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Delaying onset of Type 2 Diabetes Complications through Self-Management: A Narrative Review

Review Article

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Abstract

Diabetes Mellitus is a metabolic disorder that is caused by reduced insulin secretion or insulin resistance. It is of three types but the most common form is Type 2 Diabetes Mellitus (T2DM). The prevalence of T2DM was estimated 285 million in 2009 by The International Diabetes Federation (IDF), which increased at an alarming rate of 536.6 million in 2021. This review article focused on the researches being done on diabetes complications and the self-management practices used to control them. The studies and government reports that show data on the role of self management practices in preventing the ill effects of diabetes were included. Intervention-based studies were excluded. The data was collected from recent researches through several search engines. Indian data on diabetes have been extracted through National Family Health Survey-05 (NFHS-05). The most prevalent complications were found to be acute (hypoglycemia and hyperglycemia) and chronic macro-vascular (heart attack and stroke) and micro-vascular (retinopathy, nephropathy and neuropathy). According to The American Association of Diabetes Educators (AADE), seven self-care behaviours, namely healthy eating, being active, monitoring, taking medicines, problem-solving, healthy coping and reducing risks are key indicators of good glycemic control and preventing diabetes complications. Also, patient-oriented diabetes self-management education (DSME) was found to be equally effective. These education programs must target to raise the way of living of diabetic people through healthy eating practices and physical activities; managing body weight, HbA_{1c} and lipid levels; understanding diabetes, keeping track of glucose levels and knowing the importance of compliance with medication; emotional encouragement and terminating the use of alcohol and tobacco.

Keywords: Metabolic Disorder; Self-Care; Glycemic Control; Patient-Oriented.

Abbreviations

T2DM (Type 2 Diabetes Mellitus), IDF (International Diabetes Federation), NFHS (National Family Health Survey), AADE (American Association of Diabetes Educators), DSME (Diabetes Self-Management Education)

Introduction

Diabetes Mellitus is a metabolic disorder indicated by poor metabolism of macronutrients namely carbohydrates, proteins and fats. It is an outcome of reduced insulin secretion, insulin resistance or collaboration of both the factors. It is categorized into three main types: Type 1 Diabetes Mellitus (T1DM), Type 2 Diabetes Mellitus (T2DM) and Gestational Diabetes and the most common form is T2DM as it can be seen in more than 90% of all diabetes cases worldwide [1]. The rate of T2DM cases has been increasing at an alarming rate in recent decades [2-5]. The major reason behind this outbreak is urbanization and changing lifestyle of people, adopting the sedentary mode of living [6].

Prevalence of Type 2 Diabetes Mellitus

The International Diabetes Federation (IDF) evaluated the worldwide prevalence of T2DM and found that the total count was 285 million in 2009 [7], 366 million in 2011 [8], 382 million in 2013 [9], 415 million in 2015 [10], 425 million in 2017 [11], 463 million in 2019 [12], and 536.6 million in 2021 [13]. The National Family Health Survey (NFHS-5) report of 2019-21 revealed the total sum of diabetic people in both urban and rural areas in India. It concluded that 6.1% adult women and 7.3% adult men have blood sugar level of 141-160 mg/dl (high). Likewise, 6.3% women and 7.2% men were

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at blood sugar level of >160 mg/dl (very high) and 13.5% women and 15.6% men were those who took medicines to control their blood sugar level [14].

This literature review has been done on related studies by different researchers across the world. It comprises the findings of researchers and their viewpoint on diabetes complications and their treatment. Those studies and government reports were included which show data on the prevalence rate of T2DM and the role of self management practices in preventing the ill effects of diabetes. Those studies were excluded from the current review which were intervention-based. The data was collected from recent researches through Google Scholar, PMC, Science Direct Elsevier and a well-known Scopus indexed journal 'Diabetes Care'. The IDF records have also been used. American Diabetes Association (ADA) position statements were taken into consideration while searching the data. Indian data like the prevalence rate of diabetes have been extracted through the latest survey by NFHS (NFHS-05). Supplementary data were collected through the Google search engine. Certain keywords were used to make the search easier, such as: Type 2 diabetes mellitus, macro-vascular complications of diabetes, diabetes retinopathy, stroke in T2DM, management of hyperglycemia in type 2 diabetes, self management of diabetes, self management in diabetes complications, acute complications of type 2 diabetes and so forth.

Type 2 Diabetes Complications

When it comes to the diagnosis of T2DM, many times aberrant symptoms make it difficult to self-evaluate T2DM. Thus, while medical prognosis, some patients remain asymptomatic while others came with alarming hyperglycemia or even diabetes ketoacidosis [15]. The management of T2DM becomes a complex process through several patho-physiological defects [1, 16] and 'ABCDE' of diabetes management, comprises of Age, Body weight, Complications, Duration of disease, Education, expense and etiology [17]. It is a persistent disorder that demands full-time medical support, self-supervision for deviated blood glucose levels, lipid profile and blood pressure. These factors will assist in intercepting acute (hypoglycemia and hyperglycemia) as well as chronic macro-vascular (heart attack and stroke) and micro-vascular (retinopathy, nephropathy and neuropathy) complications [17-19]. The data on rising cases of diabetes complications in the young adult population residing not only in underserved communities, making it difficult to work for its prevention [20].

In people with T2DM, there is a positive relationship between severe hypoglycaemia and rising death rate [21- 22]. Hypoglycemia, when uncontrolled, may lead to perplexity, seizure, coma [23], treatment-related shakiness, excessive fatigue, ravenousness, reduced muscle strength and headache. Also, the recurrence and intensity of hypoglycemic episodes have a great effect on life quality of the patients [24].

Atherosclerotic Cardiovascular Disease (ASCVD), commonly known as Coronary Heart Disease (CHD) is the foremost cause of death in diabetic patients. The patients with CHD and diabetes pay higher medical expenditures i.e., approximately $37.3 billion for seeking cardiovascular-related care [25]. Heart failure is another big reason for death among diabetic patients. Data from recent studies showed that the heart failure cases were twice in diabetic patients than in non-diabetic patients [26- 27]. To prevent and manage the risk of ASCVD and heart failure effectively, diabetic patients must have their routine check-ups for cardiovascular disease (CVD) risk factors at least once a year. These risk factors may be obesity, hypertension, dyslipidemia, smoking, family history of premature CHD, chronic kidney disease (CKD) and presence of albuminuria [28]. It is evident that the treatment of heart diseases in association with hypertension, hyperglycemia, dyslipidemia and microalbuminuria may reduce the risk of both macro-vascular and micro-vascular complications of T2DM [29]. High blood pressure is a vital consequence for both ASCVD and micro-vascular complications and many studies proved that antihypertensive therapy decrease ASCVD chances, heart failure and micro-vascular complications [30]. Also, randomized controlled trials (RCT) have exhibited that diabetic patients should be treated to reach the target of less than 140/90 mmHg [28]. T2DM can lead to stroke and thus becomes a major reason behind the deaths of diabetic patients [31- 33]. Cardio-metabolic agents like excessive body weight, high blood pressure and deviated lipid levels in the body are usually accompanied with T2DM and lead to higher chances of suffering from stroke as compared to the non-diabetic population [32,34- 36].

Diabetic retinopathy is a tremendously particular micro-vascular complication in diabetes which largely depends on the duration of diabetes and the extent of glycemic control [37]. It is the most commonly occurring eye disorder, comprising of various forms such as glaucoma and cataract in people with diabetes (aged 20-74) residing in developing nations [28]. It is found to be the foremost reason of preventable blindness among working-aged (20-74 years) diabetic people in many countries [38]. Because of T2DM, patients may also suffer from CKD which is thus known as diabetic kidney disease or diabetic nephropathy and is likely to occur in 20-40% of T2DM patients [39- 42]. A variety of clinical trials analyzed that glycemic control has a direct effect on the prevention of CKD and its advancement. The outcome of glucose-lowering therapies on CKD could help elucidate glycated haemoglobin targets [28]. Diabetic neuropathy is nerve dysfunctionality that occurs in patients with uncontrolled diabetes mellitus and categorizes as peripheral, autonomic, proximal and focal. Because of irregular dispersal of pressure, diabetic foot ulcers may evolve. The timely diagnosis of diabetic neuropathy helps in a lesser cost of hospital stay and lesser chances of lower-limb amputations. The probability of getting suffered from all these complications may be decreased at a remarkable level by a controlled blood glucose level, early diagnosis, screening and treatment, and providing proper diabetes management education [43].

Self-Management in Type 2 Diabetes Mellitus

Self-management can be understood as the process of dynamic involvement of patients in their long-term treatment of disease [44]. The American Association of Diabetes Educators (AADE) elucidates AADE7 Self-Care Behaviours (healthy eating, being active, monitoring, taking medicines, problem-solving, healthy coping and reducing risks) as a foundation for patient-oriented diabetes self-management education (DSME) and care [45]. DSME is a way to

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incorporate the understanding and ability for self-care. The agenda of this process is to reinforce decision-making, self-care practices, coping strategies and coordination with the health professionals to heighten the standard of living [46]. These education programs must target to raise the way of living of diabetic people through healthy eating practices and physical activities; managing body weight, HbA_{1c} and lipid levels; understanding diabetes, keeping track of glucose levels and knowing the importance of compliance with medication; emotional encouragement and terminating the use of alcohol and tobacco [47]. The complications of T2DM aggravate the patient's health consequences, therapeutic options, the constant need for care and expenses linked with treatment of the disease [48]. The health personnel, policy makers and the patients together are aiming at upgrading the self-management practices, involving attaining good control on blood sugar and lipid levels, optimizing blood pressure to minimize the risk factors for health consequences due to T2DM [49]. The recommendations dispersed by the collaborated research of International Diabetes Federation and American Diabetes Association revealed the importance of monitoring blood glucose levels in the process of managing diabetes consequences [50].

Mumu et al conducted research on 374 T2DM patients and proclaimed that adhering to significant changes in way of living help in better control over diabetes and its further ill effects. It could be adhering to a healthy dietary regimen, workout schedule, foot care, routine blood glucose level check-up and stopping smoking and betel quid chewing habit. This adherence is somehow compromised due to several reasons like unawareness, laziness and not engaging in diabetes counselling and/or diabetes education programs. These barriers should be taken into consideration and need to be overcome to delay the occurrence of diabetes complications. It was found that 88% subjects were not compliant with a healthy diet, 25% towards routine workout, 32% towards glucose level monitoring, 70% towards foot care, 6% and 25% towards not quitting smoking and betel quid chewing habit respectively. A strong correlation was seen between altered blood glucose levels (both fasting and post-prandial) and non-compliant behaviour towards a healthy diet [51].

In the research conducted by Bezo et al, a sample of 150 persons with type 2 diabetes mellitus were registered out of which 10 were excluded due to multiple reasons. So the experiment was conducted on the remaining 140 subjects. It was found that the subjects who engaged in more than 30 minutes of exercise tend to show more problem-solving and self-integration scores [52].

A study conducted to analyze the effect of anti-diabetic medication on controlled blood glucose levels found that the patients (83% of the total sample size) who were adhered to medicines, able to manage their diabetes properly as compared to those who did not adhere. It was also found that diabetes treatment, availability of medicines and systematic diabetes education played a significant role in adhering to medication [53].

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