

Prevention and Management of Type 2 Diabetes Complications: A Systematic Review

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Abstract

The aim of the study is to identify the risk and common complications of type 2 Diabetes and how to prevent and manage the complications in type 2 Diabetes patients. The research design is to develop a general idea about best available options how to prevent and manage Type 2 Diabetes complications. A systematic review method has been used to develop a comprehensive idea about a particular topic.

Most Research suggested involvement and awareness of family member and social awareness including educational program play a vital role in prevention of type 2 diabetes alongside management.

The studies reviewed in this article show that patients can have adequate self-management when practices are tailored to address and enhance specific self-care activities. In addition, the review noted that diabetes self-management helps prevent complications and improve patients' quality of life.

Keywords: Diabetes Mellitus (DM) • Health Care Practitioners (HCPs)

Introduction

Diabetes mellitus (DM) is a chronic, progressive metabolic disorder described by hyperglycaemia with chronic microvascular such as retinopathy, nephropathy, and neuropathy and macrovascular (cardiovascular) complications. Type 2 diabetes causes high blood sugar levels when our body is not making enough of a hormone called insulin, or the insulin it makes not working properly known as insulin resistance [1]. Type 2 DM can be undiagnosed for years if there are no symptoms. Common symptoms such as Weeing a lot, especially at night, being thirsty, feeling more tired than usual, losing weight without trying to and getting thinner, Genital itching or thrush, Cuts and wounds may take longer to heal, Blurred eyesight (Diabetes UK).

Prevalence of Diabetes Mellitus

The prevalence of diabetes is rising everywhere, most rapidly in middle income countries where the prevalence is expected to reach 13.1% by 2045. There is estimated more than 5.6 million people in the UK are living with diabetes, which is an all-time high [1]. According to the diabetes UK shows that 4.4 million people in the UK live with diabetes. In addition, 1.2 million people might be living with type 2 diabetes who are not yet diagnosed. An estimated 6.4 million people are at an increased risk of type 2 diabetes in the UK based on blood sugar levels. We estimate that 1.2 million people are currently living with type 2 diabetes but are yet to be diagnosed (Diabetes UK). There are many risk factors of type 2 diabetes which are multiple and

complex. Most risk factors are included as age, family history and ethnicity, as well as living with overweight or obesity. Research has been regularly showing that for some people, combined lifestyle interventions such as including diet, physical activity and sustained weight loss can be successful in reducing the risk of type 2 diabetes by about 50%. (Diabetes UK).

Pathophysiology

Type 2 diabetes is one of the most usual metabolic disorders which is caused by a combination of two primary factors: defective insulin secreted by pancreatic β -cells and the inability of insulin sensitive tissues to respond effectively to insulin [2]. Because insulin release and activity are important processes for glucose homeostasis, the molecular mechanisms involved in the synthesis and release of insulin, as well as in its detection are tightly regulated. Failings in any of the mechanisms involved in these processes can lead to a metabolic imbalance responsible for the development of the disease [2]. More than ninety percent of the people with diabetes have type 2 diabetes which characterised by insulin resistance and progressive beta cell failure. It is commonly associated with other cardiometabolic disorders, including obesity, hypertension, cardiovascular disease, and hepatic steatosis [1].

Complications

Acute complications: These can happen at any time and may lead to chronic, or long-term, complications.

- Hypos when your blood sugars are too low
- Hypers– when your blood sugars are too high
- Hyperosmolar Hyperglycaemic State- a life-threatening emergency that only happens in people with type 2 diabetes. It's brought on by severe dehydration and very high blood sugars.
- Diabetic ketoacidosis (DKA) – a life-threatening emergency where the lack of insulin and high blood sugars leads to a build-up of ketones. (Diabetic UK)

Chronic Complications

These are long-term problems that can develop over time and can lead to serious damage if they go unchecked and untreated.

- Eye condition (retinopathy): People with diabetes may develop an eye disease called diabetic retinopathy which can affect their eyesight. If retinopathy is picked up – usually from an eye screening test - it can be treated, and sight loss can be prevented (Diabetic UK)

- Foot condition: Foot problems due to diabetes are serious and can lead to amputation if untreated. Nerve damage also affects the feeling in your feet and raised blood sugar can damage the circulation, making it slower for sores and cuts to heal. Hence, it's important to tell your doctor if you notice any change in how your feet look or feel (Diabetic UK)

- Heart Attack and Stroke-if you have diabetes, high blood sugar for a period can damage your blood vessels. This can sometimes cause heart attacks and strokes risks.

- Kidney condition (nephropathy): Diabetes can cause damage to your kidneys over a long period of time making it harder to clear extra fluid and waste from your body. This is caused by high blood sugar levels and high blood pressure. It is known as diabetic nephropathy or kidney disease (Diabetic UK).

- Nerve Damage (neuropathy): Many people with diabetes can develop nerve damage caused by complications of high blood sugar levels. This can make it harder for the nerves to carry messages between the brain and every part of our body so it can affect how we see, hear, feel and move (Diabetic UK).

- Gum disease and other mouth problems: Too much sugar in your blood can lead to more sugar in your saliva. This brings bacteria which produces acid which attacks your tooth enamel and damages your gums. The blood vessels in your gums can also become damaged, making gums more likely to get infected (Diabetic UK).

- Relevant Cancer issues: If you have diabetes, you're more at risk of developing certain cancers. And some cancer treatments can affect your diabetes and make it harder to control your blood sugar (Diabetic UK).

- Sexual problem in women: Damage to blood vessels and nerves can restrict the amount of blood flowing to your sexual organs so you can lose some sensation. If you have high blood sugar, you are also more likely to get thrush or a urinary tract infection (Diabetic UK).

- Sexual problem in Men: The amount of blood flowing to your sexual organs can be restricted which may cause you to have difficulty getting aroused. It may lead to erectile dysfunction, sometimes called impotence. (Diabetic UK).

Prevention and Management of Risks and Complications

By keeping blood sugar, blood pressure and blood fats under control will surely help to minimize your

risk of developing complications. This means going to your diabetes health checks and finding out from your diabetes healthcare clinician how to look after yourself between appointments. It can be prevented the complications of diabetes. But it requires appropriate action and it's all about how to manage your diabetes too. There are lots of professional advices on receiving the care when someone got diabetes, and it can help you prevent or delay complications too (American Diabetic Association).

Manage your diabetes: Keeping your HbA1c within the normal range set by your healthcare team is very important for reducing your risk of complications. If your blood sugar levels are rising, talk to your doctor. Your treatment may need to change to get your HbA1c back in target to avoid the complications of high blood sugar (Diabetic UK)

Stop smoking: Smoking impacts on blood to flow around your body to places like your heart and your feet. If you smoke, then stopping is a vital part of reducing your chances of complications. Again, your doctor and diabetes team will be able to help you more (Diabetic UK)

Eat more healthily: Making healthy food as part of daily plan can help you to lose weight, bring down your HbA1c, you can manage your blood pressure which help you reduce the fats in your blood like cholesterol. You may need to see a dietitian if you'd like extra help to eat balanced diet food (Diabetic UK)

Keep active: Doing more Physical Exercises help reduce your chance of getting complications. If you struggle to get about, there are help available from your GP practice to get referred to a health coach. (Diabetic UK)

Lose weight: Weight loss can help significantly over controlling type 2 diabetes, research shows losing even 1kg can help to reduce your risk. There are so many ways to lose weight, so it's important to find out what suits best for you and know what local help is available to help you. Many people at risk living with diabetes type 2. DM is living with overweight or obesity. Individual needs to plan their own to help reduce weight, it is very important what food your intake. Research shows that there are certain foods available that are helpful to reduce weight (Diabetic UK)

Family awareness: The rising prevalence of diabetes initiate for increased awareness and education about the condition. It is important to educate individuals about the risk factors, symptoms, and complications associated with diabetes. Early detection and timely management can significantly reduce the impact of diabetes on individuals and society. Public health

initiatives should focus at promoting healthy lifestyle choices can also contribute to reducing the burden of diabetes. Encouraging regular physical activity, promoting healthy eating habits, and providing support for individuals at risk of developing diabetes can make a significant difference in preventing the onset of the condition. A systematic review by Bekele H, et al. [3] concluded that lifestyle and dietary interventions for type II diabetes management in Africa were vital to prevent and manage type II diabetes.

Research Design/Method

A literature review was conducted using the PubMed, Medline, and Google Scholar databases. Search criteria included articles published between 2014 and 2024 to identify the most recent studies on this relevant topic. The search included the phrases "type 2 diabetes" and "diabetes complications and type 2 diabetes management" to specifically focus on diabetes management interventions and was limited to original research conducted in humans and published in English within the defined 5-year period. Search results were analysed and discussed later.

Literature Review of the Research papers

The Healthy People 2010 report showed health literacy as the "degree to which individuals have the scope to obtain, process, and recognise basic health information and services needed to make suitable health decisions. Health literacy on Diabetes also encompasses a wide range of skills, including basic knowledge of the disease state, self-efficacy, glycemic control, and self-care behaviours, which are all important components of type 2 diabetes management. According to the Institute of Medicine's Committee on Health Literacy, a patient who has poor health literacy are twice as likely to have poor glycemic control and were initiate to be twice as expected to be hospitalized as those with adequate health literacy [4].

There are few challenging variables in diabetes education such as medical mistrust and poor communication. The study by White et al. 2015, examined the association between communication quality and medical mistrust in patients with type 2 diabetes. HCPs at five health department clinics received training in effective health communication and use of the PRIDE (Partnership to Improve Diabetes Education) toolkit in both English and Spanish, whereas control sites were only exposed to National Diabetes Education Program materials without training in effective communication [5]. Also investigated the use of PCL in patients with type 2 diabetes and found that patients with low health literacy who take medication two or more times per day have

higher rates of proper medication use when using PCL.

Moreover, Patients who may receive educational materials based on their learning style also can be significant improvement in their diabetes knowledge and health literacy [6] developed and evaluated educational materials based on patients' learning style to improve health literacy in English language and Spanish. The materials were made available in multiple formats to target four different learning styles, including materials for visual learners, read/write learners, auditory learners, and kinaesthetic learners.

Additionally, findings by Hofer R, et al. [7] suggested that patients with high A1C levels also benefit from interventions led by community health workers (CHWs) to bridge gaps in health literacy and equip patients with the tools to make health decisions. Kim MT et al. [8] found that Korean-American participants benefited greatly from group education sessions that provided integrated counselling led by a team of nurses and CHW educators. The intervention also had a health literacy component that focused on enhancing skills such as reading food package labels, understanding medical terminology, and accessing health care services.

Some studies identified that diabetes self-management educational program and interventions that include a diabetes self-management education component are more effective in achieving clinically significant improvements in metabolic control and it promotes positive health behaviours and performing self-management activities [9].

Several other studies explored the impact of educational interventions emphasise the central role of diabetes education in managing diabetes and improving clinical outcomes. A systematic Review and meta-analysis by Kim and Huh 2021 regarding the effects of dietary education interventions on individuals with type II diabetes report improvements in HbA1C levels in the intervention groups after interventions, compared to control group members.

In developing countries, self-monitoring of blood glucose is one of the least practiced self-care activities among patients with type 2 diabetes [10]. Some of the most often cited reasons for low self-monitoring of blood glucose practice levels are financial barriers, such as the high cost of self-monitoring of blood glucose equipment and ignorance/low awareness of the importance of self-monitoring of blood glucose [11].

However, some studies report moderate to high scores for self-monitoring blood glucose. For example, a study in India reports adherence to blood glucose monitoring once every three months at 75% Karthik et al. 2017.

while another study in Pakistan reports a 59% usage of home glucometer with a mean use frequency of three times per week [11]. Higher adherence to self-monitoring of blood glucose could be due to the higher socioeconomic status of the study population, which means they can afford glucometer and have higher education levels and awareness of self-monitoring of blood glucose [11].

Some of the studies reviewed also important lifestyle modification components such as exercises, diet modification, stopping smoking, weight reduction, blood pressure control, stress control, and getting adequate rest and sleep. This finding has been agreed by a systematic review reported by Cotterez et al. [12] that found a wide variation in the targeted aspects of lifestyle modification, which involved diet, physical activities, coping skills, and reducing risks.

Most studies in the current review focused on physical activity as a critical section in self-management. Studies were conducted in rural India which reported low levels of engagement in physical activity, with no more than 50% of diabetes patients observing with the suggested practice [13]. In addition to that, for the people who diagnosed with type II diabetes found physical activity has been beneficial to decrease as diabetes progresses.

Another review found that psychological support and follow-up is an important component of interventions for preventing and managing diabetes complications. Psychological issues are reported as common in persons with type II diabetes, who are basically 2–3 times more likely to present psychological symptoms compare with the other general population Berhe et al. 2020. The development of depression, in turn, negatively affects the ability of the patients to seek care promptly and perform self-management activities. The studies in this review recognised the need for psychological support and follow-up. However, significant variability was noted in the modes of providing support. The modes involved follow-up phone calls, short message service reminders, involving family members, providing, peer support, and doing home visits [14].

Nelson et al 2020 studied patients' engagement with an automated text message approach to help diabetes self-care activities in a 12-month randomized controlled trial (RCT) called Rapid Education/Encouragement and Communications for Health. Test messages were personalised based on patients' medication adherence, the Information-Motivation-Behavioural Skills model of health behaviour change, and self-care behaviours such as diet, exercise, and self-monitoring of blood glucose. The benefits of this project gained public appreciation based on the study result.

Limitations of Study

Despite these limitations, the current review identified areas of further research, such as self-care practices to address other complications of diabetes outside of metabolism-related complications and diabetes foot, as well as variations in diabetes self-care between patients in low- and high-income countries. The results of this work show that implementing health literacy interventions to help patients manage type 2 diabetes can have beneficial results. However, such interventions could impact on significant time and monetary costs. The potential financial and time costs of diabetes education interventions were not evaluated in this review and should be considered when designing clinical interventions.

Discussion

The study aimed to review self-management practices for preventing complications of type II diabetes across the world. The review identified four broad categories of self-management practices for preventing type II diabetes complications: the acquisition of basic diabetes-related knowledge, the acquisition of essential skills to manage diabetes, the adoption of lifestyle modifications, and the availability of psychological support with follow-up.

The current review found that psychological support and follow-up was most important component of interventions for preventing and managing diabetes complications. Psychological issues are common in persons with type II diabetes, who are 2–3 times more

likely to be depressed than the general population Berhe et al. 2020.

It is well known that managing of type 2 diabetes remains a challenge for health care practitioners (HCPs) and patients, in part because of the challenges discussed in this review, including communication barriers between patients and HCPs and knowledge deficits about medications and disease states. HCPs can have a positive impact on the health outcomes of their patients with diabetes by improving patients' disease formal and medication knowledge. One of the common ideas identified in this literature review was the frequency of culturally tailored diabetes education interventions [15].

Conclusion

Most of the diabetes care is dependent on patients' self-management practices. The studies reviewed in this article show that patients can have adequate self-management when practices are tailored to address and enhance specific self-care activities. In addition, the review noted that diabetes self-management helps prevent complications and improve patients' quality of life.

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