Diabetes in the Saudi Population, Its Consequences, and Prevention

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Abstract

Saudi Arabia has the second-highest rate of diabetes in the Middle East and the seventh-highest rate overall, according to the World Health Organization (WHO). As a result, Saudi Arabia is now ranked seventh in the world. Pre-diabetes affects an additional million Saudis, and it is believed that more than 7 million people worldwide actually have diabetes. It's arguably even more worrisome that diabetes has been on the rise in Saudi Arabia over the past few years. In fact, throughout the last three time periods, the rate of diabetes cases in Saudi Arabia has increased by a factor of about 10. Diabetes mellitus (DM) has been related to increased mortality, morbidity, vascular problems, poor overall health, and a lower quality of life. The prevalence of diabetes mellitus in Saudi Arabia is increasing at an alarming rate, making it a leading cause of several health problems and even death. The study, especially its incidence, prevalence, and socio-demographic factors, has been grossly inadequate compared to that conducted in industrialized nations. Without a comprehensive epidemic management program in place, with a strong focus on supporting a healthy diet, which includes exercise an active life, and weight control, the health burden caused by DM in Saudi Arabia is expected to increase to catastrophic proportions. A multidisciplinary strategy is required to properly manage diabetes in Saudi Arabia. Everything you need to know about DM in Saudi Arabia is included in this in-depth study. In this study, we examine the current diabetes epidemic and the detrimental consequences that diabetes complications have on both individuals and the healthcare system. In addition, the report suggests potential interventions to halt the pandemic.

Keywords: diabetes; Prevalence; and Incidence; Trends Over Time; Risk Factors; Mortality; Complications; Heart Disease; Stroke; Peripheral Arterial Disease; Retinopathy; Nephropathy; Peripheral Neuropathy; Lower-Extremity Amputations; Control of Risk Factors to Reduce Complications; Prevention

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Introduction

Diabetes mellitus is a dangerous condition that manifests itself when the body has trouble correctly controlling the quantity of dissolved sugar (glucose) in the bloodstream. This may lead to a variety of health complications. There is no connection between this condition and another condition with the same name called "Diabetes Insipidus," which refers to difficulties associated with the kidneys retaining fluid.

To understand diabetes, it's important to know how glucose works in the body and what happens when it can't be controlled, causing blood sugar levels to drop dangerously low or rise dangerously high [1].

Because they are living objects, the tissues, and cells that comprise the human body need to be nourished to continue functioning properly. Glucose is a form of sugar that is used by cells for their nutritional needs. Because they are immobile, the cells of the body are wholly reliant on the circulation of blood, which they are bathed in, to get glucose. In the absence of sufficient glucose, the cells of the body have nothing else to use as a source of fuel, and they will soon perish [2].

Food, not glucose, is what human beings take in. During the digestion process, the carbohydrates in food consumed by humans are transformed into glucose. After the conversion process, glucose enters the bloodstream, which increases the total amount of glucose that is dissolved in the blood. The glucose that has been dissolved is subsequently transported throughout the body via the bloodstream to the different tissues and cells [3].

Even though glucose may be present in the blood, the cells in the surrounding area are unable to take advantage of this glucose in the absence of the chemical hormone known as insulin. Insulin plays the role of a key, unlocking the cells so that they can take in and make use of the glucose that is there. In the presence of insulin, glucose is removed from the blood and taken up by the cells; as a result, blood sugar levels decrease as sugar exits the circulation and enters the cells. Insulin may be compared to a bridge that transports glucose from the bloodstream into the cells of the body. It is essential to comprehend that when insulin levels rise, blood sugar levels fall. This is the case whenever insulin levels rise (because the sugar goes into the cells to be used for energy) [4].

The human body is equipped to control and buffer the quantity of glucose that is dissolved in the blood to keep a consistent supply of glucose available to fulfill the requirements of the cells. The pancreas is one of the organs in your body. It is in charge of making insulin, storing insulin, and releasing insulin into the bloodstream to lower glucose levels [5].

Food intake affects blood glucose levels. Candy, refined carbs, and sweets convert easily to glucose. Such foods raise blood glucose quickly. Complex, unprocessed carbs like oatmeal, apples, and baked potatoes take longer to digest and produce glucose, so blood sugar climbs slowly. The body must swiftly release huge quantities of insulin to prevent hyperglycemia (high blood sugar), Insulin helps cells use glucose, lowering glucose levels. Insulin levels vary slowly, unlike glucose levels. Glucose floods the bloodstream after eating a lot of simple sugar. Sugar increases pancreatic insulin release. High insulin levels persist in the circulation while glucose reaches cells quickly. This may cause insulin overload, hunger, and hypoglycemia, another dangerous illness. Gradual increases in blood glucose require less drastic correction. Controlled and safer insulin release reduces physical strain. This slower procedure will make you feel "full" for longer. Sweets and processed sugars should be limited for health reasons. Instead, consume fresh fruit, whole wheat bread and pasta, legumes, and complex carbohydrates. White and whole wheat bread illustrate the distinction between simple and complex carbs. Insulin is an essential component in the process that allows cells to use glucose. Problems with the synthesis of insulin or with how insulin is detected by the cells have the potential to rapidly throw the body's finely calibrated system of glucose metabolism out of whack. Diabetes, spikes, crashes in blood sugar levels, and an increased risk of harm to the body are all outcomes that may be attributed to any of these conditions [3].

Diabetes happens

The term "diabetes mellitus" refers to a range of metabolic diseases that are all chronic and have the characteristic of high blood glucose levels. These abnormally high levels of glucose in the blood are due to either the inability of the body to manufacture insulin or its resistance to the action of insulin, or both of these factors working together. Diabetes mellitus is also known as the "sweet disease." The following are the four clinically different categories that may be found within this category of conditions [6].

1. Characterized by a total absence of insulin production due to autoimmune beta-cell death in the pancreas;
2. Type 2, which happens when the body's resistance to insulin is too high and it doesn't make enough insulin to fight it;
3. Gestational diabetes, a kind of glucose intolerance that may afflict certain women when they are pregnant;
4. There are a set of other forms of diabetes that are brought on by particular genetic disorders of the beta-cell activity or the action of insulin, illnesses of the pancreas, or the use of medicines or chemicals [6].

Type 1 diabetes affects between 5% and 10% of people diagnosed with the disease. Autoimmune factors, genetic factors, and environmental variables are all included in its risk factors. There is currently no known strategy to prevent type 1 diabetes from developing in a person. The majority of diagnosed instances of diabetes are type 2, accounting for 90% to 95% of all cases. Insulin resistance is often the starting point for this kind of diabetes. If the body is unable to create sufficient insulin to overcome the resistance, the pancreas may either limit the amount of insulin it produces or, in the long run, cease generating insulin altogether. Women from minority groups, women who are obese, women with a history of diabetes in their family, and women who have had gestational diabetes in a prior pregnancy are at a greater risk than other women of having gestational diabetes in their subsequent pregnancy. Women who are pregnant and have gestational diabetes need to have their blood sugar levels closely checked and maintained to lessen the likelihood that their unborn child will have any issues throughout the labor and delivery process. Women who have experienced prenatal diabetes have a significantly increased risk of developing type 2 diabetes in later life, one that is anywhere from 20% to 50% greater than the risk that is posed to women who have not had gestational diabetes [2].

A person with high blood glucose levels but not diabetes has prediabetes. Prediabetes may affect fasting glucose or glucose tolerance. 25% of a cross-sectional sample of US adults 40-74 years old had prediabetes from 1988 to 1994. Twelve million Americans had prediabetes in 2000. This shows that a large population is at risk for diabetes in a short period [3].

Prevalence rate

It is projected that 1.5 million people were diagnosed with diabetes for the first time in 2005. Although the prevalence (or existing instances of diabetes) indicates the overall burden of the illness in the community, the incidence (or new cases of diabetes) describes increases in the number of people who are afflicted by the disease. The Saudi Health Council and the Saudi Ministry of Health are two sources of population data on diabetes that provide information on the prevalence of the disease in Saudi Arabia. Both of these organizations are responsible for the health of the Saudi population. Because these sources evaluate whether a person has been informed by a doctor or other medical professional that he or she has diabetes, they can only report the prevalence of diagnosed diabetes. Even though these sources provide accurate self-reported data about diabetes in the United States, they have been limited to reporting only the prevalence of diagnosed diabetes. Because of this constraint, it is impossible to determine the prevalence of diabetes among patients who have not yet been diagnosed (i.e., those people who have diabetes but have not yet been diagnosed by a physician) [4].

The National Health and Nutrition Examination Surveys (NHANES) are the only nationally representative surveys that have taken blood samples in addition to survey questions and, as a result, can estimate both diagnosed and undiagnosed cases of diabetes. Because of this, the NHANES can estimate the prevalence of both types of diabetes. According to estimates of diabetes prevalence from the NHANES for the year 2005, the overall prevalence of diabetes in the United States (including diagnosed and undiagnosed cases) was estimated to be 20.8 million, which is equivalent to 7.0% of the population. Of those, 14.6 million people were diagnosed with diabetes, but 6.2 million people, which accounts for over 30% of all diabetes cases, were not diagnosed [5].

Trends over Time

The Kingdom of Saudi Arabia (KSA) is not immune to this worldwide pandemic [6], and diabetes is the country's most difficult health concern [7]. According to a Saudi Ministry of Health estimate, roughly 0.9 million persons were diagnosed with diabetes in 1992, but this figure increased to 2.5 million in 2010, suggesting a 2.7-fold rise in incidence rates in less than two decades. In 2015, 4660 diabetic patients visited family and medical clinics in Saudi Arabia [8] Diabetes is becoming more prevalent due to a variety of causes, including increased obesity rates and an aging population 7.

Serious consequences are frequently seen by diabetic patients who also have other comorbid chronic illnesses. For instance, the end-stage renal disease affects between 24% to 51% of individuals undergoing renal replacement treatment and is more common in diabetic patients [9]. Patients with diabetes are two to four times more likely than the general population to acquire the cardiovascular disease, and they are two to five times more likely to pass away from it [10]. Diabetes has a negative influence on people's lives as well as on the healthcare system and the community at large [11]. Diabetes is predicted to cost more than $0.87 billion annually in Saudi Arabia, where it accounted for 11% of all healthcare spending in 2011 [12].

Understanding the epidemiology of diabetes is critical for identifying public health objectives, developing policy initiatives, and assessing the effectiveness of services in lowering the individual and social cost of diabetes [13]. Although the International Diabetes Federation provides prevalence estimates by nations and regions, there is significant variability in historical trends since these estimates are based on imputation [14]. Too far, no systematic review of the incidence and prevalence of diabetes in Saudi Arabia has been published. Given the significant socioeconomic changes that have happened in this nation over the last several decades, and their significant influence on the lifestyles, eating habits, and physical activities of the people in this region, as well as the aging of the population.

Clear and present danger Factors

There are several risk factors for diabetes, despite its complex pathogenesis. Family history, race (whites are at higher risk), and childhood viral infections are risk factors for type 1 diabetes. Some risk factors for type 2 diabetes can be changed [3].

Non-modifiable risk factors for type 2 diabetes include advanced age, being of a certain race or ethnicity, having a history of diabetes in the family (a genetic predisposition), having diabetes during pregnancy, and having a low birth weight. The prevalence of diabetes also increased with age, contributing to the fact that diabetes incidence rates rose as people got older [2].

Diabetes is more prevalent among people of African descent than it is among white people. In addition, the rates of diabetes that have been diagnosed in Saudis range from 5% to 50% depending on the tribe or population group that you look at. There is a very slight difference between the sexes. Even though genetics play a role, it appears that nongenetic or lifestyle risk factors (such as diet and exercise) are the primary ones [9].

A high body mass index (BMI), a lack of physical activity, poor nutrition, high blood pressure, smoking, and drinking are all lifestyle factors that can put you at risk for developing cardiovascular disease. Numerous studies have demonstrated that having a higher body mass index (BMI) is one of the most significant risk factors that can lead to the development of diabetes. In addition, having an increased waist-to-hip ratio, which refers to the ratio of the circumference of the waist to the circumference of the hips, raises the likelihood of developing diabetes [15].

Multiple studies show that lower physical activity increases diabetes risk. A recent review of 10 prospective cohort studies on moderate-intensity physical activity and diabetes found that even the recommended amount of moderate activity reduces the risk of diabetes by 30% compared to no physical activity [16].

The development of diabetes has been connected to both an individual's overall calorie consumption as well as particular aspects

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of their diet, such as refined carbohydrates and fats. Although drinking alcohol in moderation has been shown to lower the risk of developing diabetes, smoking is an independent risk factor for the development of diabetes [17].

Depression, increased stress, a lack of social support, and poor mental health status are some of the psychosocial factors that have been linked to an increased risk of developing diabetes. Recent research has shown that poor housing conditions are independently linked to self-reported diabetes; however, the mechanism by which housing conditions contribute to an increased risk of diabetes is not yet fully understood [24].

Mortality

With 73,249 death certificates stating diabetes as the primary cause of death and an additional 224,092 death certificates listing diabetes as a contributing cause of death, diabetes was the sixth largest cause of death. Diabetes ranked as the sixth-leading cause of mortality globally in 2014. Diabetes may be underreported as a cause of mortality due to the numerous complications that are linked to the disease and can eventually result in death. People who have diabetes face a mortality rate that is almost two times higher than the mortality rate of people of a comparable age who do not have diabetes. The length of time a person has had diabetes is another significant factor in determining mortality; people under the age of 45 have a greater risk of passing away prematurely. According to information taken from death certificates.

The majority of people have a consensus regarding the distribution of the causes of death in type 2 diabetes. The leading causes of death for diabetics are cardiovascular diseases such as heart disease and stroke. People who have diabetes have a mortality risk from cardiovascular disease that is two to four times higher than the risk that is posed by people who do not have diabetes [27].

Numerous variables increase the chance of mortality in diabetics. Men with diabetes who smoked had high systolic blood pressure, and/or high serum cholesterol and was more likely to pass away from cardiovascular disease, according to a major intervention experiment. 28 "Tight management" of high blood pressure in type 2 diabetes decreased the number of fatalities from the disease by 32% [29].

Complications

Diabetes has the potential to damage a wide variety of organs and systems throughout the body over time, which can result in serious complications. Two different types of complications can arise from diabetes: microvascular and macrovascular. Damage to the nervous system (also known as neuropathy), the renal system (also known as nephropathy), and the eye are all forms of microvascular complications (retinopathy). 1 Macrovascular complications include cardiovascular disease, stroke, and peripheral vascular disease. The peripheral vascular disease has been linked to several serious complications, including wounds that do not heal, gangrene, and in the most severe cases, amputation [23].

Illustrates the greatly increased risk of acquiring diabetes-related complications in people with type 2 diabetes. The prevalence of microvascular complications, such as chronic kidney disease (defined as microalbuminuria), foot issues (defined as foot amputation, foot lesion, or numbness), and eye damage (defined as being informed that diabetes had affected the eyes or retinopathy), is, per the NHANES study conducted between 1999 and 2004, significantly higher than the prevalence of macrovascular complications, such as heart attack, chest pain, coronary heart disease, and congestive heart failure. 30 The two types of complications are progressive (like nephropathy) and episodic (like foot ulcers or infections), which often start modestly but worsen with time [2].

Dental disease, a decreased resistance to infections such as the flu and pneumonia, macrosomia, and other birth complications among pregnant women with diabetes are some of the additional complications that can arise. Patients with type 1 and type 2 diabetes share similar complications; however, the frequency with which they occur and the order in which they manifest can be quite different. The most common complications of diabetes are discussed further and in greater detail, with particular attention paid to the distinctions that exist between the complications that are associated with type 1 diabetes and type 2 diabetes [16].

Heart Disease and Stroke

It is estimated that cardiovascular disease is the cause of up to 65% of deaths among diabetics. According to 31, ischemic heart disease and stroke account for the majority of diabetes-related morbidity. [citation needed] In addition, the risk of death from heart disease is two to four times higher in people who have diabetes compared to people who do not have diabetes. In addition, those who have diabetes have a risk of having a stroke that is two to four times higher than average. Over seventy percent of diabetics either have high blood pressure or are being treated with medication to bring it down. It is not entirely clear how hyperglycemia contributes to the cardiovascular complications that diabetics experience.

Diabetics have cardiovascular disease risk factors like hypertension, high cholesterol, and smoking. Non-diabetics have these risk factors. However, even one of these risk factors seems to worsen diabetes outcomes. 28 From the 1950s to 2003, diabetes-related cardiovascular disease complications were tracked in various populations. These data show that diabetes-related cardiovascular complications have decreased significantly over time. 32,33 The greatest decreases occurred during the 1980s and 1990s when glycemic, blood pressure and cholesterol-lowering medications advanced. Multiple factors caused these declines. However, since the late 1990s, these declines have slowed [9].

Peripheral Arterial Disease

Narrowing of the arteries that supply blood to the extremities, abdomen, and kidneys is the root cause of the peripheral arterial disease (PAD, or peripheral vascular disease [PVD]). Age, duration of diabetes, and the presence of neuropathy all increase the risk of PAD in people with diabetes. High levels of C-reactive protein and homocysteine, both of which are linked to cardiovascular disease, also increase the risk of PAD. The peripheral arterial disease has two types of symptoms: intermittent claudication, which is a pain, ache, or discomfort that comes and goes during exercise or walking but goes away when you rest, and pain at rest, which is caused by ischemia in the limb, which means that not enough blood is getting to the affected limb.33 Peripheral arterial disease is a major risk factor for lower-extremity amputation [9].

Retinopathy (Blindness)

Diabetic retinopathy causes the most blindness and microvascular complications in diabetics. Retinopathy is associated with prolonged hyperglycemia, is slow to develop, and may start 7 years before the clinical diagnosis of type 2 diabetes. Age-adjusted, 23.7 per 100 diabetics had trouble seeing in 1997, compared to 17.7 per 100 in 2005. 9 Diabetes-related vision loss increases with age. 27% of adults with diabetes 75 years or older had visual impairment in 2005, compared to 15% of those 18-44. 9 Women with diabetes had a higher rate of visual impairment from 1997 to 2005. Since 2001, men's diabetes prevalence has remained steady, while women's has fallen. Visual impairment prevalence in 1997-2005 was similar across races. Type 2 diabetes duration is the biggest predictor of visual impairment. Early detection and treatment can prevent 90% of diabetic retinopathy-related blindness. All diabetics need annual dilated eye exams [33, 34].

Nephropathy (renal disease)

Proteinuria that does not go away (greater than 500 mg of protein or 300 mg of albumin per 24 hours) in the absence of an infection in the urinary tract or any other disease that causes proteinuria is diagnostic of diabetic nephropathy. When compared to patients with type 2 diabetes, people with type 1 diabetes experience a relatively delayed onset of clinical nephropathy. Diabetic proteinuria may already be present in the patient at the time of diagnosis when type 2 diabetes is being considered.

The incidence of diabetic nephropathy is low in patients with type 2 diabetes during the first ten to fifteen years of diabetes duration, after which it increases rapidly to a maximum at approximately 18 years of diabetes duration, and then declines. The high prevalence of nephropathy at the time of diabetes diagnosis may be due to the long period that can elapse between the actual onset of type 2 diabetes and its clinical diagnosis. Diabetes-related nephropathy was the cause of 44% of new cases of end-stage renal disease (ESRD) in

2002, and 153,730 people with ESRD due to diabetes were either receiving long-term dialysis or had undergone a kidney transplant [2].

The causes of diabetic nephropathy are unknown. Modifiable and non-modifiable risk factors exist. Metabolic regulation is one of the modifiable risk factors for diabetic nephropathy. In type 1 and type 2 diabetics, strict metabolic control lowers the risk of microalbuminuria and persistent proteinuria. Strict metabolic control benefits patients with normal urine albumin and microalbuminuria the most. High blood pressure and hypertension also hasten diabetic renal disease. It is unknown whether blood pressure at the onset of diabetes predicts diabetic nephropathy. Other risk factors include smoking, obesity, anemia, and genetics [30].

People who already have diabetes type 2 and diabetic nephropathy have a greater risk of developing a wide range of additional diabetic complications. Since many years ago, medical professionals have been aware of renal-retinal syndrome. This syndrome is characterized by the concurrent presence of both renal disease and retinal disease. Patients diagnosed with diabetes and nephropathy have an increased risk of developing coronary heart disease and stroke in comparison to patients diagnosed with diabetes but not nephropathy. As was mentioned earlier, those who suffer from diabetes and nephropathy have an increased risk of passing away from macrovascular disease.

In general, there has been a reduction in the incidence of nephropathy over the past few decades as a result of improvements in the treatment of diabetes, which have led to tighter control of glycemia as well as improved control of hypertension. A comparison of four cohorts of patients who were diagnosed with type 1 diabetes between 1965 and 1984 revealed that the most recently diagnosed cohorts had the lowest cumulative incidence of diabetic nephropathy over the next 20 years. This was determined by looking at the number of patients in each cohort [29].

Peripheral Neuropathy

A frequent consequence of diabetes, known as diabetic peripheral neuropathy (DPN), is thought to afflict 30% to 50% of people with the disease. Hyperglycemia is the key risk factor for DPN. Age, illness duration, smoking, hypertension, increased triglycerides, greater BMI, drinking alcohol, and being taller are additional independent risk factors [28].

The most common kind of DPN is chronic sensorimotor distal symmetric polyneuropathy. Polyneuropathy results in pain, muscle weakness, and sensory loss. The typical polyneuropathy presentation is progressive sensory impairment, including burning and numbness in the feet. Because the sickness develops slowly, it may go undiagnosed for years. When present, neuropathic pain can be excruciating. However, it is estimated that only 11% to 32% of persons with polyneuropathy experience it.

Diabetic peripheral neuropathy causes several limitations and disabilities. In persons with DPN, foot ulcers that lead to lower-extremity amputation are particularly prevalent. When DPN is present, the patient is more likely to visit the doctor more frequently each year and to have physical challenges that prevent them from working. Other potential DPN adverse effects, such as falls, are less directly linked to the illness. They may, however, result in significant functional limitations [34].

Lower-Extremity Amputations

Complications from diabetes, such as non-traumatic amputations of lower extremities, can have devastating effects (LEAs). There is a chance that up to fifteen percent of diabetics will require an amputation at some point in their lives. When compared with people who do not have diabetes, the likelihood of diabetics experiencing LEAs is ten to twenty times higher. It is estimated that approximately 55 percent of diabetic patients who have nontraumatic LEAs are 65 years old or older [31].

Several things might put a person at a higher risk for developing LEA, including becoming older, being a man, having peripheral neuropathy, and having chronic ulcers. About 85 percent of all LEAs that occurred in persons who had diabetes for more than 30 months were preceded by a persistent foot ulcer that did not heal. Ulcers on the feet caused by diabetes are quite frequent, and it is

estimated that around 15% of individuals who have diabetes may develop one at some time in their life. About half of all amputations in diabetic patients are caused by peripheral vascular disease. [Case in point:] 33 Regular foot examinations, access to foot care, and the use of appropriate footwear are all factors that have the potential to reduce the risk of developing foot ulcers. On the other hand, the vast majority of people who have diabetes do not get their feet checked often, do not wear shoes that are appropriate for their feet, and do not receive appropriate foot care. The advantages of primary minor amputation, as opposed to main large amputation, are still a contentious topic of debate. A primary minor amputation offers several benefits, including a reduced likelihood of requiring a large amputation in the future as well as improved possibilities for recovery. Persons who had index minor amputations had longer healing durations, but there was no difference in the incidence of new amputations between those people and people who had index large amputations in a research that was prospective and included 189 diabetic patients. Patients who had an initial major amputation due to diabetes had a higher death rate, an identical risk of new amputations regardless of level, an increased rate of major amputations, and a reduced rehabilitation potential when compared with patients who had an index minor amputation. It is quite frequent for people to suffer from disabilities as a consequence of LEA [25].

Control of Risk Factors to Reduce Complications

Hyperglycemia, high blood pressure, and hypercholesterolemia are the three risk factors that are most important about all of the diabetes-related problems that were discussed before. It has been hypothesized that if a person can better regulate their blood sugar, blood pressure, and cholesterol levels, they would have a lower chance of developing problems. 2 For instance, in a person who has diabetes, a reduction of one percentage point in glycosylated hemoglobin (Hb A1c) level can reduce that person's risk for microvascular complications by as much as forty percent; a reduction of ten millimeters of mercury in blood pressure can reduce that person's risk for any diabetic complication by as much as twelve percent, and control of serum lipids can reduce that person's risk for cardiovascular complications by anywhere from twenty to fifty percent 2 It should come as no surprise that improved management of these risk factors in diabetic patients might result in more favorable outcomes [26].

A Burden to the Health Care System

About forty percent of the overall expense of diabetes in the world States is directly attributable to the provision of inpatient care for the management of diabetes-related complications. The yearly and lifetime economic costs of diabetic complications have been the subject of several research that has attempted to assess them. According to the findings of these studies, macrovascular disease, which includes mainly cardiovascular events and stroke, is responsible for as much as 85 percent of the costs associated with the complications of diabetes. Furthermore, these conditions are a significant determinant of costs at an earlier time during the course of the disease than microvascular complications are. It is essential to keep in mind, however, that seemingly innocuous microvascular problems may, with time, deteriorate into more severe conditions and considerably contribute, both in terms of morbidity and the expenditures associated with it in later years [23].

Ways to avoid
Begin with the following six-pointers

1. Remove processed carbs and sugar from your diet. Consuming meals heavy in refined carbs and sugar raises insulin and blood sugar levels, which may eventually cause diabetes. Several breakfast bowls of cereal, white bread, and potatoes are examples of refined carbs. Limit your intake of sugar and opt for complex carbs like whole grains, veggies, and oats.
2. Stop smoking today. Smoking dramatically increases insulin resistance, a risk factor for type 2 diabetes. Smoking cessation reduces long-term type 2 diabetes risk.
3. Be mindful of the quantity you eat. Cutting down on excessively large portions will help lower insulin and blood sugar levels, as well as lessen the likelihood of developing diabetes. In people who are at risk of developing diabetes, eating an excessive amount of food in one sitting has been found to raise both blood sugar and insulin levels.
4. You should make an effort to be purposefully active by going for a walk, dancing, lifting weights, or swimming for at least half an

hour, five days a week. You have a sedentary lifestyle if you sit for most of the day and if you don't receive much if any, physical exercise at all. If this describes you, it's time to get up and start moving.

5. Drink water. Consuming water regularly rather than any other beverage may assist in the regulation of blood sugar and insulin levels, thereby lowering the probability of developing diabetes. If you want to avoid drinks that are rich in sugar, preservatives, and other components that aren't necessary, sticking to water for the most part is your best bet.
6. Eat fiber. Consuming a diet rich in fiber is advantageous for both the health of the digestive tract and the control of weight. Consuming a meal that contains a source of high-quality fiber may help minimize rises in blood sugar and insulin levels, which may reduce the likelihood of developing diabetes [35].

Prevention

It has been shown that making changes to one's way of life may help avoid or delay the development of type 2 diabetes. People should do the following things to help avoid type 2 diabetes and the issues that come with it: attain and maintain a body weight that is good for you.

Maintain a physically active lifestyle by engaging in activities of at least 30 minutes in length and of moderate intensity on the majority of days. Increased physical activity is necessary for effective weight management; Consume a diet low in sugar and saturated fats, and do so while avoiding saturated fats.

Quit smoking if you want to lower your chances of developing diabetes and cardiovascular diseases, according to the WHO.

Evaluation and care for patients who have the measurement of blood glucose is a reasonably affordable method that may be used to arrive at an early diagnosis.

Diet and exercise are important components of diabetes treatment, but they are only part of the equation. Reducing blood glucose levels and the levels of other recognized risk factors that damage blood vessels are also important. Stopping the usage of tobacco is another key step in the prevention of problems.

The following are examples of interventions that are not only viable in low- and middle-income nations but also save money: regulation of the blood glucose level, especially in cases of type 1 diabetes. Insulin is necessary for diabetics with type 1 diabetes. Oral medicine is a viable treatment option for those diagnosed with type 2 diabetes; nevertheless, these individuals may also need insulin, blood pressure control, and foot care (self-care by patients by maintaining foot hygiene, wearing appropriate footwear, seeking professional care for ulcer management, and having their feet examined regularly by health professionals).

Additional cost-cutting measures include the following:

Screening and treatment for diabetic retinopathy, which is a condition that may lead to blindness; blood lipid management, which helps keep cholesterol levels under control; screening for early indicators of diabetes-related kidney damage and treatment of the condition (WHO).

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