *Definition, diagnosis and classification of diabetes mellitus and its complications: report of a WHO consultation. Part 1, Diagnosis and classification of diabetes mellitus*. No. WHO/NCD/NCS/99.2. World health organization, 1999.

[17]. Nagesh, M. Reddi, N. Vijayakumar, and Keserla Bhavani. "A review on diabetes mellitus-an annihilatory metabolic disorder." *Journal of Pharmaceutical Sciences and Research* 12.2 (2020): 232-235.

[18]. Kumar, Roshan, et al. "A review on diabetes mellitus: type1 & Type2." *World Journal of Pharmacy and Pharmaceutical Sciences* 9.10 (2020): 838-850.

[19]. American Diabetes Association. "2. Classification and diagnosis of diabetes: standards of medical care in diabetes—2020." *Diabetes care* 43.Supplement_1 (2020): S14-S31.

[20]. Lal, B. Suresh. "Diabetes: causes, symptoms and treatments." *Public health environment and social issues in India* 1 (2016): 1-8.

[21]. Srivastava, Namrata, M. Chandra, and Nitesh. "Diabetes and the retinal changes in the eye: a threat to the sight." *International Journal of Community Medicine and Public Health* 11.2 (2024): 1030.

[22]. Fagninou, A., et al. "Diabetes mellitus: classification, epidemiology, physiopathology, immunology, risk factors, prevention and nutrition." *Int J Adv Res* 7.7 (2019): 855-63