

A Review of Management and Treatment of Diabetes Mellitus

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Abstract:- This section discusses diabetes and its complications, which include immune system dysfunction, periodontal disease, retinopathy, nephropathy, neuropathy (both somatic and autonomic), cardiovascular diseases, and diabetic foot. Diabetes is classified into two types: Type I (Insulin-Dependent Diabetes Mellitus, IDDM) and Type II (Non-Insulin Dependent Diabetes Mellitus, NIDDM). Type I diabetes is an autoimmune disorder, characterized by an inflammatory response around the insulin-producing islet cells, leading to their destruction. In contrast, Type II diabetes is primarily associated with insulin resistance and decreased insulin production.

Diabetes is defined through self-reporting or elevated blood glucose levels, with values of ≥ 126 mg/dL for fasting glucose or ≥ 220 mg/dL for non-fasting glucose. According to the International Diabetes Federation (IDF), 8.8% of adults worldwide are affected by diabetes, with a higher prevalence in men (9.6%) compared to women (9.0%).

Treatment for diabetes often involves medications such as sulfonylureas, biguanides, and GLP-1 receptor agonists. Adopting seven key self-care practices—such as maintaining a healthy diet, regular exercise, blood sugar management, medication adherence, effective problem-solving, positive coping strategies, and risk reduction—can significantly improve health outcomes for people with diabetes.

Keywords:- Diabetes Mellitus, Classification, Treatment & Management, Diagnosis

I. INTRODUCTION

Diabetes mellitus is a metabolic condition that occurs when there is a dysfunction in the secretion or action of insulin, or both. This leads to long-term high blood sugar levels (hyperglycemia) and impairments in the body's ability to properly absorb and utilize proteins, fats, and carbohydrates due to inadequate insulin. (Bastaki et al, (2005) the ancient Egyptians were the first to document diabetes, recognizing symptoms like frequent urination and weight loss. The term "diabetes mellitus" was later coined by the Greek physician Aretaeus. "Diabetes" is derived from the Greek word meaning "to pass through," while "mellitus" comes from Latin, meaning "honey" or "sweetness." By 2025, an estimated 380 million people worldwide will have diabetes, a significant increase from 194 million in 2003. The United States, China, and India are projected to be the country's most affected by this global health issue. (Kaul et al, (2013) Key conclusions and criteria for diagnosing diabetes include self-reporting or elevated capillary blood glucose levels (≥ 126 mg/dL when fasting or ≥ 220 mg/dL when non-fasting). (Varghese et al 2023)

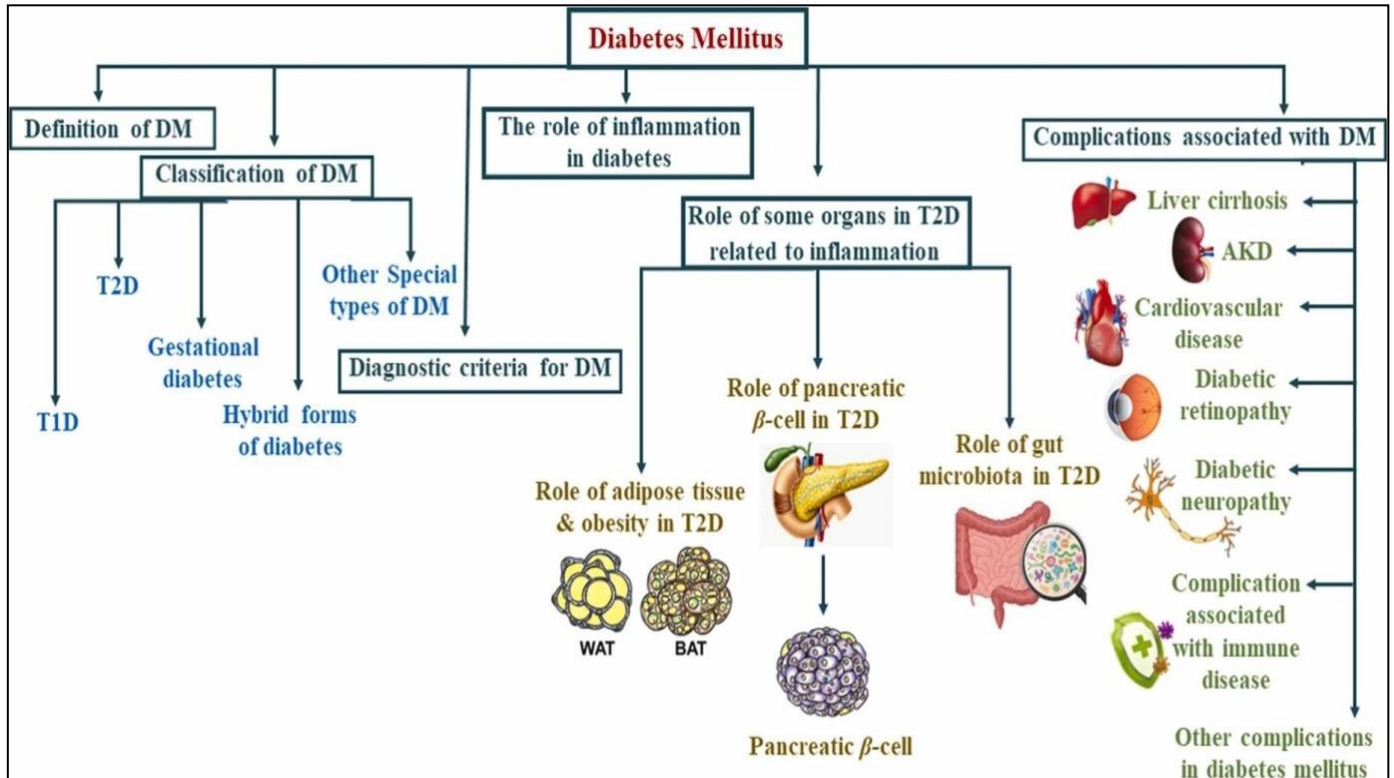


Fig 1: Diabetes Mellitus (Antar et al, 2023)

Diabetes mellitus is classified into two main types: Type I, known as Insulin-Dependent Diabetes Mellitus (IDDM), and Type II, referred to as Non-Insulin Dependent Diabetes Mellitus (NIDDM). Type I diabetes is an autoimmune disorder characterized by a targeted inflammatory response

around the islets, leading to the destruction of insulin-producing cells. In contrast, Type II diabetes is defined by peripheral insulin resistance and a reduction in insulin production. (Deshmukh et al, 2015)

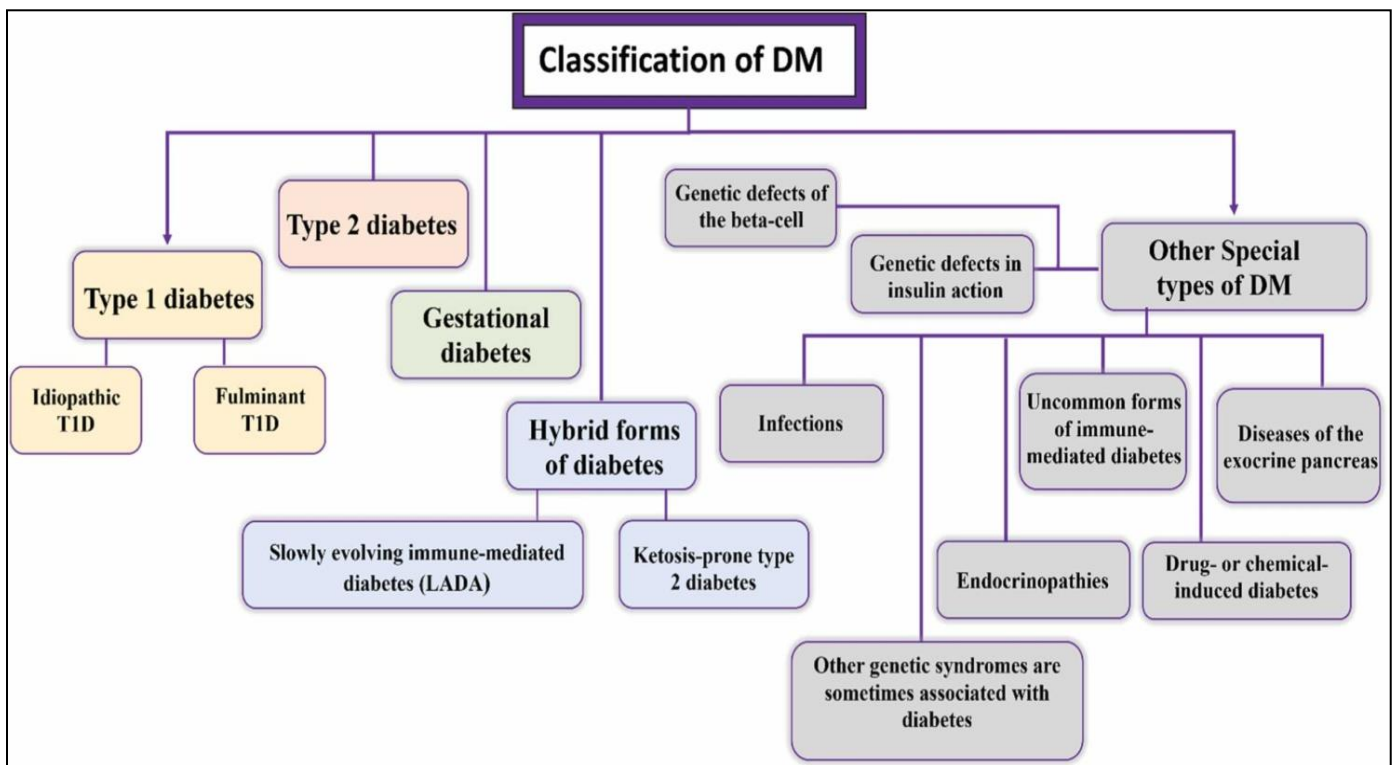


Fig 2: Classification of DM (Antar et al, 2023)

II. EPIDEMIOLOGY

According to the International Diabetes Federation (IDF), 8.8% of adults worldwide are affected by diabetes, with a higher prevalence in men (9.6%) compared to women (9.0%). The Western Pacific region has the highest number of individuals with diabetes, totaling 163 million, followed by South-East Asia with 88 million, Europe with 59 million, the Middle East and North Africa with 55 million, and North America and the Caribbean with 47.6 million. In 2019, China (116.4 million), India (77.0 million), and the United States (31.0 million) had the largest populations of people with diabetes. By 2030 and 2045, the highest numbers are still expected to be in China (140.5 million and 147.2 million,

respectively) and India (101.0 million and 134.2 million, respectively). (Pradeepa et al 2021).

- Diabetes In Indian Population:** India, the most populous country in the world, has 74 million individuals living with diabetes, contributing to 14% of the global diabetes burden. To address and manage major non communicable diseases, the National Health Mission of India launched the National Programmed for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS) in 2010. (Varghese et al 2019-2021)

III. TREATMENT OF DIABETES

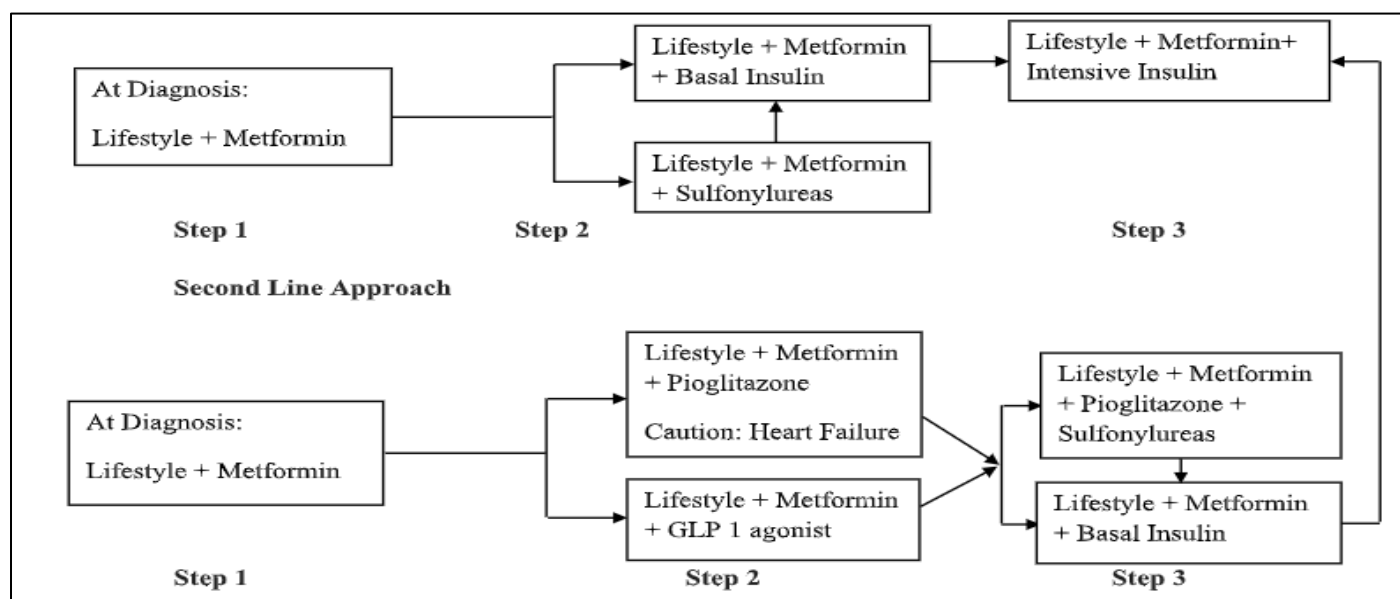


Fig 3: Treatment flow sheet for Type 2 Diabetes (Imam et al 2013)

A. Anti-Diabetic Medications

Anti-diabetic medications can be broadly classified into two types: oral medications and injectable medications.

B. Oral Anti-Diabetic Medications

➤ Insulin Secretagogues

- Sulfonylureas

- ✓ *First-generation:* Tolbutamide, Chlorpropamide, Acetohexamide

- ✓ *Second-generation:* Glimpiride, Glibenclamide (Glyburide), Gliclazide, Glipizide

- Meglitinides

- ✓ Examples include Repaglinide and Nateglinide

➤ Insulin Sensitizers

- Biguanides

- ✓ Includes Metformin and Phenformin

- Thiazolidinediones

- ✓ Includes Pioglitazone and Rosiglitazone

➤ Alpha-Glucosidase Inhibitors

- ✓ Includes Acarbose and Miglitol

➤ Dipeptidyl Peptidase-4 (DPP-4) Inhibitors

- ✓ Examples are Sitagliptin, Vildagliptin, and Saxagliptin

C. Injectable Anti-Diabetic Medications

➤ Glucagon-like Peptide-1 (GLP-1) Receptor Agonists

- Examples include Exenatide and Liraglutide

➤ *Amylin Analogues*

- Includes Pramlintide

➤ *Insulin*

- *Conventional Insulin*

- ✓ Examples are Regular Insulin and Intermediate-acting Insulin (NPH)

➤ *Mechanism of Action*

- *Insulin Analogues*

- ✓ *Ultra Short-Acting:* Lispro, Aspart, Glulisine
- ✓ *Long-Acting:* Glargine, Detemir

- **Sulfonylurea** – Sulfonylureas are among the most commonly prescribed and widely accepted oral medications for diabetes management. They are relatively effective, lowering HbA1c levels by 1% to 2% and reducing blood glucose levels by approximately 20%. (Imam et al 2013)

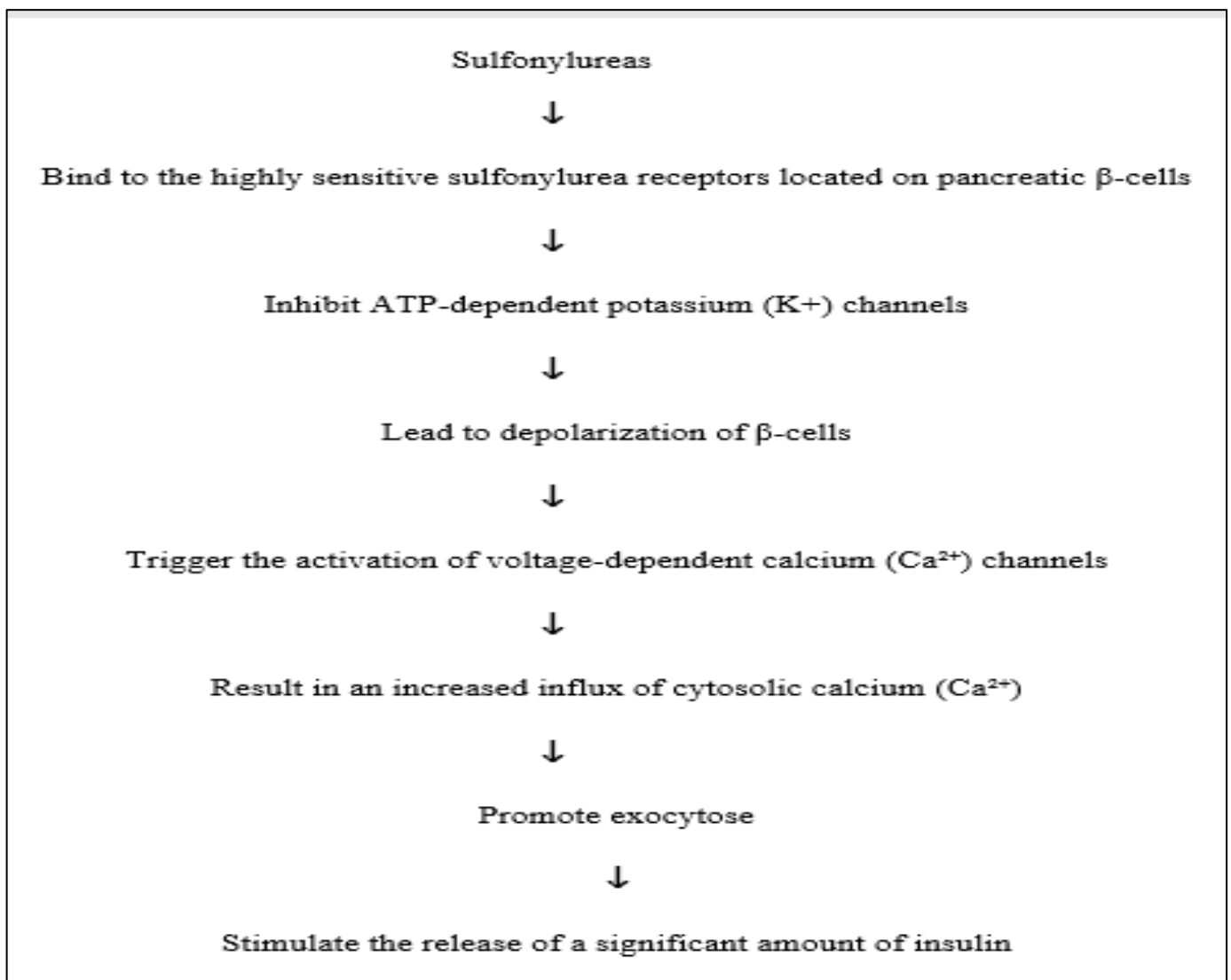


Fig 4: Flowchart (Srivani et al, 2019)

IV. MANAGEMENT OF DIABETES

Managing diabetes involves developing a deeper understanding and implementing strategies to navigate its complexity within a social context. Individuals with diabetes who adopt seven essential self-care practices tend to achieve better outcomes. These practices include maintaining a healthy diet, engaging in regular physical activity, monitoring

blood sugar levels, adhering to prescribed medications, employing effective problem-solving skills, utilizing positive coping strategies, and taking measures to reduce risks. Research indicates that these seven behaviors are strongly associated with improved blood sugar control, a reduction in complications, and an overall enhancement in quality of life. (Shrivastava et al 2013)

V. DIAGNOSIS OF DIABETES MELLITUS

- **Diagnostic Criteria:** Diabetes mellitus can be diagnosed using the following criteria: a random blood glucose level of 200 mg/dL (11.1mmol/L) or higher, fasting plasma glucose of 126 mg/dL (7.0mmol/L) or more, or a 2-hour plasma glucose level exceeding 200 mg/dL (11.1mmol/L) during an oral glucose tolerance test (oGTT). Additionally, an HbA1c value of 6.5% (48mmol/mol Hb) or above is also indicative of diabetes.
- **Elevated Fasting Glucose (EFG):** EFG is defined by fasting plasma glucose levels ranging between 100 and 125 mg/dL (5.6–6.9 mmol/L).
- **Elevated Glucose Tolerance (EGT):** EGT refers to a 2-hour plasma glucose result in the oGTT between 140 and 199 mg/dL (7.8–11.0 mmol/L) combined with a fasting glucose level below 126 mg/dL (less than 7.0mmol/L).
- Many individuals with impaired glucose regulation exhibit both EFG and EGT, indicating abnormalities in glucose metabolism. (Petersmann et al, 2018).

➤ *Diagnostic Procedure*

- **Symptoms of Diabetes:** Common symptoms include unexplained weight loss, frequent urination (polyuria), and excessive thirst (polydipsia), among others.
- **Increased Risk of Diabetes:** Risk factors can be assessed using tools such as diabetes risk questionnaires or by identifying the presence of associated or concurrent conditions.

➤ *Determination of Diabetes Markers*

- **Venous Occasional Plasma Glucose (VOPG):** Measurement of random plasma glucose levels.
- **Fasting Plasma Glucose (FPG):** Assessment of glucose levels after a period of fasting.
- **HbA1c Value:** Evaluation of average blood sugar levels over the past 2 to 3 months.

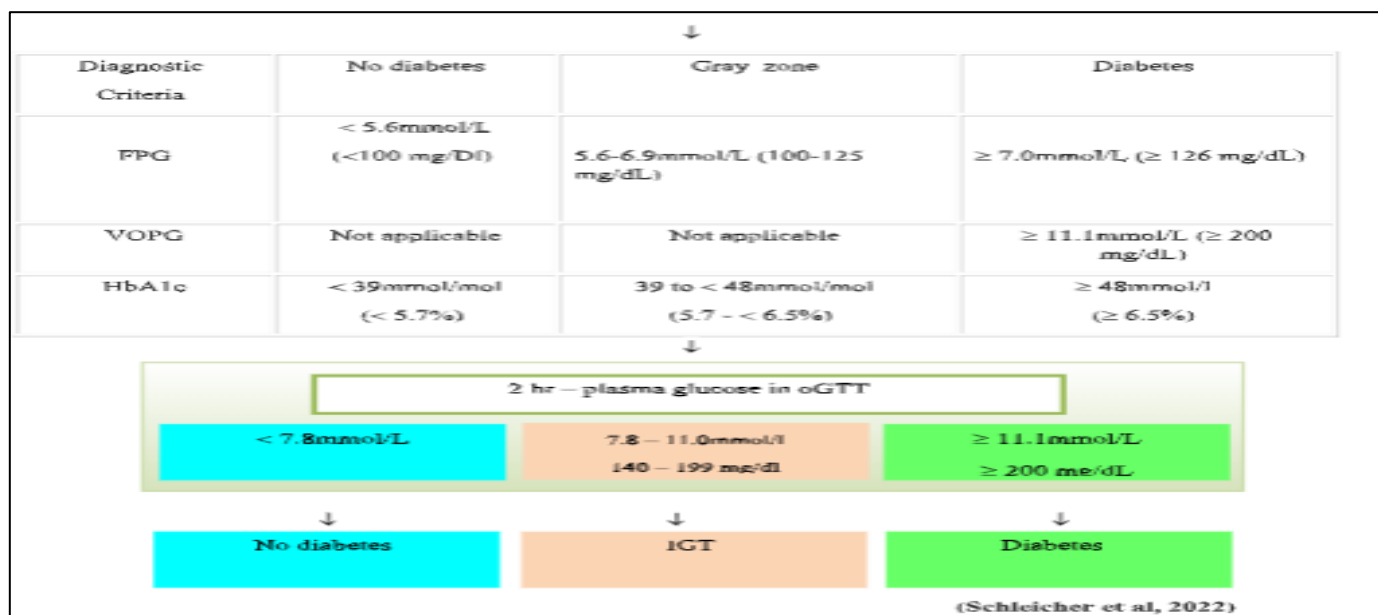


Fig 5: Diabetes Markers

VI. CONCLUSION

Diabetes mellitus has become a significant challenge in today's world. Lifestyle choices and contemporary circumstances play a crucial role in the development of this serious condition. This review provides insights into various aspects of diabetes mellitus, enhancing our understanding of the disease.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest related to the publication of this study.

ACKNOWLEDGEMENT

The authors express their gratitude to the Director and library staff for providing the necessary resources and support for this review.

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