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Diabetes mellitus: Etiology, prevalence and effects on quality of life of diabetic patients

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Abstract
Quality of life is an important health outcome in its own right, representing the ultimate goal of all health interventions. This paper reviews the published, English-language literature on self-perceived quality of life among adults with diabetes. Quality of life is measured as physical and social functioning, and perceived physical and mental well-being. People with diabetes have a worse quality of life than people with no chronic illness, but a better quality of life than people with most other serious chronic diseases. Duration and type of diabetes are not consistently associated with quality of life. Intensive treatment does not impair quality of life, and having better glycemic control is associated with better quality of life. Complications of diabetes are the most important disease-specific determinant of quality of life. Numerous demographic and psychosocial factors influence quality of life and should be controlled when comparing subgroups. Studies of clinical and educational interventions suggest that improving patients' health status and perceived ability to control their disease results in improved quality of life. Methodologically, it is important to use multidimensional assessments of quality of life, and to include both generic and disease-specific measures.

Introduction
Diabetes mellitus (DM) was first coined by the Greek physician Aertaeus. In Greek the term diabetes means "to pass through" and mellitus which came from latin word honey (symbolizes sweetness) and is the leading cause of prolonged ill health and premature mortality with nearly 1 death every 10 second. (Kaul *et al*., 2013) [2].

Diabetes Mellitus can be define as a combination of metabolic disease which are characterized by high level of glucose results from insufficient insulin secretion, insulin action or both. The chronic hyperglycemia if not controlled it can have serious results causing damage to various body organs and tissues such as your heart, kidneys, eyes and nerves. (American Diabetes Association. (2010) [1].

Diabetes mellitus is a metabolic disorder characterized by high blood glucose due to reduction in the ability or complete inability of the tissue to utilize carbohydrates by changes in digestion of protein, fat, electrolytes and water. The disorder is cause by a deficiency or diminished effectiveness of the hormone insulin which produces by beta cells (Khanna *et al*., 2017).

According to world health organization diabetes can be define as a chronic disease that occur when pancreas does not produce sufficient insulin or when the body become resistant to insulin produce. Insulin is a hormone that regulates the blood glucose levels. Hyperglycemia is the common effect of uncontrolled diabetes and over time leds to serious health implications. (World health Organization)

DM can be diversify into several types but the two major types are type 1 and type 2. Drugs are primarily incorporate to save life and depress the symptoms along with the secondary aims are to prevent long time complications and to increase longevity. Insulin replacement therapy is the only cure for people diagnosed with type 1 diabetes whereas diet and lifestyle modifications are considered as one of the most effective way to treat type 2 diabetes. Various oral hypogylcemic drugs are incorporated to correct the underlying metabolic disorder, such as insulin resistance and inadequate insulin secretion. These medications work well if take in combination with diet therapy along with maintaining active lifestyle.

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Diet and lifestyle strategies are to reduce weight, improve glycaemic control and reduce the risk of cardiovascular complications, which account for 70% to 80% of deaths among those with diabetes. (Mellitus, D. (2005) [6].

Symptoms accompanied with hyperglycemia include polyuria, polydipsia, weight loss, sometimes with polyphagia, and blurred vision. Susceptibility to various other disease also proliferated hyperglycemia condition. Life threatening outcomes of chronic hyperglycemia is ketoacidosis retinopathy with potential loss of vision; nephropathy leading to renal failure, peripheral neuropathy with risk of foot ulcers, amputations, and Charcot joints; and autonomic neuropathy causing gastrointestinal and cardiovascular symptoms and sexual dysfunction is also diagnosed. Patients with diabetes have an increased incidence of atherosclerosis with CVDs, peripheral and cerebrovascular disease. Hypertension and abnormalities of macro nutrients metabolism are often found in people with diabetes. (American Diabetes Association. (2010) [1].

One of the most serious public health issues is diabetes mellitus (DM). In most nations around the world, the prevalence of diabetes mellitus has risen rapidly. According to recent estimates, the number of diabetic patients will rise from 171 million to 366 million between 2000 and 2030.

Sleep disturbance, such as poor sleep quality, is frequent in people with T2DM, with incidence rates ranging from 25 to 70% in various groups. (Narisawa *et al*., 2017) In T2DM patients, diabetes-related symptoms were found to have a strong link to sleep disturbance. (Zhu *et al*., 2018). Patients with uncontrolled diabetes showed a considerably higher rate of poor sleep quality than those with diabetes under control. (Alshenghiti *et al*., 2016) [43].

T2DM has thus been discovered to have a negative impact on patients' health-related quality of life (HRQoL). (Anderson *et al*., 2006) [57].

Many measures have been created over time to capture the perceived behaviour of patients in order to assess HRQoL and diabetes-specific variables. Some are meant for general usage, regardless of the patient's sickness or condition. Even healthy persons can benefit from the generic devices. Some of the first were created with population surveys in mind, but were later expanded to incorporate clinical trial settings. Because the focus is mostly physical symptoms, these instruments are frequently referred to as QoL scales and are health status measurements. Some generic HRQoL measures, such as the SF-36, include all of the fundamental elements of HRQoL and can be easily cross-culturally verified. (Tian-hui *et al*., 2005) [58].

The main goal of T2DM treatment is to maintain blood glucose levels in the normal or near-normal range. (Shojaiefard *et al*., 2008) [59] Diabetes self-care has been defined as an evolutionary process of knowledge or awareness development by learning to cope with the complex nature of T2DM in a social environment. Shrivastava *et al*., 2013) [60].

The National Programme for the Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases, and Stroke (NPCDCS), which includes diabetes, is currently beset by problems such as a lack of adequate human resources and infrastructure, as well as medicine shortages and other operational issues. As a result, a large number of people have no choice but to seek DM diagnosis and treatment from the private sector. (NPCDCS).

Understanding the situation of DM in each state of India has major policy implications for regional DM control, as health is a state subject in India. However, there is currently no comprehensive review of studies that can provide insight into the prevalence of T2DM in different Indian states. In the management of diabetes and its consequences, metabolic control is the cornerstone. Obtaining the HbA1c target lowers the risk of microvascular problems and may help protect against CVD, especially in newly diagnosed patients. (Franz *et al*., 2010) [50].

Previous research has discovered that diabetes self-care activities are inversely connected to health-related quality of life, and that the EuroQoL-5 dimensions (EQ-5D) score is substantially associated with non- adherence to foot care, exercise duration, and smoking (Saleh *et al*., 2014) [61]. Psychological factors such as diabetes-related emotional distress were found to be associated with lesser adherence to diet, exercise, frequent blood glucose testing and medication regimens (Delahanty *et al*., 2007) [62]. Individuals with diabetes must engage in a variety of activities in their everyday life, including eating a healthy diet, exercising regularly, monitoring their blood glucose levels, foot care, and medication self-administration. HRQoL was shown to be lower in patients who did not adhere to self-care behaviors such as exercise and medication (Saleh *et al*., 2014) [61].

Prevalence
(Aljin *et al*., 2018) [34] One of the most common non-communicable diseases (NCD), type 2 diabetes mellitus (T2DM), is a serious public health concern around the world. Diabetes mellitus affects roughly 422 million adults globally, accounting for about 8.5 percent of the global population.

Several studies have been carried out to determine the prevalence of diabetes in various parts of India. There are two recent studies worth mentioning. The India Diabetes (INDIAB) study, conducted by the Indian Council of Medical Research, was the largest nationally representative study of diabetes in India. It was carried out with the goal of calculating the national prevalence of diabetes and prediabetes in India by calculating prevalence by state. A stratified multistage sampling design was used to obtain a community-based sample of 57,117 people aged 20 and up for this study. A total of 15 regions (eight from the mainland, six from the northeast, and one union territory) of India's 36 regions (28 states and 8 union territories) were sampled. The overall prevalence of diabetes in 15 states of India was 7·3% (95% CI 7·0–7·5) and it was higher in urban areas (11·2%, 10·6–11·8) than in rural areas (5·2%, 4·9–5·4; $p<0·0001$). This study showed that 47% of diabetes cases in the study population were undetected. (Anjana *et al*., 2017) [17]. According to a second study by India State level collaborators based on the District Level Household Survey (DLHS) data and modelling exercise, the prevalence of diabetes in adults aged 20 and older in India increased from 5.5 percent in 1990 to 7.7 percent in 2016 (Tandon *et al*., 2016).

According to research conducted by (Anjana *et al*. 2011) [9] 14,277 (86 percent) of the 16,607 people who were chosen for the study took part, with 13,055 of them giving blood samples. Tamilnadu had a weighted prevalence of 10.4 percent diabetes (both known and newly diagnosed), Maharashtra had 8.4 percent, Jharkhand had 5.3 percent, and Chandigarh had 13.6 percent.

Diabetes leads among the potential epidemic in India with more than 62 million diabetic individual currently diagnosed with the disease. In year 2000 India rank topped around the world among the highest count on diabetes individual ie 31.7

million followed by china with count number ie 20.8 million and the united states with 17/7 million rank third. (Kaveeshwar *et al*., 2014) [3].

(Wild *et al*., 2004) [4] predicted that the prevelance of diabetes double globally from 171 million in 2000 to 366 million in 2030 with a maximum prevelance in India. Worldwide prevalence of diabetes for all age groups was estimated to be 2.8% in 2000 and 4.4% in 2030. The prevalence of diabetes found higher in men as compare to women. The most important diabetes prevalence across the world appears to be the increase in the propotion of people who are >65 years of age.

(WHO) In 2019 diabetes was the direct cause of 1.5 million death and 48% of all the death occur due to diababets is before the age of 70 years. Between 2000 and 2016, there was a 5% increase in premature mortality rates (i.e. before the age of 70) from diabetes. In high-income countries the premature mortality rate due to diabetes decreased from 2000 to 2010 but then increased in 2010-2016. In lower-middle-income countries, the premature mortality rate due to diabetes increased across both periods. More than 95% of people with diabetes have type 2 diabetes.

According to the International Diabetes Federation (IDF), the worldwide prevalence of diabetes mellitus in 2011 was 366 million with projections that by 2030, the prevalence will reach 552 million with a 7.7% comparative prevalence. In 2011 the worldwide prevalence of IGT which was recognized as a marker of beta cell dysfuncion and precursor to diabetes mellitus is estimated at 280 million with elivations to reach 398 million by 2030. This trent increase parallely with increase in obesity that carries risk of developing diabetes. In an analysis of mean BMI from 1980 to 2008, women tends to have a mean BMI increase of 0.5 per decade and a men had an increase of 0.4 per decade this clearly shows that the problem is only continuing to grow.(Atlas, D. (2015). In 2015, 415 million people were estimated to have diabetes, with type 2 diabetes accounting for more than 90% of cases. By 2040, that number is expected to rise to 642 million. (Chatterjee *et al*., 2017) [15].

Types
Various types of Diabetes mellitus include
1. Type 1 (T1DM)
2. Type 2 (T2DM)
3. Maturity-onset diabetes of the young (MODY)
4. Gestational diabetes
5. Neonatal diabetes, and
6. Steroid-induced diabetes.

Type-1 Diabetes: This type of diabetes found in 5-10% of the diagnosed cases of diabetes. This type of diabetes is infrequent and may see at the age of 20 years although it can be occur in any age. First defect is destruction of beta cells of the pancreas which causing insulin deficiency. Type – 1 diabetes has 2 forms:- Immune mediated which results from an autoimmune destruction of beta cells and idiopathic which has no known diagnosis (Eiselein *et al*., 2004) [7].

Type-2 Diabetes: This type of diabetes usually occurs in middle life or beyond the age of 40 years although it may occur in the young age also. Many of the patients have long history of mild symptoms which may remain ignored and undiagnosed. In this case risk factors are both environmental and genetic. Patients are most often obese and benefit from

weight loss assisted by an oral hypoglycemia drug (Berbudi *et al*., 2020).

MRDM (Malnutrition Related Diabetes Mellitus): This is further divided into 2 parts 1. **Fibro Calculous Pancreatic Diabetes (FCPD):** This is the onset of pancreatic disease during childhood with peak onset of symptoms in the age of 15-35 years (Sneha. S., 2020) [8].

Protein Deficient Diabetes Mellitus (PDDM): The relationship between diabetes and protein deprivation is due to lack of function of beta cells of pancreas in Kwashiorkor. Some features are the same as FCPD.

IGT (Impaired Glucose Tolerance): Impaired glucose tolerance are regared as at risk factor, therefore to be minimized in such patients to prevent development of diabetes (Khanna *et al*., 2017).

GDM (Gestational Diabetes Mellitus): In this case glucose intolerance is detected for the first time during pregnancy. This condition does not apply to those women who know to be diabetic before conception. It is often diagnosed during second and third trimester due to insulin resistance caused by a rise in insulin hormone. It is important to control glucose level to avoid complications for infants (Buchanan *et al*., 2005) [10].

Drug induced diabetes: many drugs can impaire the insulin secretion. These drugs don't cause diabetes in a direct way but they leads to diabetes with already insulin resistance person. There are many drugs and hormones that can interfere with the insuin action examples include nicotinic acid and glucocorticoids. Persons who receive alpha-interferons have been shown to develop diabetes associated with islet cells antibodies and in certain instances, serve insulin deficiency.

Etiology
Diabetes mellitus has a number of reasons that are still unknown. It is now largely understood that diabetes mellitus is complex in nature, with hereditary and environmental factors both playing a role.

Genetics of type 1
Although type I diabetes is not a genetically predetermined disease, it can be passed down through the generations. The identical twins of a patient with type I diabetes, for example, have a 30–50 percent disease concordance rate. The fact that 95% of type I diabetes patients have HLA-DR3, HLA-DR4, or both is also evidence of genetic involvement in the disease's aetiology. DR3 confers a 7-fold increase in the risk of type I diabetes, DR4 confers a 9-fold increase, and both DR3 and DR4 confer a 14-fold increase in the risk of type I diabetes. (Delli *et al*., 2013) [11].

Environmental
Greater ingestion of nitrates, nitrites, and N-nitroso compounds, as well as higher serum levels of polychlorinated biphenyls, have all been linked to an increased risk of type 1 diabetes. However, the data was limited or inconsistent in general. (Longnecker *et al*., 2001) [12].
Type 2 Obesity, physical inactivity, and energy-dense diets have all contributed to an astonishing rise in the number of people diagnosed with type 2 diabetes around the world. (Chatterjee *et al*., 2017) [15].

MRDM Malnutrition, infection, eating habits such as increased consumption of cassava, and immunological death of pancreatic beta cells are all contributors in the etio-pathology of malnutrition-related diabetes mellitus. However, the specific etiopathogenesis of MRDM is still unknown. (Sneha. S., 2020) [8].

The aetiology of MRDM is yet unknown. Both FCPD and PDPD are found in disadvantaged populations, according to clinical observations. Patients are typically under 40 years old, underweight or cachectic, and have hair and skin abnormalities as well as parotid enlargement, all of which are signs of acute malnutrition. (Abdulkadir et al., 1993) [13].

GDM
The molecular foundation for pregnancy-related insulin resistance and how it develops are still unknown. The majority of pregnant women may overcome insulin resistance during pregnancy by increasing their insulin production. Glucose intolerance arises when the capacity of insulin secretion is insufficient to match the resistance, and the woman develops gestational diabetes. Kuhl, C. (1998) [14]. Etiology and pathogenesis of gestational diabetes. Diabetes care, 21, B19.

Quality of life among diabetes
The World Health Organization redefined health in 1948, claiming that it encompassed not only the absence of disease and infirmity, but also the presence of physical, mental, and social well-being.

The largest perceived burden on quality of life is end-stage complications; nevertheless, comprehensive diabetic therapies also have considerable negative quality-of-life impacts. (Huang et al., 2007) [19].

Diabetics frequently feel challenged by their disease and the demands of day-to-day management. And these are significant demands. Patients must deal with their diabetes all day, every day, making countless decisions in an often futile attempt to achieve a metabolic state that is similar to that of non-diabetics. Diabetes treatment, such as insulin injections, can have a significant impact on quality of life, either positively (by reducing high blood sugar symptoms, for example) or negatively (by increasing low blood sugar symptoms).

This condition could have a significant psychological impact on those suffered, increasing their impression of a low quality of life. Diabetes mellitus is one of the chronic diseases that has a significant impact on people's perceptions of their health-related quality of life (HR-QOL), and is often associated with depression. Patients described diabetes as a disease that is difficult to manage and that necessitates a lifestyle adjustment that requires work and sacrifice. Affected people used the term "sugar" to refer to type 2 diabetes treated with oral antidiabetic medicines, and "diabetes" to refer to insulin-treated type 1 or type 2 diabetes, showing a perception of increased severity and complexity. On an interview with 71 year old man he stated "At the beginning, it didn't affect me because I only had high blood sugar but when I got diabetes and had to inject insulin I was very worried; diabetes changed my life" Some patients claimed that their fear of hypoglycemia prevented them from sleeping well, working normally, driving, or socialising with friends. Patients in primary care had a high opinion of their doctors, although many had complaints about their medical care. They complained about the biomedical focus, long wait periods, short consultations, and frequent doctor changes. (Pera et al., 2011) [26].

People with type 1 (n = 2479) and type 2 (n = 2469) diabetes were surveyed in this cross-sectional study.

Adults with high-risk HbA1c levels have reduced HRQOL in most but not all domains of the SF-36v2 in patients with type 1 diabetes and type 2 diabetes, according to the study. The domains RP (Role emotion), GH, and VT (Vitality) for participants with type 1 diabetes and the domains RP(Role emotion), GH, and VT (Vitality) for participants with type 2 diabetes showed the most differences between the high-risk group and the other two groups. (Engstrom et al., 2019).

There is a link between diabetes-specific QoL and dietary habits, as demonstrated in a recent multicenter study. The fact that QoL is reduced in diabetic patients, particularly in the "freedom to eat" domain, which is linked to people's perceptions of their eating abilities, suggests that boosting dietary freedom could be a viable method to enhance QoL in diabetics. (Wang et al., 2017) [28].

We highlight the primary instruments used to measure quality of life difficulties in persons with diabetes and describe the range of criteria considered by various researchers to constitute parts of quality of life. Then we look at the elements that affect diabetes patients' quality of life and compare it to the quality of life of people who don't have diabetes.

The impact of domain-specific satisfaction on overall life satisfaction has been studied in some study on the impact of health on quality of life. When compared to satisfaction in other categories, health-related quality of life has a minor effect on overall life satisfaction in the general population but it has a higher effect when concentrating on those who experience substantial health decrements. (Andrews et al., 2005) [20].

Diabetes patients have a disproportionately high risk of social and emotional problems compared to the overall population, according to studies. Frustration and a sense of powerlessness were among the negative feelings that contributed to poor self-care habits, including inadequate blood sugar monitoring. Tewahido et al., 2017 [39].

Diabets and duration
Several studies indicated that having diabetes for a longer period of time was linked to a lower quality of life, as measured by the Nottingham Health Profle in a Finnish community of persons with various types of diabetes. (aalto et al., 1997) [21].

A total of 180 subjects were used in the study (80 diabetics, 50 asthmatics and 50 healthy controls) When anxiety and depression symptoms were compared between the groups, it was discovered that 16 (20%) of diabetic patients had anxiety symptoms, 17 (34%) of asthmatics had anxiety symptoms, and four (8%) of healthy controls had anxiety symptoms. Depressive symptoms were reported by 16 (20%) diabetic patients, six (12%) and two (4%) asthmatic patients, respectively. Among diabetic patients, seven (9%) had both anxiety and depressive symptoms. This study emphasises the harmful influence of the presence of psychological symptoms on the quality of life of diabetics. The prevalence of these symptoms, particularly depression, was linked to a lower sense of overall well-being and influenced the patients' sense of positive well-being. (Mosaku et al., 2008) [22].

Type of diabtets on quality of life

Jacobson and colleagues employed the SF-36 and the DQOL to measure quality of life in adults with Type 1 and Type 2 diabetes, and discovered that Type 2 patients who did not use insulin had a greater quality of life than Type 2 patients who did. Type 2 diabetics on insulin had a higher health-related quality of life than Type 1 diabetics. (Jacobson *et al*., 1994) [23].

Diabetes related complications and quality of life

The presence of two or more diabetes-related complications was associated with a significant increase in the risk that patients with either type of diabetes experienced clinically meaningful symptoms of sadness or anxiety, according to studies done by the current authors. (Peyrot *et al*., 1997) [24].

Treatment regimen and quality of life

The findings of studies on the relationship between treatment regimen and diabetes quality of life are varied, with some evidence that increasing treatment intensity in Type 2 diabetes patients from diet and exercise alone to oral drugs, to insulin, is related with poorer quality of life. Patients taking oral medications had more DQOL- assessed diabetes-related worries than those controlling their diabetes solely through diet and exercise, and those taking insulin had less DQOL-assessed treatment satisfaction and more burden of illness than those taking oral blood-glucose-lowering medication or none at all, according to Jacobson and colleagues. (Jacobson *et al*., 1994) [23].

Glycemic control

In a Dutch community of Type 2 diabetes patients, Van der Does and colleagues discovered that poor mood (as measured by discontent, despair, tension, and exhaustion scores) was linked to higher HbA1c values. (Vander *et al*., 1996) [25]. Mazze and colleagues discovered that people with Type 1 diabetes who were in good control had lower levels of sadness and anxiety than those who were in average or poor control.

Reason for low life satisfaction among diabetes

Definition: Life satisfaction is a person's view of how his or her life is going and where they envision it going in the future. Life satisfaction is a metric of well-being as well as a cognitive, global assessment. It meant having an optimistic outlook on life in general. Life satisfaction can be judged in terms of a person's financial situation, education, experiences, and where they live, among other things.

It has been proposed that total life happiness is derived from within an individual depending on the individual's personal values and what he or she considers significant, which may include family, love, money, or other material objects; however, this differs from person to person. Prior studies have indicated that materialistic people are more likely to be men, and that they have lower levels of life satisfaction than non-materialistic people. (Agrawal *et al*., 2015) [29].

Life satisfaction is a multifaceted notion that includes both psychological and environmental factors. Life satisfaction refers to a person's entire life, including all parts of it. Life satisfaction is defined as the predominance of happy sentiments over bad feelings in daily life, and it entails being excellent in various aspects such as happiness and morality. The level of enjoyment is determined by personal and environmental factors. (A Study on Life Satisfaction Level among Persons with Diabetes).

(Takahashi *et al*., 2010) [30] Investigated the relationship between community participation and life satisfaction in old diabetics. A questionnaire addressing medical, psychological, and social elements was presented via interview to 56 elderly diabetic outpatients. Life satisfaction was measured using the Life Satisfaction Index K (LSIK). Diabetic neuropathy and pain in the lower back or knee joints were found to be associated with low Life satisfaction index K scores, whereas community participation, social curiosity, interpersonal relationships, and instrumental support from families living with the participants were found to be positively correlated with high Life satisfaction Index K scores. High LSIK scores were independently associated with community participation, instrumental support from participants' relatives, and the absence of neuropathy. According to the findings, community participation is a significant factor connected with life satisfaction in senior diabetics.

Kalawa *et al*. (2013) investigated the quality of life satisfaction of diabetic foot patients, with 77 Egyptians and 100 Sudanese taking part in the study, which was conducted in Egypt at the diabetic outpatient clinic of the Port General Hospital. A customized data collection tool was employed, which was separated into four parts: socio- demographic factors, diabetes mellitus duration, feeling, quality of life, and satisfaction. The findings showed that there was a significant difference in several items linked to quality of life and diabetic foot patient satisfaction between Egyptian and Sudanese diabetic foot patients, with Sudanese diabetic foot patients having a low quality of life and happiness with their disease.

The goal of (Humboldt *et al*., 2013) [32] study on Aging with Diabetes: Sense of Coherence and Satisfaction with Life in European Older Adults with Type 2 Diabetes was to find out significant differences between three groups of older adults with various diabetes diagnoses, i.e., with only type 2 diabetes, with diabetes and other chronic diseases, and remaining patients without any chronic disease, in terms of (SWL) satisfaction with life and (SOC) sense of coherence scores. Only diabetes' group had lowest SOC and SWL scores and There was no association between SOC and SWL in the 'without diabetes' and 'with diabetes and other' groups. The findings imply that chronic diseases, such as diabetes, and the presence of comorbidities, have differing effects on both SWL and SOC. This study focuses on the relevance of healthy ageing and the value of SWL and SOC in the elderly, especially in the context of diabetes.

(Rubin *et al*., 1999) [33] Reviewed the existing literature on diabetic adults' self-perceptions of quality of life, physical and social functioning, and perceived mental and physical wellbeing. It was discovered that better glycemic control is related to better quality of life, regardless of how intensive treatment is given, and that any type of complication in diabetes has a negative impact on quality of life, similarly when the patient's health status is deteriorated.

Agrawal *et al*., 2015) [29] conducted a study of life satisfaction and happiness in diabetic males who were on insulin (N=20) and those who were not on insulin (N=20), chosen at random, from a private hospital in Bhopal, M.P. They discovered that happiness is higher in diabetic males of the non-insulin category as compared to diabetic males of the insulin category, and diabetic males of the insulin category were found higher in mental, social, and Egede and Ellis (2010) Diabetes and depression were the subjects of a study. He agreed that having diabetes plus depression is linked to poor

treatment adherence, but in a follow-up study, they discovered that metabolic control measures did not differ substantially between depressed and non-depressed individuals. (Pan *et al* (2010) did a clinical study in which he looked at the bidirectional relationship between depression and type 2 diabetes in women. He discovered that type 2 diabetes and clinical depression had a two-way interaction.

Hislop and others (2008) discovered that one-third of young Australian adults with Type 1 diabetes (mean age 22 years) also showed psychological discomfort. Clinicians and academics are increasingly recognising the link between diabetes and poor mental health, with evidence primarily derived from clinical investigations.

According to EI-Mallakh (2007) Diabetes mellitus is more common among people with schizophrenia and schizoaffective disorders than in the general population, A strong link exists between diabetes and mental disease. (Aljin *et al*., 2018) [34] Conducted a study to assess diabetes awareness among type 2 diabetes patients attending a rural health and training centre (RHTC). Those who were able to accurately answer at least 5 of the ten questions used to test T2DM knowledge and awareness were considered to have appropriate knowledge. 163 (63.17 percent) of the 258 study participants had adequate awareness of T2DM, according to the findings. Those with a family history of T2DM were shown to be twice as likely to be well-informed and knowledgeable about the disease. The practise of the participants in controlling blood sugar levels and preventing diabetic complications still needs to be improved. This can be accomplished more effectively through diabetes health education, which educates patients about their illnesses and eventually changes their attitudes toward diabetes, resulting in good lifestyle practises among diabetic patients and a reduction in the burden caused by the disease's complications.

According to a study conducted by (Priya *et al*), the majority of diabetic patients have a medium mental capacity. It can be improved by staying in good physical shape. Living with physical discomfort on a daily basis puts a strain on one's mental health. It's not always simple to keep the mind healthy when the body suffers, but it's crucial for living with day-to-day discomfort. In addition to their handicap, patients with chronic physical problems frequently suffer from depression or anxiety. Chronic sickness, especially those that induce pain, alters brain chemistry, disrupts sleep, and causes mood swings. Although excellent therapies exist for both diabetes and mental health issues, administering services for physical and mental health issues separately may be inefficient. Psychosocial therapies may help patients with diabetes improve their physical and emotional health. (https://www.iosrjournals.org/iosr-jhss/papers/Conf.17004/Volume-3/9.%2051-55.pdf)

In a study conducted by (Srinivasan *et al*., 2017) [35] it was discovered that Diabetic retinopathy causes visual impairment and blindness, however it is virtually fully avoidable with early detection and treatment. The patients in the study had poor awareness and knowledge of diabetic retinopathy. Of the 288 patients in the study, 42% had good knowledge of diabetes, but only 4.5% had good knowledge of retinopathy. Good diabetes knowledge was connected with a positive attitude toward diabetes and good retinopathy practise patterns; awareness of retinopathy was also associated with good practise patterns. A total of 61.1% of patients did not have their eyes examined on a regular basis; the most common barrier was a lack of awareness about the importance

of this (38.5%). A major barrier to regular screening for diabetic retinopathy was found to be a lack of understanding about the necessity for screening. Positive attitudes about diabetes and good retinopathy practise patterns were substantially connected with diabetes knowledge. Diabetic retinopathy awareness was found to be substantially linked to good retinopathy practise patterns. As a result, measures to educate diabetic people about this potentially blinding consequence of diabetes are urgently needed.

Diabetes self-care habits sometimes fall short due to a lack of suitable information and motivation to engage in regular physical activity. (Abebe *et al*., 2013) [36]. Injection site pain and abscess are common side effects that make it difficult for diabetics to stick to their treatment regimen.

Diabetes self-care is often inadequate, owing to a lack of instruction and support for people with the disease. To promote improved self-care habits and minimize early problems, more emphasis should be placed on improving patient education and assistance in diabetes clinics. (Tewahido *et al*., 2017) [39].

One-third of diabetic patients were aware of the necessity of meal planning and lowering cholesterol consumption to avoid CVD, according to the study. Several studies have found that T2DM patients had a higher prevalence of eating disorders and eating disorder symptoms. Because of its significant link to obesity, a condition that contributes to T2DM, the majority of these investigations have focused on binge eating disorder. (Carr Hill *et al*., 2005) [31].

Diabetes is primarily caused by poor eating habits and a lack of physical activity. Failure to stick to a rigorous diet and exercise routine, as well as taking prescribed medicine, are the major causes of problems in T2DM patients. (Gæde *et al*., 2008) [48].

Suggestions to improve quality of life

Diabetes self-management is significant since it might affect a person's quality of life (QoL) if they have type 2 diabetes mellitus. (Khanna *et al*., 2012) [54].

Going to the gym on a regular basis may be impossible for elderly and ill people due to cost or distance. As a result, adequate recommendations for the type of exercise that can be done at home must be provided. (Nshisso *et al*., 2012) [37].

Adherence to anti-diabetes medication, on the other hand, was the best of all self-care measures. This could be due to an over-reliance on medication, its free availability, or the simplicity with which it can be implemented compared to the other components that need more dedication. (Al-Maskari *et al*., 2013) [38].

In our scenario, foot care was the least practised diabetes self-care. This could be due to diabetes patients' lack of comprehension of its importance or the repercussions. Foot wounds in Sub-Saharan Africa are frequently complicated, leading to serious infection/sepsis gangrene. Proper diabetes education has resulted in a significant improvement in foot self-care. Tewahido *et al*., 2107) [39].

Long times between clinic sessions were noted as one of the reasons by diabetic patients who accept responsibility for self-adjusting medication dosages. In overcrowded diabetes clinics in Sub-Saharan African nations, providing a comprehensive education programme and delegating chores from physicians to nurses or a person specifically trained to perform a limited job such as diabetes education delivery have been demonstrated to improve patient care. Marilyn D Ritholz, Elizabeth A Beverly, Kelly M Brooks, Martin J Abrahamson,

and Katie Weinger. Barri- ers and Facilitators to Self-Care Communication during Medical Appointments in Adults with Type 2 Diabetes. Patients with diabetes who take care responsibility for self-adjusting medication dosage cited for long periods between clinic consultations as one of the reason. Patients should be instructed and encouraged to adhere to their drug regimens as closely as possible in order to have less discomfort and a higher quality of life. Diabetic self-care should be emphasised as well because it reduces diabetes distress and improves overall quality of life. Clinicians are encouraged to play a more active role in assisting their patients with medication adherence and self-care activities. Effective health-care interventions are critical to encouraging and assisting T2DM patients in improving their quality of life while living with and coping with this burdensome disease. (Jannoo et al., 2017) [40].

Cognitive behavior therapy CBT was found to reduce the emotional load of diabetes, enhance patient adjustment, and improve QOL in a previous study. (Harvey et al., 2017) [44]. CBT, when used as a psychological disorder therapeutic, has been shown to improve QOL in individuals with T2DM in some trials. (Noroozi et al., 2017) [45].

In a study done by (Zuo et al 2020) [46] they found that individuals who got CBT had a 10.70 point greater Diabetic specific quality of life (DSQLS) score than those who received conventional care immediately after treatment ended (2-month evaluation), showing considerable improvement in QOL in the CBT group.

Improvements in a patient's nutritional knowledge, attitudes, and habits can help them control their diabetes. These elements are seen to be an important aspect of comprehensive diabetes care. Islam et al., 2015) [47].

High carbohydrate and high monounsaturated fat diets increase insulin sensitivity, while glucose disposal dietary strategies are the first line of defence against dyslipidemia in diabetic patients, according to interventional research. (Krawagh et al., 2011) [49]. In persons with diabetes, carbohydrate intake has a direct effect on postprandial glucose levels, and it is the primary macronutrient to be concerned about in glycemic management. (Holman et al., 2008). Individual dietary habits are critical components of cardiovascular and metabolic risk. Elmazar et al., 2014 [52].

T2DM patients, according to a review of various studies by (Sami et al., 2017) [53], require reinforcement of DM education, including dietary management, from stakeholders (health-care providers, health-care facilities, etc.) to encourage them to better understand disease management for better self-care and quality of life. The overall goal of T2DM treatment is to prevent early end-organ problems, which can be accomplished with careful nutritional management. Dietary management success necessitates that health providers have a basic understanding of the patients' cultural beliefs, thoughts, family, and social networks. Because diabetes is a lifelong disease, healthcare practitioners should provide adequate therapeutic methods, with a special emphasis on nutrition, in order to regulate the disease, alleviate symptoms, and avoid problems from developing. (Kueh et al., 2017) [55] Found that those who practised more frequent diet management had better levels of satisfaction than those who practised less diet management, and they had lower levels of T2DM's influence on QoL than those who practised less diet management in a research of 266 patients with T2DM. T2DM self- management in the context of exercise was linked to T2DM QoL satisfaction. Participants who engaged in more regular self-management of T2DM through exercise reported higher levels of satisfaction with their T2DM QoL than those who engaged in less exercise management.

According to (Toumpanakis et al., 2108) [56]'s comprehensive review, plant-based diets combined with educational interventions can considerably enhance psychological health, quality of life, HbA1c levels, and weight, and thus diabetes treatment.

According to (diabetes.co.uk) there are some straightforward ways of improving your quality of life if you have either type 1 or type 2 diabetes.

1. Set yourself achievable targets
Once you've figured out what's causing your blood sugar levels to spike, you can concentrate on staying within the desired range. Similarly, if you've recently struggled with weight loss or specific parts of nutritional and/or lifestyle modifications, concentrate on tiny gains in the short term. If you've struck a stumbling block, small adjustments can provide you a much-needed lift before you resume your long-term goals.

2. Eat a healthy diet
For someone with diabetes, a balanced diet is crucial; processed foods should be avoided as much as possible. Set a reasonable goal to wean yourself off processed foods if you eat them frequently. The low-carb diet is one that many people find beneficial for controlling blood sugar levels and weight loss – both of which can make you feel better about yourself and your diabetes. The benefits of a low-carb diet for diabetics are constantly being supported by research. The Low Carb Program was just released to help people manage their diabetes and enhance their health and wellbeing in the short and long term.

3. Regular exercise
Exercise has been demonstrated to lower HbA1c levels in type 2 diabetes patients, making you feel better about yourself. Furthermore, exercising three times per week can improve the quality of life for type 2 diabetics who are overweight, and supervised walking with a pedometer can help people feel better about their diabetes. Exercise can help persons with type 1 diabetes increase their insulin sensitivity. You may require less medication if your insulin is more effective.

4. Mindfulness
By addressing despair, stress, and anxiety, mindfulness training can help persons with diabetes improve their quality of life. It's a coping mechanism that can be especially useful if you've recently been feeling overwhelmed by your diabetes care, and it can help you get back on track. Mindfulness has also been linked to better blood sugar control and psychological well-being in clinical studies.

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