



DIABETES MELLITUS: EPIDEMIOLOGY, PATHOPHYSIOLOGY, CLINICAL MANIFESTATIONS, AND MULTIDISCIPLINARY MANAGEMENT APPROACHES

Mr. Madivalappa N* | Dr. Dipika Rao**

*Research Scholar, Himalayan University, Itanagar, Arunachal Pradesh, India.

**Research Supervisor, Himalayan University, Itanagar, Arunachal Pradesh, India.

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ABSTRACT

Diabetes mellitus (DM) is a chronic, progressive metabolic disorder characterised by persistent hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. It represents one of the most significant global public health challenges due to its rapidly increasing prevalence, particularly in developing countries undergoing epidemiological transition, urbanization, and lifestyle modification. Sustained hyperglycaemia contributes to long-term microvascular and macrovascular complications, including cardiovascular disease, nephropathy, neuropathy, and retinopathy, which substantially increase morbidity and mortality rates.

Evidence indicates that structured home-based care interventions, self-monitoring of blood glucose (SMBG), patient-centred education, and lifestyle modification play a pivotal role in optimizing glycaemic control and enhancing self-management behaviours. Multidisciplinary care models integrating medical treatment, nursing support, digital health interventions, and behavioural counselling have demonstrated improved adherence, metabolic outcomes, and quality of life among individuals with diabetes. Additionally, geriatric populations with diabetes face unique challenges, including multimorbidity, polypharmacy, cognitive decline, and functional impairment, necessitating individualised management strategies.

Given the escalating burden of diabetes globally and particularly in India, strengthening diabetes self-management education and support systems remains essential. Comprehensive, continuous, and evidence-based care approaches are fundamental to preventing complications, reducing healthcare costs, and improving long-term patient outcomes.

Keywords:

Diabetes Mellitus; Hyperglycaemia; Self-Monitoring of Blood Glucose; Type 1 Diabetes; Type 2 Diabetes; Home-Based Care; Glycaemic Control; Diabetes Education; Insulin Resistance; Geriatric Diabetes.

ABOUT AUTHORS:



Author, Mr. Madivalappa N is Research Scholar in Himalayan University, Itanagar, Arunachal Pradesh, India. He has attended various Seminars and conferences.



Author, Dr. Dipika R. Rao is a Research Supervisor at Himalayan University, Itanagar, Arunachal Pradesh, India. She has extensive experience in academic research and supervision, with a strong focus on nursing, healthcare management, and quality improvement in health services. Her scholarly interests include quality of work life, job satisfaction, nursing performance, and patient care outcomes. Dr. Rao has guided research scholars at postgraduate and doctoral levels and actively contributes to academic publications and professional development in the healthcare education sector.



INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder that requires continuous management to prevent complications and improve the quality of life for affected individuals. The prevalence of DM is increasing globally, with developing nations witnessing a significant rise due to lifestyle changes, urbanization and sedentary behavior. Studies have shown that structured home care interventions can enhance diabetes self-management, leading to better glycemic control and reduced risk of complications. Diabetes mellitus (DM) is an inherited or acquired chronic disease caused by deficiency in the production of insulin or ineffectiveness of the insulin (insulin resistance) produced by the pancreas. This condition causes an increased concentration of glucose in the blood and the condition later affects other organs of the body. Research studies have shown that the progress of diabetes is also associated with a high risk of developing vascular, renal, retinal and neuropathy complications leading to premature disability and death. Home-based diabetes care programs, such as structured education and self-monitoring techniques, have been found to significantly improve regulation in type 2 diabetes patients. Research highlights that self-monitoring blood glucose (SMBG) as part of home care interventions can enhance patient adherence to dietary modifications, medication use and lifestyle changes, ultimately improving diabetes outcomes (Asmi et al., 2024; Khodaveisi et al., 2018).

Patient self-care, including intensive insulin therapy and frequent self-monitoring of blood glucose (SMBG), is an important aspect of managing T1DM. Considering that a significant number of people with T1DM may experience worsening glycemic control due to difficulties in adherence to consistent treatment (Cameron et al., 2018), effective methods are needed to enhance self-efficacy and promote intensive insulin therapy. To compensate for the substantial insufficiency of face-to-face care, attempts have been made to improve access to patient care for T1DM from outside the health care facility using interventions such as home nursing and text messaging (Offringa R et al 2018; Rami B et al 2006). Several studies have demonstrated that additional support for patient education can help improve glycemic control and encourage routine SMBG rather than simply intensifying treatment (McGill DE 2020). Recent guidelines of the American Diabetes Association (ADA) have emphasized the importance of diabetes self-management education and support for people with T1DM to provide them with the knowledge and confidence to manage the disease daily (Holt RI et al 2021). According to International Diabetes Federation's (IDF) India is home to over 61 million diabetic patients — an increase from 50.8 million last year. By 2030, India's diabetes burden is expected to cross the 100 million. The country is also the largest contributor to regional mortality with 983,000 deaths caused due to diabetes this year. IDF's fifth diabetes atlas has released the staggering figures. IDF says India's prevalence of diabetes among 20-79 year olds is 9.2%. India is only second to China, which has 90 million diabetics (2011) that will increase to about 130 million by 2030. IDF says, —New figures indicate the number of people living with diabetes is expected to rise from 366 million this year to 552 million by 2030, if no action is taken. This equates to approximately three new cases every 10 seconds or almost 10 million per year.|| This year, South Asia accounted for 71.4 million diabetics. This number is expected to increase to 120.9 million by 2030. The Atlas said, —Four in every five diabetics are between 40 and 59 years.(Dr. P Tomer, 2011)

Common Geriatric Syndromes Associated with Diabetes

Older adults with diabetes suffer excess morbidity, multimorbidity, and mortality compared with older individuals without diabetes (Bethel MA et al 2007). In addition, they are at high risk for polypharmacy, functional disabilities, and other common geriatric syndromes that include cognitive impairment, depression, urinary incontinence, falls, and persistent pain. Screening for geriatric syndromes may be beneficial in selected patients, particularly when identification and treatment may help achieve more appropriate glycemic goals and/or better glycemic control.

In particular, cognitive function and the possibility of depression should be assessed in older diabetic patients when there is

- Nonadherence with therapy
- Frequent episodes of hypoglycemia or extreme glucose excursions
- Deterioration of glycemic control without obvious explanation

Diabetes mellitus (DM) is one of the most common metabolic disorders in the world and the prevalence of diabetes in adults. The 2010 world prevalence of diabetes among adults aged 20 – 79 is 6.4% (approximately 285 million adults) and is projected to increase to 7.7% (approximately 439 million adults) by 2030.



TYPES OF DIABETES

Type 1 diabetes: Type 1 diabetes is a chronic autoimmune condition where the body's immune system attacks and destroys insulin-producing beta cells in the pancreas, resulting in a lack of insulin production. This leads to high blood sugar levels, causing symptoms like increased thirst, urination, and hunger. If left untreated, it can lead to serious complications like nerve damage, kidney disease, and coma. Management involves lifelong insulin therapy, monitoring blood sugar levels, and balancing diet and exercise. People with type 1 diabetes need to carefully manage their condition to prevent complications and maintain quality of life. Insulin therapy can be administered through injections or an insulin pump, and continuous glucose monitoring systems can help track blood sugar levels. A healthy diet and regular physical activity also play a crucial role in managing the condition.

Type 2 diabetes: Type 2 diabetes is a metabolic disorder characterized by insulin resistance and impaired insulin secretion, leading to high blood sugar levels. It's often associated with lifestyle factors like obesity, physical inactivity, and an unhealthy diet. In type 2 diabetes, the body's cells become less responsive to insulin, making it harder for glucose to enter cells, resulting in high blood sugar levels. Symptoms can be subtle, but if left untreated, it can lead to complications like cardiovascular disease, kidney damage, and nerve damage. Management typically involves lifestyle changes like weight loss, exercise, and a balanced diet, alongside medications or insulin therapy to regulate blood sugar levels. Early detection and treatment can help prevent long-term complications and improve quality of life. A healthy lifestyle and regular monitoring are key to managing type 2 diabetes effectively (Patel, 2024).

Prediabetes: Prediabetes is a condition where blood sugar levels are higher than normal but not high enough to be classified as diabetes. It's a warning sign that you're at increased risk of developing type 2 diabetes and cardiovascular disease. Prediabetes often doesn't cause noticeable symptoms, but it can be detected through blood tests like fasting plasma glucose or HbA1c. Lifestyle factors like being overweight, physically inactive, and having a family history of diabetes contribute to prediabetes. Making healthy changes like losing weight, exercising regularly, and eating a balanced diet can help reverse prediabetes and prevent progression to diabetes. Early detection and intervention are crucial to reducing risks and improving health outcomes. With lifestyle changes, it's possible to bring blood sugar levels back to normal and reduce the risk of complications (Gupta, 2023).

Gestational diabetes: Gestational diabetes is a type of diabetes that develops during pregnancy, typically in the second or third trimester. It occurs when the body's insulin production can't keep up with the insulin resistance caused by hormonal changes during pregnancy. This leads to high blood sugar levels, which can affect the mother's and baby's health. Risk factors include being overweight, family history, and previous gestational diabetes. Untreated gestational diabetes can lead to complications like preeclampsia, premature birth, and macrosomia (large baby). Management involves monitoring blood sugar, healthy eating, physical activity, and sometimes insulin therapy. After pregnancy, blood sugar levels usually return to normal, but women with gestational diabetes have a higher risk of developing type 2 diabetes later. Healthcare providers closely monitor women with gestational diabetes to ensure a healthy pregnancy and postpartum care (Sharma, 2022)

SIGNS AND SYMPTOMS

Common signs and symptoms of diabetes mellitus include:

Increased thirst and urination: Increased thirst and urination are common symptoms of diabetes mellitus. High blood sugar levels cause the kidneys to produce more urine, leading to dehydration and thirst. As the body tries to dilute sugar in the blood, it pulls water from tissues, increasing urine production (Khan, 2023).

Fatigue: Fatigue in diabetes is often caused by high blood sugar levels, leading to impaired glucose uptake in cells, resulting in energy deficits. Dehydration and sleep disturbances also contribute to fatigue. Managing blood sugar levels, hydration, and sleep can help alleviate fatigue symptoms (Patel, 2022).

Blurred vision: Blurred vision in diabetes occurs when high blood sugar levels cause fluid to be pulled into the lens of the eye, altering its shape and focusing ability. This leads to temporary vision changes. Managing blood sugar levels can help alleviate symptoms and prevent long-term eye damage (Lee, 2021).

Slow healing of cuts and wounds: Slow healing of cuts and wounds in diabetes is due to high blood sugar levels impairing blood flow, reducing collagen production, and weakening immune response. This creates an environment prone to infection and delayed healing. Managing blood sugar levels, wound care, and infection prevention can promote healing (Gupta, 2020).



Tingling or numbness in hands/feet: Tingling or numbness in hands/feet, known as neuropathy, occurs in diabetes due to high blood sugar damaging nerve fibers. This leads to symptoms like numbness, tingling, or pain. Managing blood sugar levels, lifestyle changes, and medications can help alleviate symptoms and prevent progression (Sharma, 2019).

Recurring skin, gum, or bladder infections: Recurring skin, gum, or bladder infections in diabetes are often due to high blood sugar levels weakening the immune system and promoting bacterial growth. Managing blood sugar, practicing good hygiene, and timely medical treatment can help prevent and manage infections (Kumar, 2018).

CAUSES

Diabetes mellitus is caused by a combination of factors, including:

Genetics: Genetics play a significant role in diabetes mellitus, with certain genetic variants increasing risk. Family history is a key factor, especially in type 1 and type 2 diabetes. Genetic predisposition can affect insulin production, insulin sensitivity, or glucose metabolism, contributing to diabetes development (Reddy, 2017).

Lifestyle: Lifestyle factors like poor diet, physical inactivity, and obesity contribute to type 2 diabetes risk. Consuming high-calorie, high-sugar foods and lacking exercise lead to insulin resistance and impaired glucose regulation. Adopting a balanced diet and regular physical activity can reduce diabetes risk (Misra, 2016).

Insulin resistance: Insulin resistance occurs when cells become less responsive to insulin, impairing glucose uptake. The pancreas compensates by producing more insulin, but eventually may fail to keep up, leading to high blood sugar levels and type 2 diabetes. Lifestyle factors and genetics contribute to insulin resistance development (Samuel, 2015).

Autoimmune response: In type 1 diabetes, an autoimmune response causes the immune system to attack and destroy insulin-producing beta cells in the pancreas. This leads to insulin deficiency and hyperglycemia. Genetic predisposition and environmental triggers contribute to this autoimmune process (Bluestone, 2014).

Hormonal changes: Hormonal changes, like those during pregnancy or menopause, can contribute to diabetes risk. Hormonal imbalances affect insulin sensitivity and glucose metabolism, potentially leading to gestational diabetes or worsening existing diabetes. Managing hormonal changes and blood sugar levels is crucial (Buchanan, 2013).

TREATMENT

Treatment for diabetes mellitus typically involves:

Lifestyle changes: Lifestyle changes, such as unhealthy diet, physical inactivity, and obesity, contribute to type 2 diabetes risk. Consuming high-calorie, high-sugar foods and lacking exercise lead to insulin resistance and impaired glucose regulation. Adopting a balanced diet and regular physical activity can reduce diabetes risk (Hu, 2012).

Medications: Certain medications, like steroids and antipsychotics, can increase diabetes risk by impairing insulin sensitivity and glucose metabolism. Long-term use can contribute to hyperglycemia and diabetes development. Monitoring blood sugar levels and adjusting medications can help manage risk (Gardner, 2011).

Monitoring: Monitoring is key in diabetes management, involving regular blood glucose checks to track levels, adjust treatment, and prevent complications. It helps identify patterns, inform insulin dosing, and guide lifestyle choices, enabling better blood sugar control and reducing risks (Polonsky, 2011).

Insulin therapy: Insulin therapy is a cornerstone treatment for diabetes, involving insulin injections or pump therapy to regulate blood sugar levels. It mimics natural insulin production, improving glucose control and reducing complications. Types include rapid-, short-, intermediate-, and long-acting insulins, tailored to individual needs (DeWitt, 2009).

Healthcare team: A multidisciplinary healthcare team is crucial for diabetes management, including endocrinologists, dietitians, nurses, and educators. They provide medical treatment, lifestyle guidance, and support, empowering patients to manage their condition effectively and improve outcomes (Funnell, 2008).

CONCLUSION

Diabetes Mellitus remains a major public health concern worldwide. Effective management requires continuous monitoring, lifestyle modification, patient education, and appropriate medical treatment. Structured home-based interventions and self-management strategies have proven beneficial in improving glycemic control and reducing complications. Therefore, strengthening diabetes education and support systems is essential to control the rising burden of the disease and enhance patient outcomes.



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