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Master of Science Thesis

EVALUATION OF EXERCISE SELF-EFFICACY AMONG DIABETIC PATIENTS IN PRIMARY HEALTH CENTERS IN AL-QADISIYAH CITY / IRAQ

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BY

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ETHICS STATEMENT

The thesis entitled “Evaluation of exercise self-efficacy among diabetic patients in primary health centers in Al-Qadisiyah city / Iraq,” which was prepared and presented as a thesis, was written by myself and followed the scientific, academic rules, and ethical conduct. The idea/hypothesis of my thesis solely belongs to my supervisor and me. I researched the thesis; therefore, all of the used sentences and interpretations within the work belong to me.

I declare the issues mentioned above to be correct.

Signature

Date

NOOR MOHAMMED KADHİM AL-QURAISHI

ABSTRACT

EVALUATION OF EXERCISE SELF-EFFICACY AMONG DIABETIC PATIENTS IN PRIMARY HEALTH CENTERS IN AL-QADISIYAH CITY / IRAQ

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Master of Science in Nursing

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Exercise self-efficacy in diabetes refers to an individual's belief in their ability to engage in and adhere to an exercise regimen as part of their diabetes management plan. It specifically relates to their confidence in their capability to perform regular physical activity, overcome barriers or challenges, and maintain consistency in exercise participation. Believed that regular exercise is highly beneficial for individuals with diabetes as it can help improve glycemic control, enhance insulin sensitivity, manage weight, reduce cardiovascular risk factors, and promote overall well-being. However, incorporating exercise into one's lifestyle can be challenging, especially for individuals with diabetes who may have concerns about managing blood glucose levels, potential complications, or physical limitations. In Iraq, there is a lack of understanding regarding the management of self-efficacy and the role that self-efficacy has on adherence to activities that promote self-care and overall illness control. The aim of this study is to evaluate exercise self-efficacy among diabetic patients in primary healthcare centers in Al-Qadisiyah, Iraq. A descriptive and cross-sectional research design was used. The study was conducted in primary healthcare centers in Al-Qadisiyah City in central Iraq from April 2022 to November 2022. The study population consisted of 200 patients (Male and Female) with diabetes living in Al-Qadisiyah City. As a data collection tool, The Arabic version of the Sociodemographic Characteristics Form and Exercise self-efficacy scale (ESE). The data collection was conducted through face-to-face interviews. The data analysis involved utilizing descriptive statistics (such as numbers,

percentages, means, and standard deviations) and quantitative data analysis methods, including t-tests and ANOVA. The results of the study showed that 51.5% of them are 44 years old or below, 51.0% are male, 70.5% of them are married, in the number of people in the family 36.5% were more than 6, and 34% are Bachelor. Also, regarding the occupational distribution of the participants 38.5% were employees, participant's work experience 36% were 5 years or less, participants regarding income satisfaction 43% were somehow satisfied, regarding the presence of a previous illness 63.5% answered no, regarding the diagnosis period of the disease were 43.5% of them gave the answer between 1-5 years, and regarding the evaluation of physical activity 38.5% were good/moderate. In another hand, the results showed a statistically significant association between self-efficacy exercise and physical activity for diabetic patients in primary health centers in Qadisiyah in Iraq, where p value were <0.05. It is demonstrated a significant association between exercise self-efficacy and physical activity among diabetic patients in the primary health centers of Qadisiyah, Iraq. This highlights the importance of promoting and enhancing exercise self-efficacy to encourage individuals to adopt and sustain regular physical activity as part of their diabetes management.

2023, 74 pages

Keywords: Diabetic, Evaluation, Exercise Self-Efficacy, Primary Health Centers

ÖZET

AL-QADİSİYAH ŞEHRİ / IRAK'TAKİ BİRİNCİ BASAMAK SAĞLIK MERKEZLERİNDE DİYABETİK HASTALAR ARASINDA EGZERSİZ ÖZ-ETKİLİLİĞİNİN DEĞERLENDİRİLMESİ

Noor Mohammed Kadhim AL-QURAISHI

Hemşirelik, Yüksek Lisans

Tez Danışmanı: Prof. Dr. Azize Serap TUNÇER

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Mayıs 2023

Diyabette egzersiz öz yeterliliği, bireyin diyabet yönetim planının bir parçası olarak bir egzersiz rejimine katılma ve bu rejime bağlı kalma becerisine olan inancını ifade eder. Özellikle düzenli fiziksel aktivite yapma, engelleri veya zorlukların üstesinden gelme ve egzersiz katılımında tutarlılığı koruma yeteneklerine olan güvenleriyle ilgilidir. Düzenli egzersizin glisemik kontrolü iyileştirmeye, insülin duyarlılığını artırmaya, kiloyu yönetmeye, kardiyovasküler risk faktörlerini azaltmaya ve genel refahı artırmaya yardımcı olabileceğinden diyabetli bireyler için oldukça faydalı olduğuna inanılmaktadır. Bununla birlikte, egzersizi kişinin yaşam tarzına dahil etmek, özellikle kan şekeri düzeylerini, potansiyel komplikasyonları veya fiziksel kısıtlamaları yönetme konusunda endişeleri olabilecek diyabetli bireyler için zor olabilir. Irak'ta, öz yeterliliğin yönetimi ve öz yeterliliğin öz bakım ve genel hastalık kontrolünü teşvik eden faaliyetlere bağlılık üzerindeki rolü konusunda bir anlayış eksikliği vardır. Bu çalışmanın amacı, Irak'ın Al-Qadisiyah bölgesindeki birinci basamak sağlık merkezlerindeki diyabetik hastalarda egzersiz öz-yeterliliğini değerlendirmektir. Tanımlayıcı ve kesitsel araştırma deseni kullanılmıştır. Çalışma, Nisan 2022'den Kasım 2022'ye kadar Irak'ın merkezindeki Al-Qadisiyah Şehrindeki birinci basamak sağlık merkezlerinde gerçekleştirilmiş. Çalışma popülasyonunu, Al-Qadisiyah Şehrinde yaşayan diyabetli 200 hasta (Erkek ve Kadın) oluşturmuş. Veri toplama aracı olarak, Sosyodemografik Özellikler Formu ve Egzersiz öz-yeterlik ölçeğinin (ESE) Arapça versiyonu. Veri toplama yüz yüze görüşmeler yoluyla gerçekleştirilmiştir. Veri analizi,

tanımlayıcı istatistiklerin (sayılar, yüzdeler, ortalamalar ve standart sapmalar gibi) ve t-testleri ve ANOVA dahil olmak üzere nicel veri analiz yöntemlerinin kullanılmasını içeriyormuş. Araştırma sonuçlarına göre, %51,5'i 44 yaş ve altında, %51,0'ı erkek, %70,5'i evli, ailedeki kişi sayısının %36,5'i 6'dan fazla ve %34'ü bekar. Ayrıca, katılımcıların mesleki dağılımına bakıldığında %38,5'i çalışan, %36'sı 5 yıl ve daha az iş deneyimine sahip, katılımcıların gelirinden memnun olma oranı %43, önceden bir hastalığının varlığı konusunda %63,5'i tanı konusunda hayır cevabını vermiştir. hastalık süresi ise %43,5'i 1-5 yıl arası yanıtını verirken, fiziksel aktivite değerlendirmesi %38,5'i iyi/orta düzeyde idi. Diğer yandan, sonuçlar Irak'ta Qadisiyah'taki birinci basamak sağlık merkezlerinde diyabetik hastalar için öz-yeterlik egzersizi ile fiziksel aktivite arasında istatistiksel olarak anlamlı bir ilişki gösterdi, burada p değeri < 0.05 idi. Irak, Qadisiyah'taki birinci basamak sağlık merkezlerinde diyabetik hastalarda egzersiz öz-yeterlik ve fiziksel aktivite arasında anlamlı bir ilişki olduğu gösterilmiştir. Bu, bireyleri diyabet yönetiminin bir parçası olarak düzenli fiziksel aktiviteyi benimsemeye ve sürdürmeye teşvik etmek için egzersiz öz yeterliliğini teşvik etmenin ve artırmanın önemini vurgulamaktadır.

2023, 74 sayfa

Anahtar Kelimeler: Basamak Sağlık Merkezleri, Birinci, Değerlendirme, Diyabetik, Egzersiz Öz Yeterliliği

PREFACE AND ACKNOWLEDGEMENTS

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Noor Mohammed Kadhim AL-QURAISHI

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CONTENTS

LIST OF ABBREVIATIONS

DM	Diabetes mellitus
ER	Endoplasmic reticulum
esrd	End-stage renal disease
FPG	Fasting plasma glucose
GLUT	Glucose transporter
IDDM	Familial insulin-dependent diabetes mellitus
IDF	International diabetes federation
NIDDM	Non-insulin-dependent diabetes mellitus
OGTT	Oral glucose tolerance test
PCOS	Polycystic ovarian syndrome
RDA	Recommended daily allowance
RPG	Random plasma glucose
SGLT2	Sodium-glucose cotransporter-2
SMBG	Self-monitoring of blood glucose
T1DM	Type 1 diabetes mellitus
T2DM	Type 2 diabetes mellitus
US	United States
WHO	World Health Organization

LIST OF TABLES

1. INTRODUCTION

Diabetes mellitus encompasses a diverse group of metabolic diseases that often lead to elevated blood glucose levels (hyperglycemia). As a result, diabetic patients face an increased risk of various complications that significantly impact their quality of life and contribute to higher mortality rates (Baena-Díez *et al.* 2016). Prolonged elevation of blood glucose levels in individuals with diabetes causes vascular damage, both at macro and micro levels, making it a primary contributor to the development of various complications such as cardiovascular diseases, nephropathy, retinopathy, neuropathy, and other associated conditions (Hippisley-Cox and Coupland 2016, Karuranga and Duke 2018).

As human civilization progressed, diabetes became one of the most deadly chronic conditions. To put it simply, it is one of the most severe and persistent problems in the field of public health today. There are now 371 million adult diabetics and an additional 187 million undiagnosed cases of diabetes worldwide; diabetes is responsible for the deaths of 4.8 million people per year and costs a total of $471.6 billion (Atlas 2015).

These figures are anticipated to reach 439 m by the year 2030, and the rate of newly diagnosed cases of diabetes in developing nations is likely to be (69%), which is much higher than the anticipated rate of (20%) in wealthier countries (Boyle *et al.* 2010).

The information on diabetes demonstrates that it is a severe disease linked with high morbidity and death rates and increased expenses associated with medical treatment. Diabetes may result in significant biopsychosocial repercussions for those with it if it is not treated promptly. In order to manage diabetes effectively, significant adjustments must be made to several elements of each patient's daily routine. It may include taking oral drugs, insulin injections, checking one's blood sugar at home, and following a specific diet and exercise routine. In order for persons with diabetes to be able to do their self-care tasks, diabetes education focuses on fostering individuals' senses of autonomy and self-assurance. Patients have said that putting their self-management plan into action is an endeavor that is even more challenging than coming to terms with their

diabetes diagnosis. The difficulty is in assisting people in developing their methods for the long-term control of their diabetes (Hurley and Shea 1992).

There are several probable reasons for a disparity gap, but one is that developing countries have fewer resources than emerging countries. The quality of health care is greatly affected by variables such as the high cost of treatment, the insufficient number of available hospital beds, and low socioeconomic status (Goweda *et al.* 2017). According to the International Diabetes Federation, around 80 percent of the world's diabetes population lives in countries with low or intermediate incomes (Atlas 2015).

Diabetes mellitus (DM) represents a significant global public health challenge, impacting individuals across various dimensions of life, including biological, psychological, and social aspects. The financial burden associated with diabetes is escalating rapidly due to its complications, which range from heightened risks of heart attacks, strokes, and amputations to vision impairment and kidney damage (Khattab *et al.* 2010, Oluma *et al.* 2010). Successful management of these debilitating diabetes complications necessitates behavioral modifications that rely on self-efficacy and self-care practices (Shrivastava *et al.* 2013).

Self-efficacy emerges as a significant determinant that plays a crucial role in the achievement of effective diabetic control and self-care. Researchers posit that self-efficacy provides a suitable framework for comprehending and forecasting patients' behaviors and dedication to self-care in diabetes management (Sarkar *et al.* 2006, King *et al.* 2010).

The self-efficacy theory contends that people will act when they believe they are capable of doing so and will refrain from acting when they fear failure. Self-efficacy is a prerequisite for a behavior and should be regarded as a distinct component of fundamental skills (Williams *et al.* 2014).

According to Bandura, self-efficacy serves as a fundamental construct for anticipating individual behavioral changes. Individuals who exhibit a high level of behavioral changes often possess elevated self-efficacy (Dehghan *et al.* 2014). Self-efficacy (SE) assumes a significant role in diabetes self-management and serves as a predictive factor for its outcomes.

Consequently, the implementation of self-management and self-care strategies is strongly advised to enhance quality of life and mitigate the progression of diabetic complications in patients (Seib *et al.* 2018). Self-care behaviors among individuals with diabetes encompass enhancing knowledge and understanding of the intricate nature of the condition, as well as actively engaging in measures such as blood glucose control, adopting a healthy diet, participating in physical activity (PA), and practicing proper foot care (Shrivastava *et al.* 2013).

Regular physical exercise is an essential component of diabetes management, as it helps improve glycemic control, enhance cardiovascular health, and promote overall well-being. However, adherence to exercise regimens can be challenging, and individuals with diabetes often face unique barriers that hinder their engagement in physical activity. One crucial psychological factor that influences exercise participation is exercise self-efficacy, which refers to an individual's belief in their ability to successfully perform and sustain exercise behaviors in various situations (Pekmezi *et al.* 2009).

The significance of exercise in promoting health has been recognized since ancient times. Hippocrates, considered the father of scientific medicine, was the first documented physician to acknowledge the value of exercise in treating patients with "consumption" (Tipton 2014). In present times, exercise is recommended as an initial management approach for individuals recently diagnosed with type 2 diabetes. It is also a key component, alongside diet and behavior modification, in comprehensive programs aimed at preventing type 2 diabetes and obesity.

A person who has diabetes needs to make it a priority to participate in various sports and other physically active pursuits regularly. Because exercise improves a patient's mental state, helps them lose weight, and makes drugs more effective, it is essential to mitigate the risk of the patient developing problems due to their condition. Research shows that individuals are becoming more aware of the advantages of exercise, but whether or not diabetes patients should engage in aerobic exercise is still debatable. Inactivity and a lack of exercise are associated with the development of diabetes (Sgrò *et al.* 2021).

However, studies have shown that knowledge alone is not enough to motivate people to adopt a healthy lifestyle that includes regular physical activities. Other factors, such as the belief in one's vulnerability to disease, the belief in the seriousness of the disease, the perceived benefit of exercise, and the belief in the barriers to exercise, also play a role. Moreover, even if diabetes patients' awareness of these things improves, they will not start exercising unless they have a positive outlook on their ability to do so. To successfully alter one's behavior, a person must first develop a high level of self-efficacy, a notion unique to the study of behavior. One's confidence in one's capacity to complete a challenging task strongly predicts one's willingness to try new and different behavioral challenges connected to that task. A person's capacity to continue in the face of setbacks and failure is affected by their degree of self-efficacy, affecting their effort towards achieving their goal behavior. Self-efficacy assessments may help anticipate behavioral change intent and guide selecting self-care-promoting treatments (Kavookjian 2001). Predictive of future behavior, self-efficacy may also work as an inducer or inhibitor of the right kind of activity (Prochaska *et al.* 1985).

By focusing on exercise self-efficacy within primary health centers, healthcare providers can implement evidence-based interventions, including patient education, counseling, goal-setting, and support networks, to empower individuals with diabetes to adopt and maintain regular exercise habits. Such interventions can help enhance exercise self-efficacy levels, increase physical activity participation, and ultimately improve diabetes management and overall health outcomes. This research aims to

measure exercise self-efficacy among diabetes patients visiting primary healthcare clinics in Qadisiyah, Iraq.

1.1. Important of the study

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by hyperglycemia, poor carbohydrate, lipid, and protein metabolism, and insufficient insulin production or sensitivity. (DM) Diabetes mellitus is an acronym that stands for diabetes mellitus (Kumar *et al*. 2019).

Diabetes mellitus affects (10.4%) of the adult population in Iraq, which translates to approximately 3 million people. Despite the high prevalence of diabetes mellitus across the country and the fact that there is a chance of avoiding or delaying the onset of end-stage renal disease (ESRD), very little is known about early DN (Ali and Al Lami 2016).

Diabetes may be avoided and treated with the help of regular exercise. Aerobic exercise, resistance exercise, or a mix of the two may efficiently regulate glycolipid metabolism in DM patients, which helps manage diabetes. This is the conclusion drawn from a large number of randomized controlled research. Patients who engaged in regular physical activity had lower odds of developing diabetic nephropathy, diabetic retinopathy, peripheral neuropathy, peripheral vascular disease, and diabetic foot (Yang *et al.* 2019). Diabetes is associated with inactivity (Sgrò *et al.* 2021).

Even if people's awareness of the advantages of physical activity has improved, aerobic exercise in individuals with diabetes is still controversial. According to studies, factors such as illness susceptibility, disease severity, benefits, and exercise barriers have an impact on adopting a lifestyle that includes regular physical activity in addition to knowledge. Even if these characteristics are better perceived, individuals with diabetes will not exercise until they feel confident. Exercise's perceived effectiveness in diabetics must be determined. This research intends to examine exercise self-efficacy in Iraq's Al-

Qadisiyah city. The results of this research are anticipated to bridge the information gap about the level of exercise self-efficacy held by diabetes patients in Iraq. Clinical nursing practitioners, nursing educators, public health professionals, and those who influence health policy will all find this new information to be of interest. Because of this research, nurses who work with diabetic patients will be able to identify the amount of exercise self-efficacy and the variables that affect it among their patients. According to the findings, the study will also help nursing educators improve their students' understanding of diabetic conditions. In conclusion, it is anticipated that the findings of this particular study will contribute to the work of other scientific researchers in the area of exercise and diabetes, as well as enact legislation that permits diabetic patients to practice exercise.

1.2. Statement of the problem

The statement of the present study is the " Evaluation the exercise self-efficacy among diabetic patients in primary health centers in Al-Qadisiyah city in Iraq".

1.3. Objectives of the study

The objectives of this study are:

1- To describe the sociodemographic characteristics of diabetic patients in Al-Qadisiyah city
2- To assess the exercise self-efficacy among diabetes patients attending primary health care centers of Al-Qadisiyah city
3- To identify the association between exercise self-efficacy and the sociodemographic characteristics of diabetic patients in Al-Qadisiyah city
4- To predict the factors that determine exercise self-efficacy among diabetes patients attending primary health care centers of Al-Qadisiyah city

1.4. Definition of terms

1.4.1. Evaluation

Theoretical definition: Evaluation is the process of assessing the worth of something. Evaluating anything entails taking measurements or making observations about the process to assess it or figure out its worth by contrasting it with other things or some form of the benchmark (Yambi 2018). Operational definition: Evaluation in this study referred to the diabetic patients' exercise self-efficacy. Evaluation is obtained by using the exercise self-efficacy scale.

1.4.2. Self-efficacy

Self-efficacy, a psychological construct, has garnered significant attention in the management of numerous chronic diseases. Introduced by Bandura (1977) as a fundamental component of his Social Learning Theory, self-efficacy is defined as individuals' beliefs in their capacity to achieve specific levels of performance that exert influence over events impacting their lives (Jones and Riazi 2011). Self-efficacy beliefs play a significant role in shaping individuals' emotions, thoughts, motivation, and health-related behaviors. Specifically, self-efficacy influences motivation and various health behaviors by determining the goals individuals set, the level of effort they invest in pursuing those goals, and their resilience in the face of challenges or setbacks (Dixon *et al.* 2007). Operational definition: Self-efficacy is determined by summing the score of exercise self-efficacy scores among diabetic patients. The diabetes exercise self-efficacy scale calculates self-efficacy.

1.4.3. Diabetes mellitus

Theoretical Definition**:** Diabetes mellitus (DM), which is more commonly referred to simply as diabetes, refers to a group of metabolic conditions that are characterized by

consistently high levels of blood sugar (Podrimçaku 2020). Diabetes mellitus (DM) is the most frequent form of diabetes.

1.4.4. Patient

Theoretical Definition: Patients who are already registered or planning to receive treatment and medical care from qualified and specialized service providers (Kirk 2007). Operational Definition: Any person with diabetes mellitus disease attending a primary health care center in Al-Qadisiyah city.

1.4.5. Primary health centers

Theoretical Definition**:** Comprehensive, culturally appropriate, and high-quality primary health care is provided through community-based and patient-directed organizations known as primary health centers to some of the most marginalized people and families in the country (World Health Organization 2018). Operational Definition: These are places where primary health care is provided for diabetics patients.

2. LITERATURE REVIEW

2.1. Historical background of diabetes mellitus

Insulin-dependent type 1 and non-insulin-dependent type 2 (non-insulin-dependent) The anomalies in glucose, lipid, and protein metabolism associated with diabetes are consequences of the disease. Chronic hyperglycemia, a characteristic of the condition, may be caused by defects in insulin secretion, defects in insulin action, or a combination of inadequate insulin secretion and incorrect insulin action. Both decreased insulin production and resistance to the action of insulin play a role in the development of both type 1 and type 2 diabetes. However, the autoimmune destruction of pancreatic cells in type 1 diabetes is the direct cause of the disease. This is in contrast to type 2 diabetes, in which decreased insulin production and resistance to the action of insulin play a role in the development of the disease (Eisenbarth *et al.* 2005).

Current epidemiological statistics show that 9 percent of persons aged 18 and above have diabetes mellitus, and it is projected that 1.5 million people worldwide lost their lives to the condition in 2012. The World Health Organization predicts that by 2030, diabetes will be the seventh most significant cause of mortality worldwide (World Health Organization 2014).

The origins of the illness may be traced back to ancient times. However, doctors had difficulty making sense of the illness back then since they had no firm grasp of anatomy, pathophysiology, or diagnostic tests. Nevertheless, ancient doctors were aware of diabetes's unique characteristics and offered a variety of treatments. The Ebers papyrus was written about 1500 B.C. and contains references to individuals with symptoms patients with symptoms such as increased thirst and frequent urination that may benefit from treatment with plant extracts. This is something that Paul Ghalioungui, an Egyptian endocrinologist, medical historian, and translator of the Ebers papyrus, disagrees with (1908-1987). It is believed that Ebers' diagnosis of diabetes is inaccurate and insufficient. The title of a recipe for "Treatment of a thirsty lady" appears on a Kahun papyrus (about 2000 BC), but the content is lost. So, it's safe to presume

that ancient Egyptians did not understand the significance of diabetes's broader symptoms. In his treatise Samhita, written about 500 B.C.E., the eminent Indian physician Sushruta recognized diabetes using the name Madhumeha (honey-like pee). He noted the urine's sweet taste, its sticky feel to the touch, and its capacity to attract ants (!). Sushruta also notes that the excessive eating of foods like rice, cereals, and sweets is linked to the development of diabetes. Polyuria, polydipsia, and weight loss were all documented by Chang Chung-Ching, often known as the "Chinese Hippocrates," who lived from around 160 to approximately 219 BCE. He was the first person to explain the symptoms of a particular illness. Chen Chuan, who lived in the 7th century AD, was the first person to document the presence of urine sugar levels and sweetness in diabetes. Hsiao Kho ping was the name he gave the ailment, and he explained its hallmark symptoms, which included severe thirst, frequent drinking, and copious streams of pleasant urine. In order to treat the ailment, Li Hsuan recommended cutting down on alcoholic beverages, reducing salt intake, and avoiding sexual activity. Diabetes patients began to suffer furuncles, rodent ulcers, and eye issues as early as the 8th century, according to medical records. Avicenna (980-1037) was an Arabo-Islamic physician who lived in the 11th century and wrote a treatise called El-Kanun (Canon of Medicine) in which he covered diabetes and the difficulties associated with the disease. Moises Maimonides (1138-1204) discussed diabetes and acidosis in depth. Ancient Egyptians, Indians, Chinese, and Arabs described diabetic symptoms. Few are the primary characters in the history of diabetes mellitus who contributed considerably to its diagnosis, treatment, and contemporary understanding of the condition, opening the way for future research and creating a new medical sub-specialty, diabetology (Karamanou *et al.* 2016).

2.2. Classifications of diabetes

In 1965, the World Health Organization (WHO) released its first diabetes classification system, which divided the disease into four groups based on age at diagnosis: infantile or infancy (onset between 0 and 14 years of age), young (15 to 24 years of age), adult (25 to 64 years of age), and geriatric (with onset at the age of 65 years or older) In addition to categorizing diabetes based on age, the World Health Organization

recognized the following distinct kinds of diabetes: adolescent-onset, fragile, insulin-resistant, gestational, pancreatic, endocrine, and iatrogenic diabetes mellitus (Schwarzer 1999).

It is possible that different types of diabetes call for different guidelines and precautions regarding the amount of physical activity considered safe. Diabetes types 1 and 2 accounts for the vast majority of diagnosed cases of the illness. The cellular-mediated autoimmune death of pancreatic beta cells, which leads to insulin insufficiency, is the etiology of type 1 diabetes, which accounts for 5%–10% of all incidences of diabetes. This death results in insulin insufficiency (ADA 2016).

The destruction of beta cells is a process that may occur at any age; however, it occurs more rapidly in children than in adults. Type 2 diabetes accounts for the vast majority of diabetes cases, and its development is linked to a slight but steady decrease in insulin production and increased insulin resistance. Because of the increased likelihood of developing gestational diabetes mellitus in pregnant women who do not have a previous diagnosis of diabetes, it is suggested that screening occurs between the 24th and 28th week of pregnancy. Prediabetes is a condition that a person might have if their blood glucose levels are higher than usual but not high enough to be diagnosed with diabetes. If a person has prediabetes, their blood glucose levels are higher than average but not high enough to be diagnosed with diabetes. People with prediabetes have an increased risk of developing type 2 diabetes, but they may delay or even prevent the onset of the disease by maintaining healthy diet and exercise habits (ADA 2016).

2.3. Epidemiology and global burden of diabetes

Rural areas in low and medium-income nations are no exception; rural populations worldwide are hit hard by the diabetes epidemic. With the World Health Organization estimating 422 million persons globally had diabetes in 2014, the prevalence of this disease is clearly on the rise. The highest increase occurred in low and medium-income nations compared to high-income countries, with the age-adjusted frequency in adults rising from 4.7% in 1980 to 8.5% in 2014 (World Health Organization 1965).

In addition, the International Diabetes Federation estimates that 1.1 million children and adolescents between the ages of 14 and 19 are living with type 1 diabetes (IDF) (Federation 2017). If the present trends continue, at least 629 million people will have diabetes all over the globe by the year 2045 (Federation 2017) Nearly 4 million fatalities a year may be attributed to high blood sugar (World Health Organization 1965) Health care costs for individuals with diabetes were estimated to reach US$ 850 billion worldwide in 2017, according to the International Diabetes Federation (Federation 2017).

According to data compiled by the World Health Organization in 2012, diabetes mellitus ranked as the eighth leading cause of mortality worldwide. This statistic corresponded to an estimated 1.5 million fatalities around the globe in 2012. A high blood sugar level also increases the risk of cardiovascular disease and other problems (such as renal failure) that may lead to death. Although diabetes is frequently listed as the secondary cause of death on death certificates, these other conditions are commonly listed as the primary cause of death. The place where at least eighty percent of all deaths caused by diabetes take place. It is anticipated that by the year 2030, the populations of Asia and Africa will have the most significant total numbers of diabetics, and their rates of diabetes prevalence growth will also be anticipated to be the highest (Wild *et al.* 2004).

The global nutrition shift, characterized by increased consumption of high-energy-dense but nutrient-poor foods, is a significant factor in the rising rates of obesity and diabetes in emerging nations (often high in sugar and saturated fats, sometimes referred to as the "western-style" diet). The number of people with diabetes throughout the world might rise by 48% between 2017 and 2045 (Schwarzer 1999).

2.4. Pathophysiology of diabetes

All kinds of diabetes have a similar mechanism: the malfunction or loss of pancreatic -cells are now primarily accepted (Tuomi *et al.* 2014). The -cells in the pancreas may be damaged or destroyed in many ways, and once they die off, they never regenerate. This

is especially true beyond the age of 30 when the pancreas stops producing new –cells (Perl *et al.* 2010).

Genetic susceptibility and anomalies, epigenetic processes, insulin resistance, autoimmunity, comorbid conditions, inflammation, and environmental variables are all potential contributors. There may be therapeutic implications for maintaining or enhancing glucose tolerance if we can distinguish between -cell malfunction and decreasing -cell bulk (Del Prato, 2014). Identifying diabetes subtypes and developing effective treatment plans rely on a thorough understanding of -cell function (Skyler *et al.* 2017).

2.4.1. Pathophysiology of type 1 diabetes (IDDM)

When pancreatic -the immune system destroys cells, insulin secretion is reduced, causing metabolic disturbances in IDDM. IDDM patients have decreased insulin secretion, aberrant pancreatic-cell function, and increased glucagon production. Glucagon secretion is generally decreased by hyperglycemia; glucagon secretion is not affected, however, in people with IDDM (Matigian *et al.* 2010).

Patients who have IDDM can quickly develop diabetic ketoacidosis if they are not given insulin medication; this is the most severe manifestation of this metabolic abnormality. IDDM is caused not just by a shortage of insulin but also by difficulties in the way that insulin is delivered. A number of metabolic processes cause reduced sensitivity to insulin. Insulin insufficiency leads to unregulated lipolysis and elevated amounts of free fatty acids in the plasma, both of which limit glucose utilization in peripheral organs like skeletal muscle. Insulin deprivation resulted in decreased expression of genes such as glucokinase in the liver and the GLUT 4 family of glucose transporters in adipose tissue, preventing these tissues from responding correctly to insulin and impairing glucose use. Because of this, metabolic abnormalities caused by insulin deficiency are made worse by the resulting abnormally increased glucagon levels.Noted that IDDM is characterized by significant metabolic derangements, including altered glucose, lipid,

and protein metabolism, as a consequence of insulin insufficiency (Raju and Raju 2010).

2.4.1.1. Effects on glucose metabolism

Uncontrolled IDDM enhances hepatic glucose production.Hepatic gluconeogenesis is the process by which glucose is produced after the glycogen stores in the liver have been broken down. Insulin insufficiency affects glucose use by nonhepatic tissues. Insulin stimulates an increase in glucose absorption in skeletal muscle and adipose tissue. Insulin-mediated translocation of glucose transporters to tissue plasma membranes achieves this. Less glucose absorption by peripheral organs slows glucose metabolism. Insulin regulates liver glucokinase levels. Lower hepatocytes have a higher rate of glucose phosphorylation, which drives up transport to the circulation. Insulin affects enzymes in glucose anabolism (Raju and Raju 2010) .

2.4.1.2. Effect on lipid metabolism

Following a meal, insulin prompts hepatocytes and skeletal muscle to accumulate more of the ingested food's potential energy in glycogen. Hepatocytes in the liver are responsible for the storage of this energy. When insulin is present, hepatocytes become stimulated to manufacture triglycerides; these triglycerides are subsequently stored in adipose tissue after being made. When IDDM is not under control, fast triglyceride mobilization occurs, leading to increased levels of free fatty acids in the plasma. Free fatty acids may be taken in by a variety of tissues, except for the brain, which cannot convert them into a form that can be used to generate energy. Malonyl COA levels fall when insulin is not present, and this coincides with an increase in the transport of fatty acyl-COA into mitochondria. The oxidation of fatty acids in mitochondria results in the production of acetyl COA, which may then be oxidized in the TCA cycle (Raju and Raju 2010).

2.4.2. Pathophysiology of DM type2

Diabetes mellitus type 2 is characterized by abnormalities in the metabolism of carbohydrates and lipids. Both genetics and the environment have a role in the development of type 2 diabetes, which results in decreased beta-cell function and insulin sensitivity in tissues (muscle, liver, adipose, pancreas). The genesis of diabetes is complicated because beta-cell malfunction and reduced insulin sensitivity play essential roles in the disease. It is yet unclear how these two deficiencies interact with one another. There is a possibility that insulin resistance and beta-cell malfunction are connected to type 2 diabetes. Most people with type 2 diabetes have excess visceral fat and obesity. It is thought that adipose tissue plays a significant role in developing type 2 diabetes. Even though the portal/visceral hypothesis plays a significant part in the elevation of non-esterified fatty acid concentrations, two new paradigms have emerged in recent years: the ectopic fat storage syndrome (characterized by the deposition of triglycerides in muscle, liver, and pancreatic cells) and the adipose tissue as endocrine organ hypothesis (characterized by the secretion of various adipocytokines such as leptin, These two models serve as the foundation for research into insulin resistance and beta-cell malfunction in type 2 diabetes, as well as the obesogenic environment in which we live and the likelihood of developing diabetes in the next ten years (Galicia-Garcia *et al.* 2020).

2.5. Clinical manifestation of DM

Uncontrolled diabetes may be identified by its telltale symptoms, which include unexplained weight loss, an increase in urine and thirst, and an increase in appetite (increased hunger). The symptoms of type 1 diabetes may occur rapidly (within weeks or months), but the signs of type 2 diabetes often emerge gradually and discreetly, if they emerge at all. Fatigue and a loss of appetite are two more symptoms caused by diabetes mellitus (Cooke and Plotnick 2008).

Some additional symptoms may also accompany the beginning of diabetes. While not being disease-specific. In addition to the symptoms mentioned above, others include

visual blurring, headache, tiredness, delayed wound healing, and itching skin. If blood sugar levels stay high for too long, the eye's lens may absorb some of it, altering the eye's shape and affecting eyesight. Diabetic retinopathy is a leading cause of permanent visual loss. Diabetic dermadromes are a group of skin eruptions that may develop in people with diabetes (Rockefeller 2015) .

2.6. Causes of diabetes mellitus

The exact cause of diabetes is unknown, but several studies have looked at how a genetic predisposition or mutation, as well as some outside factors, might contribute to the disease. These outside factors include pollutant exposure, microbial infection, insufficient breastfeeding, vitamin and mineral deficiencies, and early exposure to infant formulas (Davies *et al.* 2018).

2.6.1. Genetic predisposition and mutation

The origins of type 1 and type 2 diabetes may be distinct, although they share at least two key features. This illness has two causes: first, a genetic propensity, and second, an environmental trigger. All kinds of diabetes, thus, have a hereditary tendency; nonetheless, it takes more than genetics to bring on diabetes, as the instance of identical twins demonstrates. Despite sharing the same DNA, only 50% of the time will an identical twin get Type 1 diabetes if one has the condition. The risk for the second twin to get Type 2 diabetes is 3 out of 4 when one twin has the disease (Davies *et al.* 2018).

2.6.2. Pollutant exposure

Several studies have shown a connection between exposure to environmental contaminants and diabetes, even though this is a mostly ignored topic. Lockwood discovered the connection in the USA in 2002. Lockwood discovered that the incidence of diabetes was higher in states that released more hazardous substances into the environment (Lockwood 2002).

2.6.3. Microbial infection

Some microorganisms may have a role in the etiology of diabetes, according to a large body of research. Many infectious agents, including viruses and some types of bacteria, have been linked to the development of diabetes.

2.6.4. Viral infection

People are occasionally diagnosed with Type 1 diabetes during or after a viral illness, which shows a relationship between the two conditions. However, diabetes cannot be caused by a virus on its own. Additionally, it is more likely to develop into Type 1 diabetes during the winter, which is the time of year when viruses are most prevalent. Viruses like coxsackievirus B, cytomegalovirus, adenovirus, rubella, and mumps may be linked to Type 1 diabetes (National Heart 1998). There are some ways in which a virus might contribute to the onset of Type 1 diabetes. A pathogen-derived peptide may cause an immune response to self-tissue in the host by having sequence similarity with a self-peptide (known as molecular mimicry). Such viral infections may lead to host cell death and inflammation, leading to the generation of autoantigens and the activation of autoreactive T cells (called bystander activation of T cells). Extreme inflammation may cause endoplasmic reticulum (ER) stress, leading to the denaturation of proteins and the presentation of new autoantigens, two effects of this process (known as antigen spreading). Second, polioviruses, echoviruses, and rhinoviruses are human enteroviruses linked to Type 1 diabetes. Most cases of enterovirus infection are traced back to eating or drinking anything tainted. "Hygiene Hypothesis" proponents point to the fact that enteroviruses are rarer in industrialized nations as evidence that improved sanitation practices may contribute to the rise in the prevalence of Type 1 diabetes in such areas. As hygiene theory suggests, those who live more hygienically may not be well prepared for future exposure to microbes. When an enterovirus infection reaches the pancreas, The immune system launches assaults against the virus and the cells in the affected area that produce insulin (Ghazarian *et al.* 2013).

2.6.5. Bacterial infections

Researchers from the University of Iowa's College of Medicine found evidence that bacteria may have a role in developing Type 2 diabetes. After exposing rabbits to a Staphylococcus aureus toxin for extended periods, the researchers discovered that the animals developed insulin resistance, glucose intolerance, and inflammation, all of which are hallmarks of Type 2 diabetes. Staph superantigen exposure led to the development of diabetes type 2 in rabbits (toxins produced by all strains of staph bacteria). Findings from the University of Iowa indicate that medicines aiming at eradicating staph bacteria or neutralizing the superantigens may promise to prevent or treat diabetes type 2. Although being overweight increases the risk of Type 2 diabetes, it also has other negative health consequences due to its effects on the microbiota. More and more staph germs will settle in on the skin of overweight persons. Chronic exposure to the superantigens produced by staph bacteria results in a variety of health problems for those who are colonized by the bacterium (Brown *et al.* 2015).

2.6.6. Vitamin deficiencies

Lack of vitamins and minerals has been linked to various health problems, including diabetes, and has been shown to weaken the immune system. Getting the recommended daily allowance (RDA) of all vitamins and minerals is crucial to maintaining good health. The majority of the publications discussed in this book agreed, however, that vitamins A, B complex, C, D, and E are the essential vitamins for people with diabetes (Weyrich *et al.* 2018).

2.6.7. Mineral deficiencies

In addition to vitamins, Minerals are essential to healthy health and play a significant part in its maintenance. According to a significant body of research, insufficient mineral consumption has been related to various health problems, one of which is an increased chance of developing diabetes. The essential minerals, a lack of which has been linked

to an increased risk of diabetes, are magnesium, chromium, zinc, calcium, vanadium, and omega-3 fatty acids (Schellenberg *et al.* 2013).

2.6.8. Inadequate breastfeeding

Breastfeeding has been debated for its possible impact on the development of type 1 diabetes. Depending on the study, there may be a protective effect, a predisposing impact, or no effect at all (Knip *et al.* 2010).

2.6.9. Early exposure to baby formulas

According to a significant body of data, the use of infant feeding formulas has been associated with an increased risk of acquiring Type 1 diabetes in children. Cow milk-based formulas, soy-based formulas, gluten-containing formulae, and even solid foods like fruits, berries, and roots have all been implicated in the development of diabetes in later life (Morales-Oyarvide *et al.* 2017).

2.7. Risk factors

2.7.1. Risk factors for type 1 diabetes

Low and medium-income nations have seen a tremendous increase in the prevalence of diabetes mellitus than high-income countries have. Damage to the eyes, kidneys, neurological system, hearing, and maybe Alzheimer's and cardiovascular disease are just some of the potential problems that might result from diabetes mellitus, a metabolic disorder that affects the circulatory system. Numerous variables increase the likelihood that you may develop diabetes mellitus. However, the vast majority of people do not understand what causes this. The primary goal of the present research was, thus, to identify the risk factors for developing diabetes mellitus. Due to industrialization and globalization, people are eating more processed foods rich in sugar and leading less

active lives. And as a result, the prevalence of diabetes mellitus has risen (Abegunde *et al.* 2007).

2.7.2. Risk factors for type 2 diabetes

Absolute insulin resistance and relative insulin shortage are hallmarks of type II diabetes, which often manifests against a genetic predisposition. Age, inactivity, excess weight (BMI 25–29.9 kg/m2), and obesity (BMI 30 kg/m3) all contribute to the development of insulin resistance. Improving insulin sensitivity by weight loss may postpone or even prevent the onset of diabetes and lower the severity of the condition's symptoms in obese persons. Insulin resistance is characterized by complex derangements in cellular receptors, intracellular glucose kinase activity, and other intracellular metabolic processes, and it primarily affects the liver muscle and adipocytes. Insulin resistance is associated with type 2 diabetes and obesity. Due to the intricacy and diversity of these intracellular derangements, it is possible that what we now call type II diabetes represents a more generalized collection of disorders that still needs to be defined (UPSTF 2003).

Certain factors increase the risk for Type 2 Diabetes, including :

- Obesity: Being overweight is the most significant contributor to developing type II diabetes.
- Fat distribution: If your body stores most of its fat in your belly, you have a larger chance of developing type II diabetes than if it stores fat in other parts of your body. Include the areas around your hips and thighs.
- Inactivity: The risk of developing type II diabetes increases proportion to the degree to which a person engages in less physical activity.
- If a member of your family already has type II diabetes, such as a parent or sibling, your chance of developing the condition is increased.

- People of specific races, notably blacks, are more likely to commit violent crimes, but it is not apparent why this is the case. It is more probable for people of Hispanic, American Indian, and Asian ancestry to acquire type II diabetes than whites.
- Age: the chance of developing type II diabetes rises with age, particularly beyond the age of 45.
- Prediabetes, for someone to be diagnosed with prediabetes, their blood sugar levels must be higher than usual without actually becoming diabetic.
- Pregnancy-related diabetes, also known as gestational diabetes, raises the long-term diabetes risk.
- Polycystic ovarian syndrome for women (PCOS) is a disorder often seen in women that raises the risk of diabetes because of its hallmark symptoms: abnormal menstrual cycles, increased hair growth, and weight gain. Those findings were published in 2013 (Ginter and Simko).

2.8. Long-term complications of diabetes

2.8.1. Retinopathy

Retinopathy, like other diabetic complications, is directly related to how long a person has had the condition (Schwarzer 1999). The first visible lesions are called microaneurysms, originating in the retinal capillaries. The release of erythrocytes from microaneurysms may lead to dot-and-blot hemorrhages.

The leakage of serous fluid from retinal arteries results in the formation of hard exudates. Since diabetes causes them so often, It is possible to have "background" or nonproliferative retinopathy even if you have microaneurysms, dot-and-blot hemorrhages, and hard exudates. Nonproliferative retinopathy does not cause blindness until it produces macular edema. Leakage of fluid from aberrant arteries near the maculae causes macular edema and vision loss. With severe retinopathy, aberrant arteries may get blocked, causing retinal Ische Mia with nerve layer infarctions, appearing as "cotton wool" exudates (Preprolifera Tive Retinopathy). New vessels form

after ischemia (Neovascularization). New vessels grow from the retina into the vitreous cavity. They are easily broken and cause vitreous hemorrhage. Hemorrhages in the vitreous humor may cause visual loss, although they often heal within a month to three. Eye problems such as retinal strain, detachment, and blindness may be traced back to fibroproliferative changes. According to the risk of vision loss, proliferative retinopathy is clinically classified as either neovascularization of the disk (within one disk diameter) or neovascularization elsewhere (Diabetic Retinopathy Study Research Group 1978).

2.8.2. Nephropathy

The most deadly diabetic consequence is nephropathy, which affects the kidneys. While almost all diabetes patients have some kind of retinopathy, only around 35% to 45% of those with IDDM and fewer than 20% of those with NIDDM acquire nephropathy (Andersen *et al.* 1983). In patients with IDI I, the development of clinically recognizable diabetic nephropathy often begins with the appearance of microalbuminuria, which may range from 30 to 300 mg of albumin per 24 hours. This condition can appear as soon as five years following the diagnosis of diabetes (Selby 1990). It has been suggested that people with glomerular hyperfiltration (A glomerular filtration rate of more than 150 ml/min) are more prone to develop stage 1 nephropathy (Mogensen 1986). After another 5 to 10 years of diabetes, those destined to develop the end-stage renal disease will develop overt proteinuria, which is defined as the presence of more than 500 mg of protein per liter, equivalent to more than 300 mg of albumin every 24 hours. During this time, high blood pressure almost always begins to manifest. Reduced glomerular filtration rate characterizes the onset of nephrotic syndrome. Leading to end-stage renal disease in the next 5–10 years. On average, people with IDDM have it for 17 years before they acquire proteinuria and for 23 years until they reach end-stage renal disease (Kussman *et al.* 1976). Though some people with IDDM and nephropathy may succumb to uremic complications, the majority succumb to patients with IDDM who do not have nephropathy have a 30-40 times greater risk of cardiovascular disease. Unlike retinopathy, nephropathy prevalence does not rise linearly with the duration of diabetes (Krolewski *et al.* 1985).

Developing nephropathy from IDDM typically begins between the ages of 25 and 30. To diminish if overt protein uria, the most accurate sign of diabetic nephropathy, has not occurred. Our knowledge of nephropathy in NIDDM patients is clouded by the disorder's indeterminate course and the common occurrence of concomitant hypertension, which may lead to nephrosclerosis. Similar to those with IDDM, individuals with NIDDM seem to develop microalbuminuria before the onset of nephropathy (Mogensen 1986). Even though histological alterations are not necessarily indicative of clinical severity, they, too, tend to follow a predictable pattern (Osterby 1974). There is first renal hypertrophy, which involves a rise in kidney size and an enlargement of the mesangium and the glomerular basement membrane, which are both components of the glomeruli (Mathiesen *et al.* 1991).

The make-up of the globules changes. A slower flow rate causes afferent and efferent arteriosclerosis, mesangial expansion, and glomerular basement membrane thickening. The glomeruli begin to close when nephropathy (progressive proteinuria) progresses. Functional glomeruli undergo compensatory hypertrophy at this point (Østerby *et al.* 1987). A late-onset form of glomerulosclerosis, kimmelstiel-Wilson nodular glomerulosclerosis is characterized by the presence of nodules in the glomeruli condition that only a subset of people with nephropathy experience (Kimmelstiel and Wilson 1936). Small, atrophic kidneys with diffuse Glomeruloscle Rosis are typical of patients with end-stage renal disease (Bilous *et al.* 1989) .

2.8.3. Neuropathy

Neuropathy Patients with either IDDM or NIDDM might have a wide range of neuropathy's clinical symptoms. Most people with diabetes have peripheral, symmetric sensorimotor neuropathy, although the condition may manifest as cranial, peripheral, or autonomic neuropathy. While neuropathy is more frequent in those who have had diabetes for longer, a very severe form of early-onset polyneuropathy has been observed (Said *et al.* 1992). After 5 to 10 years of diabetes, subclinical problems, such as slower motor- and sensory-nerve conduction, are revealed by electrophysiologic investigations (DCCT Research Group 1988). Most people with distal symmetric sensorimotor

neuropathy, which may be diagnosed during a physical, report very mild discomfort. Pares this is one symptom that tends to worsen in the evening. The main concern presented is foot trauma, and diabetic ulcers are both examples of peripheral neuropathy. Because of the difficulty in caring for the feet due to a lack of feeling and a changed foot architecture. Painful peripheral neuropathy with lancinating or searing dysesthesia affects a subset of people, and in some cases, the pain is severe enough to be linked to mental health issues, including depression and eating disorders (Ellenberg 1974). The severity of symptoms tends to increase and decrease. Sensorimotor Neuropa Thies are more prevalent than other types of neuropathies, such as focal motor (cranial and peripheral), compression, and mononeuritis multiplex. Some radiculopathies might seem to be degenerative disk diseases. Usually, motor neuropathies go well on their own within a few weeks to a few months, except for compression neuropathies like carpal tunnel syndrome, which may need surgical decompression. Gastric or intestinal motility, erection strength, urinary control, cardiac rhythm, and blood pressure are all impacted by autonomic neuropathy. However, clinical autonomic neuropathy is uncommon, even if subclinical alterations (such as the lack of fluctuation in heart rate in conjunction with the respiratory phase or altered gastrointestinal contractility) may typically be observed within 5 to 10 years following the beginning of IDDM. Not only may gastroparesis create symptoms, but it can also affect food absorption, which can wreak havoc on glycemic management. Diarrhea and incontinence due to diabetes are not common, but they may be severely limiting. Over half of all diabetic males will have impotence at some point in their lives, making it the most prevalent clinical symptom of autonomic neuropathy. Resting tachycardia and postural hypotension are possible side effects of cardiac autonomic neuropathy (Ellenberg 1974).

2.8.4. Cardiovascular disease

Individuals with either kind of diabetes (IDDM or NIDDM) are typically at the same risk of developing cardiovascular disease as those who do not have diabetes. Patients diagnosed with NIDDM have been the primary source of epidemiological data. Diabetic people, particularly women, have a higher risk of cardiovascular disease than the general population (Gordon *et al.* 1977).

Diabetes reverses the typically protective impact of the female sex in coronary artery disease. Furthermore, if renal illness supervenes, diabetic individuals acquire coronary disease at a younger age than nondiabetic patients. People who have diabetes are more likely to present with atypical anginal symptoms, which may include symptoms of congestive heart failure. This is a more prevalent clinical presentation of coronary artery disease than in people who do not have diabetes. This is because asymptomatic coronary artery disease and myocardial infarction are probably not much more prevalent in diabetic people than in persons who do not have diabetes (Singer *et al.* 1989) .Diabetic people have an increased risk of death after suffering a myocardial infarction for the first time or a recurrent infarction (Rytter *et al.* 1985).

2.9. Diagnosis of diabetes mellitus

The three most common diagnostic tools for diabetes mellitus among medical professionals are the A1C test, the fasting plasma glucose test (also known as the FPG test), and the random plasma glucose test (also known as the RPG test) (Care 2016).

2.9.1. Fasting plasma glucose (FPG) test

In screening for diabetes in both children and adults, the fasting plasma glucose (FPG) blood test involves taking a single measurement of glucose in the blood plasma at a predetermined time after the subject has fasted (8 to 12 hours after the last meal). Adults who are not pregnant but have a high risk for diabetes have a fasting plasma glucose test. Individuals doing the fasting plasma glucose test should refrain from eating or drinking for at least 8 hours before the test, and the procedure should be carried out first thing in the morning. For the duration of a fast, the only thing you may consume is water. A blood sample is drawn from an arm vein. One is considered to have diabetes if they have a blood glucose level that is consistently more than or equal to 126 mg/dl, regardless of how many times they are tested. Before a few years ago, the ADA's diagnostic cut-off point was 140 mg/dl; however, studies have indicated that even those with fasting plasma glucose levels between 126 and 140 mg/dl are at increased risk for developing diabetes medical problems. Therefore the ADA decreased the threshold.

Fasting plasma glucose levels below 126 mg/dl but over 100 mg/dl are considered impaired. Individuals who do not metabolize glucose have a higher risk of acquiring hypertension, blood lipid problems, and Type 2 diabetes, even though they do not already have diabetes (Kalathi *et al.* 2018).

2.9.2. A1C test

The hemoglobin test known as the A1C determines a person's average blood sugar (glucose) levels over the previous three months. Different designations, including hemoglobin A1c, HbA1c, and Glycohemoglobin, are given to the same test, frequently referred to simply as A1C. The A1C test is considered the industry standard for diabetes research and treatment. Determining an individual's A1C level depends on the fact that glucose has been attached to hemoglobin, the oxygen-carrying protein found in red blood cells. Red blood cells have a very short average lifetime of about three months, even though they are constantly being produced and eliminated. Therefore, the A1C test gives an average reading of a person's blood glucose levels over the previous three months. The results of the A1C test are presented in the form of a percentage. Generally, it may be assumed that the individual's blood glucose levels have been greater when the fraction is bigger. Under 5.7% is considered normal for A1C. To avoid affecting test results, you may eat and normally drink before taking this exam. Factors like age and hematological issues like anemia should be considered before utilizing this test. Because of this, the A1C test is not reliable for those who suffer from anemia (Hotel 2014).

The A1C test gained popularity when it was approved as a tool for diagnosing Type 2 diabetes and prediabetes by an international expert group in 2009. Before now, diabetes and pre-diabetes were diagnosed only via the use of conventional blood glucose testing. Experts are hopeful that the A1C test's accessibility would encourage greater numbers of individuals to be tested for diabetes and ultimately reduce the number of undetected cases. The test does not need fasting, and blood may be obtained for the test at any time of day. Some medical groups, however, still advise utilizing blood glucose testing as a primary diagnostic tool (Silva 2015).

2.9.3. Random plasma glucose (RPG) test

If a physician has reason to think that a patient has diabetes but does not want to require the patient to fast, the RPG test is an alternative that may be used. There is no need to refrain from eating or drinking anything before the random plasma glucose test, which measures the amount of glucose present in the plasma rather than the blood. Any time of the day or night, very few volumes of blood may be taken (hence the name "random"). When doing a random plasma glucose test, findings below 200 mg/dl (11.1 mmol/l) are considered acceptable. Diabetes is diagnosed when a person's blood glucose levels are consistently above 200 mg/dl (11.1 mmol/l), in addition to meeting other diagnostic criteria (such as the presence of diabetes symptoms such as increased thirst and/or urination, blurred vision, and unexplained weight loss). Blood glucose levels are measured in millimoles per deciliter (mg/dl). The American Diabetes Association (ADA) recommends doing a second blood sugar test on a different day from the first to ensure the diagnosis's accuracy. If it is at all possible, you should repeat either the test of your ability to tolerate oral glucose or the test of your fasting plasma glucose (Rhee *et al.* 2019).

2.9.4. Oral glucose tolerance test (OGTT)

Glucose is the body's primary energy source, and the oral glucose tolerance test (OGTT) examines how well the body can utilize this sugar. Diagnosing prediabetes and diabetes may be done using an oral glucose tolerance test (OGTT). Gestational diabetes testing involves having a healthcare provider collect blood after the patient has consumed a beverage containing glucose to detect the presence of the disease. This test's premise is that it can reveal how well the body manages glucose. A pregnant woman's blood will be taken once an hour for two or three hours to detect gestational diabetes. When the fasting, one-hour, two-hour, or three-hour blood glucose levels are high during the OGTT, the expectant mother is diagnosed with gestational diabetes. The OGTT can also detect prediabetes and type 2 diabetes in people who are not pregnant. This ability is reserved for medical professionals. Medical practitioners may use the oral glucose tolerance test (OGTT) as an alternative to the fasting plasma glucose (FPG) test to make

a more accurate diagnosis of Type 2 diabetes and pre-diabetes in their patients. On the other side, taking the OGTT will save you more money and require you to go through more hoops. A medical professional can diagnose type 2 diabetes and pre-diabetes in a patient by drawing blood from the patient one hour and then again two hours after the patient has consumed a beverage that contains glucose (ADA 2016).

2.9.5. Glucose challenge test

Like the glucose tolerance test, the glucose challenge test measures how effectively the body responds to glucose. Pregnancy screening for diabetes occurs with this test. There is no need to fast before the glucose challenge test, often known as the glucose screening test. In this test, the subject first consumes a sweet solution and then has their blood sugar checked an hour later. A positive result on a glucose challenge test is suggestive of gestational diabetes. Fasting oral glucose tolerance testing may be necessary if the blood glucose level is 135 or above (ADA 2016).

2.10. Management of diabetes mellitus

In only the last three decades, the number of individuals who have diabetes has increased by a factor of four, making it the fastest-growing chronic disease worldwide (Zheng *et al.* 2018). In 2015, the International Diabetes Federation estimated that 415 million people were living with diabetes. It is anticipated that by 2040, that number will have increased to 642 million (Dagogo-Jack 2017). Dietary therapies continue to play a vital role in preventing and managing diabetes alongside pharmaceutical interventions. The nature and quality of nutrients ingested are the primary treatment method for lowering the prevalence and severity of type 2 diabetes. A circadian clock is a group of endogenous molecular oscillators regulating various biological processes on a 24-hour timescale (Kurose *et al.* 2014) . The circadian system in mammals is made up of several separate timescale clocks that operate in different tissues. Type 1 Diabetes Mellitus (insulin-dependent diabetes mellitus): management with insulin, nutrition, and physical activity. Mellitus, Diabetes, Type 2 (Non-insulin dependent diabetes mellitus)

1. Begin by controlling your diet and getting regular exercise.

2. If unsuccessful (Diet regulation and exercise), so:

- Metformin or Acarbose as a monotherapy option.
- Include sulfonylurea in the treatment of the preceding steps that were unsuccessful.
- If the previous steps were unsuccessful, try adding a glitazone.
- If the initial treatments are unsuccessful, you should stop taking the sulfonylurea, but you should keep taking the metformin and glitazone. You should also begin insulin therapy.

3. Suppose there is significant stress in the patient's life (for example, an infection, an operation, or pregnancy). In that case, the oral hypoglycemic medication should be discontinued temporarily, and soluble insulin should be injected subcutaneously 30 minutes before each of the three main meals. After the patient has recovered, they should return to their previous treatment.

4. If you have renal impairment, you must stop using oral hypoglycemics for good and switch to intermediate-acting insulin-like Lente Or Isophane (Egabella 2021).

2.11. Diabetes treatment

2.11.1. Pharmacotherapy

For those with type 1 diabetes, insulin may save their lives. In order to alter the pharmacokinetics of insulin, most insulin preparations are made utilizing recombinant DNA technology and are either structurally similar to human insulin or insulin Analogues. People with type 1 diabetes are more likely to utilize human insulin or an insulin mimic. At the moment of diagnosis, patients with type 1 diabetes will begin insulin treatment. A proper insulin schedule must be chosen, and instruction must begin. Care and usage of insulin, hypoglycemia prevention, diagnosis, and treatment, sick day

management, diet (including carbohydrate counting), exercise changes, and blood glucose self-monitoring should all be included in this education (SMBG) (McGibbon *et al.* 2013).

Methods for treating type 2 diabetes mellitus have been developed to improve blood sugar management and lessen the likelihood of diabetic complications such as retinopathy, neuropathy, nephropathy, and death. Multiple medications are included in it.

Metformin: In treating type 2 diabetes, it is unquestionably the first line of defense. It increases the liver's sensitivity to insulin and is classified as a biguanide. In addition to helping with weight loss, it improves peripheral glucose absorption, reduces hepatic glucose production, and prevents glucose from being stored as fat. Starting with a modest dosage of metformin may help reduce the likelihood of gastrointestinal side effects such as bloating, cramping, nausea, vomiting, and diarrhea. According to British national prescriptions, the recommended starting dose of metformin is 500 mg once daily for at least a week, with further increases in dosage up to a maximum of 2 grams per day. Glucagon-like peptide 1 (GLP-1) receptor agonist, sulfonylurea (SU), thiazolidinedione (TZD), an inhibitor of dipeptidyl peptidase 4 (DPP-4), and sodium-glucose transporter inhibitor 2 are only some of the other therapies that may be used in conjunction with metformin (SGLT2). If after three months of dual treatment, the A1C goal has still not been attained, a total of three different medication combinations should be tried (Papatheodorou *et al.* 2018). In patients with type 2 diabetes, sulfonylureas (such as gliclazide, glimepiride, and meglitinides) are often prescribed as second-line medications, while they may be used as first-line treatment in the absence of obesity or intolerance to metformin. When used with sulfonylureas, metformin improves glucose management. Sulfonylureas increase insulin release from the pancreatic beta cells by binding to a specific receptor. Sulfonylureas most often cause weight gain and hypoglycemia and are associated with a higher risk in patients with mild to moderate renal impairment and severe liver disease (Papatheodorou *et al.* 2018).

Insulin resistance may be treated with thiazolidine (like pioglitazone), a second or third-line medication. When taken alone or in conjunction with other oral medication factors like metformin and/or sulfonylureas, it has been demonstrated to lower HbA1C via activating the peroxisium receptor, a nuclear transcription factor (Tran *et al.* 2015)

Therapy with insulin may be recommended for individuals with type 2 diabetes who have not successfully lowered their blood sugar levels with dietary and other behavioral modifications alone. In the early stages of this condition, an oral antihyperglycemic is necessary to maintain normal blood sugar levels. Calibration to safe glucose goals, appropriate patient selection, education, and dosing modifications in response to dietary and physical activity changes are all crucial to insulin's efficacy. Medium and long-acting insulin formulations are distinct in their onset of action, duration of action, and hypoglycemia risk. The adverse effects of insulin are more strongly influenced by factors like as dosage and timing of injections than by changes in insulin formulations (Davies *et al.* 2018).

2.11.2. Non-pharmacological treatment

Diabetic self-efficacy

Diabetes is a long-term illness that causes high rates of illness and death and higher health care costs. For diabetes treatment to work, essential parts of each patient's daily life need to change. It may include taking pills by mouth, insulin shots, testing your blood sugar at home, and a healthy diet and exercise plan. Diabetes education is about helping people become more independent and sure of themselves so they can care for themselves. Patients say that doing their self-management program is even more complicated than being told they have diabetes. The challenge is to help people come up with plans for dealing with their diabetes in the long run (Hurley and Shea 1992).

Self-efficacy is a psychological construct that predicts how much effort an individual will put into achieving a goal behavior and how likely they will be to keep trying

despite setbacks. Studies have revealed that one's sense of self-efficacy is significant in successful diabetic self-management (Schechter and Walker 2002). The involvement of the self-efficacy concept, which is unique to the realm of behavior change, is substantial. Future attempts at engaging in various behavioral challenges related to a task are predictably related to the individual's perceptions of his or her ability to overcome the difficulties in the task. Self-efficacy assessment can be used to foretell willingness to alter and guide the selection of self-care-boosting interventions. The belief in one's ability to do a task successfully can either motivate or discourage one from taking the necessary steps. Improvements in patients' perceptions of their abilities have been shown to increase their likelihood of following doctors' orders when treating chronic conditions (Kavookjian *et al.* 2005). Multiple diabetes education programs are now investigating the efficiency of the self-efficacy framework in treating diabetes (Smith and West 2006).

Although self-efficacy is generally recognized as a critical motivating element in diabetes care, it is often evaluated in the context of a broad spectrum of treatment options. Since self-efficacy is context and action-dependent, this method may diminish its predictive power. Self-efficacy has been linked to nutrition, exercise, and hemoglobin A1c. There is only a modest correlation between overall self-efficacy and diabetes-specific self-efficacy measures, which consider dietary and physical activity habits, blood glucose monitoring, and insulin dosing (Martin *et al.* 2008).

Concurrently and on the same degree of caregiving behaviors. Regarding self-care, patients are more likely to adhere to behaviors like insulin usage, oral medicine consumption, and blood glucose monitoring. However, patients are less likely to adhere to self-care behaviors like diet and exercise, which involve lifestyle adjustments. Despite knowing that making positive lifestyle changes, such as eating better and getting more exercise, would positively impact their health, many patients fail to do so. Depending on the specific treatment plan, several self-management methods may need to be used. Since this is the case, it is crucial to evaluate and comprehend self-efficacy concerning the many self-regulatory behaviors involved in managing diabetes (Nwasuruba *et al.* 2007). Self-efficacy includes a set of activities:

1. Education

Improved self-management behaviors may lead to better DM control, which can minimize the risk of DM complications. Hence DM education programs often feature ongoing general information about diabetes, often linked to self-care practices. Increased patient knowledge about diabetes is crucial to better self-care management practices, so culturally focused efforts must prioritize this goal. Compared to those without a college degree or a high school diploma, those with a college education or a high school diploma had a lower prevalence of diabetes and a better prognosis for their condition. Patients with diabetes were also shown to suffer secondary consequences from a lack of education. Medical professionals should assess their patients' educational levels before beginning any educational activity, whether an ordinary clinical meeting or a group DM education program, since this might reveal important socio-cultural components that may affect the treatment of diabetes (Poretsky 2010).

2. Exercise And physical activity

Lowering your blood sugar with exercise is possible. When you exercise, your muscles may utilize glucose without the help of insulin. In other words, it makes no difference whether you are insulin resistant or if you do not have enough insulin; when you exercise, your muscles get the glucose that they need, and your blood glucose level decreases (Yardley *et al.* 2015).

As part of a comprehensive plan to reduce the risk of developing or managing type II diabetes, regular physical activity is essential. Exercising as part of a weight-reduction routine helps maintain weight loss and prevent weight return, but the food is likely more significant in the early stages of weight loss. An increased risk of diabetes and its precursor, prediabetes, is connected with inactivity or low levels of exercise. Impaired fasting glucose may develop up to 1.9 times more often in men with low cardiorespiratory fitness levels than in individuals with high fitness levels. Patients should be aware that even a small quantity of physical activity, such as 30 minutes per day, may have positive health effects, including prevention against diabetes. In the same

way that more intense exercise and activity leads to lower AIC levels, the benefits increase linearly with the intensity of your workouts (Colberg *et al.* 2010).

Women who engage in more physical exercise have a decreased chance of acquiring diabetes than those who do not. According to the results of this research, physical activity should be one of the critical means by which diabetes is prevented (Van Belle *et al.* 2011).

Regardless of weight gain or loss, individuals with type II diabetes who followed a structured exercise program for eight weeks or longer had improvements in their glycated hemoglobin (AIC). Increasing the intensity of one's workouts may also lead to a rise in AIC. Regarding type 2 diabetes, exercise does not increase the risk of developing neuropathy or worsening existing non-proliferative retinopathy. Temporary increases in urine albumin excretion have been linked to physical activity, but there is no evidence to suggest that exercise accelerates the course of diabetic kidney disease. Without warnings, resistance training may be part of a regular fitness routine. The degree of physical fitness connected with overall mortality in males with diabetes, and this connection persisted after controlling for body mass index (Van Belle *et al.* 2011).

3. Diet and nutritional therapy

Eating the healthiest foods in moderation and at regular mealtimes is all that's required for a diabetic diet. A diabetic diet is a nutritious diet with minimal fat and calories without sacrificing flavor. Fruits, veggies, and complete grains are essential components. To be more precise, a diabetic diet is the optimal eating plan for everyone (Beall 2019).

In order to help you create a healthy eating plan, your doctor may suggest seeing a nutritionist if you have diabetes or prediabetes. The strategy aids in glucose (blood sugar) regulation, weight management, and mitigating risk factors for cardiovascular diseases, such as high blood pressure and abnormal cholesterol levels. When you

consume excess calories and fat, your body raises your blood sugar levels. High blood glucose levels (hyperglycemia) and long-term issues such as nerve, kidney, and heart damage may occur if the glucose levels in the blood are not managed properly. Maintaining a healthy blood glucose level may be accomplished by choosing nutritious foods and regularly keeping track of your meals. Patients diagnosed with type 2 diabetes stand to benefit physically and mentally by losing weight in several important ways. A diabetic diet has been carefully thought out, a healthy strategy to reduce weight safely and effectively (Coates and Meyers 2011).

Specifics on your diet To control blood sugar levels, a diabetic diet center on three square meals daily. If you take insulin or are otherwise exposed to insulin, this will help your body use that insulin more effectively. A dietitian can help you create a meal plan that considers your health, preferences, objectives, and way of life. The dietitian may also advise you on how to modify your diet to meet your requirements better, such as by helping you determine appropriate portion sizes based on your height, weight, and level of physical activity (Wheeler *et al.* 2014).

4. Management of food and insulin with physical activity

Due to individual differences in glycemic response to exercise, it is difficult to provide universal guidelines for controlling food intake and insulin dosage. Additional carbohydrate intake and/or decreases in insulin are often necessary to avoid hypoglycemia after long (30 min), primarily aerobic exercise. 10–15 g of carbohydrate may avoid hypoglycemia during 30–60 minutes of low- to a moderate-intensity aerobic activity performed under low circulating insulin levels (i.e., fasting or basal conditions (Biankin *et al.* 2003).

3. MATERIAL AND METHOD

This chapter illustrates the methodological procedures applied in this study to reach the objectives and deal with statistical results in scientific methods.

3.1. Design of the study

The type of study is descriptive and cross-sectional. This study evaluated exercise self-efficacy among diabetic patients in primary healthcare centers in Al-Qadisiyah, Iraq. The study was conducted from April 2022 to November 2022.

3.2. Administrative arrangements

After obtaining the institute's approval, the researcher submitted the study project to the Institute of Health Sciences at Çankiri University in Turkey (Appendix, A1). An official application was submitted that includes the study protocol and its objectives. And its significance to the Ethics Committee of Çankiri University, and approval was obtained. Acceptance of the draft questionnaire (Appendix A2). A permit was obtained from the Ministry of Health and Environment / Al-Diwaniyah Health Directorate / Training and Development Center for cadres to study in primary health care centers in Al-Diwaniyah, (Appendix A3).

3.3. Ethical consideration

This is an integral part of the study as it concerned itself with the ethical issues of scientific analysis at the beginning of the sample selection period, as shown below:

- Anonymity: The names of the patients were not obtained .
- Holding a special meeting with the participating patients in the primary health care centers according to the schedule to remind them of the research and its objectives.
- All patients in this study received complete knowledge of their task .

- Patients are informed that the results of this questionnaire will only be used for study purposes only.
- Informed all patients that everyone here is independent and has the right to refuse to participate.

3.4. Place of study

To assess exercise self-efficacy for diabetic patients in primary health care centers in the city of Al-Qadisiyah / Iraq. This city contains a group of primary health centers that provide various health services for various conditions, including diabetes patients. This study was conducted in primary healthcare centers in Al-Qadisiyah city.

3.5. Sample of the study

The study was designed in a cross-sectional and descriptive type, the sample in this study conducted of (200) patients, which were selected using the sampling method. The target group was diabetic patients attending primary healthcare centers in Al-Qadisiyah, Iraq.

Non-probability sample (appropriate sample). Sample size equation Yamane formula for calculating sample size. In addition to Cochran's formula, Yamane (1967) introduced another, simpler formula for measure the sample size of a population. According to Yamane, the sample size should be at a 95% confidence level and p= 0.05, Where (N) is the population size of diabetic patients in primary healthcare centers in the city of Al-Qadisiyah and (e) is the level of accuracy (Kasiulevičius *et al.*, 2006).

n = N / (1 + N(e) 2)
n = 403 / (1 + 403 (0.05) 2)
n = 200
(N = 403): The number of diabetic patients in healthcare centers in the city of Qadisiyah
(e = 0.05): is the accuracy level

(N = 200): This figure represents a representative sample from the current study of all diabetic patients in primary health care centers in Al-Qadisiyah city

Samples were collected from diabetic patients participating in the study in primary healthcare centers in Qadisiyah, Iraq. The response rate was (95%), where the net sample was (200).

3.6. Validity of the instrument

This questionnaire was prepared by the Arab researcher Darawad *et al.* (2018) in both English and Arabic. It was applied in his study in Jordan (2018). Permission to use this questionnaire was obtained from the researcher by sending an email. The credibility of the researcher was relied upon in using this questionnaire, Cronbach's alpha was 0.89 and split-half coefficient was 0.83 indicating that the ESE-A is a reliable scale. The ESE-A was found to be a robust measure to evaluate exercise self-efficacy (Darawad *et al.* 2018).

3.7. Construction of the study instrument

The questionnaire consists of demographic information and an Exercise Self-Efficacy Scale (ESE). As shown in English (Appendix B1), in Turkish (Appendix B2) and in Arabic (Appendix B3)

Part 1: Section socio-demographic

Socio-demographic questionnaire composed of Age, Gender, Marital status, Family No, Educational status Occupation, Work experience (years), Income satisfaction, Previous diseases, Duration of diagnosis of (D.M), and Evaluation of physical activity.

Part 2: Exercise self-efficacy scale (ESE)

Exercise self-efficacy scale (ESE) consisted of 18 questions. The answer to it will be as follows: do not trust at all that I can (0,10,20,30), I trust that I can moderately (40,50,60,70), I am very confident that I can (80,90,100)

3.8. Data collection

Data were collected through a questionnaire (Arabic version), and an interviewed with all diabetic patients included in the current study in primary healthcare centers in Al-Qadisiyah/Iraq. Diabetic patients were interviewed, their consent to participate in this study was obtained, and the study form was explained. Data was collected through a face-to-face interview and questionnaire distribution to patients. The interview took about (10-20) minutes. Data collection started from 1 April 2022 to 1 July 2022.

3.9. Statistical data analysis

SPSS (Statistical Package for Social) was used in Science (version 25) and Excel (2010) for data analysis. The data were analyzed using frequency, percentage, mean, standard deviation, hierarchical regression, one-way analysis of variance (ANOVA), and an independent sample t-test in SPSS software. The significance level for evaluating the data was $P \leq .05$.

4. RESULTS

The socio-demographic characteristics of the participants participating in the research are given in Table 4.1. When the age distribution of the participants is examined, it is seen that 51.5% of them are 44 years old or below, and 48.5% are over 44 years old. When the gender distribution of the participants is examined, it is seen that 51.0% are male and 49.0% are female.

When the marital status distribution of the participants is examined, it is seen that 70.5% of them are married, and 29.5% are single. When the distribution of the participants regarding the number of people in the family is examined, it is seen that 28% of them answered 3 or less, 35.5% gave the answer between 4-5, and 36.5% answered more than 6.

When the distribution of the participants is examined, 10.5% of them are illiterate, 11.5% are literate, 5.5% are primary school graduates, 16% are secondary school graduates, 34% are Bachelor, and 22.5% are degree. It is seen that he gave the answer of graduate. When the occupational distribution of the participants is examined, it is seen that 38.5% are employee, 27.5% are workers, and 24% are retired.

When the distribution of the participants' work experience is examined, it is seen that 36% have 5 years or less, 35% have 6-10 years, and 29% have more than 11 years of experience. When the distribution of the participants regarding income satisfaction is examined, it is seen that 34.5% of them are satisfied, 43% are somehow satisfied, and 22.5% are not satisfied.When the distribution of the participants regarding the presence of a previous illness is examined, it is seen that 36.5% answered yes, and 63.5% answered no. When the distribution of the participants regarding the diagnosis period of the disease is examined, it is seen that 43.5% of them gave the answer between 1-5 years, 31% between 6-10 years, and 25.5% of them for 11 years and above. When the distribution of the participants regarding the evaluation of physical activity is examined, it is seen that 14.5% of them answered weak/absent, 36.5% a little, 38.5% good/moderate, and 10.5% frequent/very good.

Table 4.1 Socio-demographic characteristics of the participants in the study

VARIABLES		N	%
Age ($\bar{X}$±SD, 43.69±15.36)	44 years and under	103	51.5
	Over 44 years old	97	48.5
Gender	Woman	98	49.0
	Male	102	51.0
marital status	Married	141	70.5
	Single	59	29.5
Number of people in the family	3 and less	56	28.0
	Between 4-5	71	35.5
	More than 6	73	36.5
Educational status	İlliterate	21	10.5
	Literate	23	11.5
	Primary school graduate	11th	5.5
	Secondary school graduate	32	16.0
	Bachelor	68	34.0
	Degree	45	22.5
Job	Employee	77	38.5
	Worker	75	27.5
	Retired	48	24.0
Job experience	5 years or less	72	36.0
	Between 6-10 years	70	35.0
	More than 11 years	58	29.0
Income satisfaction	Pleased	69	34.5
	Somehow satisfied	86	43.0
	Not glad	45	22.5
Presence of previous illness	Yes	73	36.5
	No	127	63.5
DM diagnosis time	1-5 years	87	43.5
	6-10 years	62	31.0
	11 years and above	51	25.5
Evaluation of physical activity	weak/absent	29	14.5
	A little	73	38.5
	Good/moderate	77	36.5
	Frequent/very good	21	10.5
Total		**200**	**100.0**

The results of the current study showed that the self-efficacy exercise of the total diabetic patients participating in this study (30%) was (Do not trust), (55.5%) were moderate, while (14.5%) were (Very confident). Through the results mentioned ın Table 4.2, it was found that exercise self-efficacy was 55.5% (Moderate)

Table 4.2 Distribution of exercise self-efficacy among diabetic patients in primary health centers in Al-Qadisiyah city in Iraq

	SCALES	F	%
Exercise self-efficacy	Don't trust	60	30.0
	Moderate	111	55.5
	Very confident	29	14.5
	Total	200	100.0

The result showed a majority of exercise of self-efficacy was moderate, 55.5%

The results of the normality analysis of the scale used in the research are given in the Table 4.3. The fact that the skewness and kurtosis values of the data are between ±3 indicates a normal distribution.

Table 4.3 Descriptive statistics of the exercise self-efficacy scale used in the study

SCALE	MINIMUM	MAXIMUM	AVERAGE	STANDARD DEVIATION
EXERCISE SELF-EFFICACY SCALE	15.00	70.56	41.17	11.57

Independent t-test was applied to compare the scores of the exercise self-efficacy scale according to the age of the participants (Table 4.4). As a result, it is seen that there is no statistically significant difference between the scores of the exercise self-efficacy scale according to the age of the participants ($p>0.05$).

Table 4.4 Comparison of the scores of the exercise self-efficacy scale according to the gender of the participants

		MIN	MAX	$\bar{X}$	SS	TEST VALUE	P
Gender	Woman	15.00	63.33	39.72	10.89	-1.793**	0.074
	Male	16.11	70.56	42.64	12.09		

*p<0.05, **Independent t test

Independent t-test was applied to compare the scores of the exercise self-efficacy scale according to the marital status of the participants. As a result in Table 4.5, it is seen that there is no statistically significant difference between the scores of the exercise self-efficacy scale according to the marital status of the participants ($p>0.05$).

Table 4.5 Comparison of the scores of the exercise self-efficacy scale according to the marital status of the participants

		MIN	MAX	$\bar{X}$	SS	TEST VALUE	P
Marital status	Married	16.11	70.56	41.71	11.64	1.022**	0.308
	Single	15.00	62.22	39.87	11.37		

*p<0.05, **Independent t test

One-way analysis of variance was applied to compare the scores of the exercise self-efficacy scale according to the number of people living in the family. As a result in Table 4.6, it is seen that there is no statistically significant difference between the scores of the exercise self-efficacy scale according to the number of people living in the family (p>0.05).

Table 4.6 Comparison of the scores of the participants' exercise self-efficacy scale according to the number of people living in the family

		MIN	MAX	$\bar{X}$	SS	TEST VALUE	P
Number of people in the family	Three and less	16.67	70.00	39.45	11.69	0.869***	0.421
	Between 4-5	15.00	63.33	41.66	11.37		
	More than 6	17.78	70.56	42.00	11.67		

*p<0.05, **One-way analysis of variance

One-way analysis of variance was applied to compare the scores of the exercise self-efficacy scale according to the educational status of the participants (Table 4.7). As a result, it is seen that there is no statistically significant difference between the scores of the exercise self-efficacy scale according to the educational status of the participants (p>0.05).

Table 4.7 Comparison of the scores of the exercise self-efficacy scale according to the educational status of the participants

		MIN	MAX	$\bar{X}$	SS	TEST VALUE	P
Educational status	İlliterate	16.11	63.33	38.01	12.38	0.732***	0.600
	Literate	17.78	57.78	39.54	10.01		
	Primary school graduate	22.78	65.00	40.30	12.41		
	Secondary school graduate	24.44	60.56	40.55	10.58		
	Bachelor's degree	15.00	70.00	41.82	11.98		
	Degree	16.67	70.56	43.13	11.89		

*p<0.05, **One-way analysis of variance

Variance was applied to compare the scores of the exercise self-efficacy scale according to the occupations of the participants . As a result in Table 4.8, it is seen that there is no statistically significant difference between the scores of the exercise self-efficacy scale according to the professions of the participants (p>0.05).

Table 4.8 Comparison of the scores of the exercise self-efficacy scale according to the occupations of the participants

		MIN	MAX	$\bar{X}$	SS	TEST VALUE	P
Job	Officer	15.00	70.00	40.73	10.97	0.145***	0.865
	Employee	16.11	65.00	41.15	11.95		
	Retired	17.22	70.56	41.88	12.08		

*p<0.05, **One-way analysis of variance

One-way analysis of variance was applied to compare the scores of the exercise self-efficacy scale according to the work experience of the participants. As a result in Table 4.9, it is seen that there is no statistically significant difference between the scores of the exercise self-efficacy scale according to the work experience of the participants (p>0.05).

Table 4.9 Comparison of the scores of the exercise self-efficacy scale according to the work experience of the participants

		MIN	MAX	$\bar{X}$	SS	TEST VALUE	P
Job experience	5 years or less	15.00	65.00	40.74	11.59	0.571***	0.566
	Between 6-10 years	16.11	63.33	40.47	11.33		
	More than 11 years	18.89	70.56	42.52	11.90		

*p<0.05, **One-way analysis of variance

One-way analysis of variance was applied to compare the scores of the exercise self-efficacy scale according to the income satisfaction of the participants (Table 4.10). As a result, it is seen that there is no statistically significant difference between the scores of the exercise self-efficacy scale according to the income satisfaction of the participants (p>0.05).

Table 4.10 Comparison of the scores of the exercise self-efficacy scale according to the income satisfaction of the participants

		MIN	MAX	$\bar{X}$	SS	TEST VALUE	P
Income satisfaction	Pleased	15.00	63.33	40.31	12.69	1.002***	0.369
	Somehow satisfied	19.44	70.56	42.49	11.09		
	Not glad	17.22	65.00	39.95	10.59		

*p<0.05, **One-way analysis of variance

Independent t-test was applied to compare the scores of the exercise self-efficacy scale according to the presence of a previous disease of the participants. As a result in Table 4.11, it is seen that there is no statistically significant difference between the scores of the exercise self-efficacy scale according to the presence of a previous disease (p>0.05).

Table 4.11 Comparison of the scores of the exercise self-efficacy scale according to the presence of a previous disease of the participants

		MIN	MAX	$\bar{X}$	SS	TEST VALUE	P
Presence of previous illness	Yes	15.00	70.00	40.91	11.22	0.237**	0.813
	No	16.67	70.56	41.31	11.80		

*p<0.05, **Independent t test

One-way analysis of variance was applied to compare the scores of the participants on the exercise self-efficacy scale according to the duration of DM diagnosis. As a result in Table 4.12, it is seen that there is no statistically significant difference between the scores of the exercise self-efficacy scale according to the duration of DM diagnosis of the participants (p>0.05).

Table 4.12 Comparison of the participants' exercise self-efficacy scale scores according to the duration of DM diagnosis

		MIN	MAX	$\bar{X}$	SS	TEST VALUE	P
DM diagnosis time	1-5 years	15.00	70.00	40.17	12.47	0.675***	0.510
	6-10 years	20.56	63.33	42.40	10.12		
	11 years and above	16.67	70.56	41.36	11.67		

*p<0.05, **One-way analysis of variance

One-way analysis of variance was applied to compare the scores of the exercise self-efficacy scale according to the evaluation of physical activity of the participants. As a result in Table 4.13, it is seen that there is a statistically significant difference between the scores of the exercise self-efficacy scale according to the evaluation of physical activity of the participants ($p<0.05$). Bonferroni was applied to find the group that made the difference. Participants with good/moderate assessment of physical activity had higher scores on the exercise self-efficacy scale than those with weak/absent and little.

Table 4.13 Comparison of the scores of the exercise self-efficacy scale according to the evaluation of physical activity of the participants

		MIN	**MAX**	$\bar{X}$	**SS**	**TEST VALUE**	**P**	**BONFERRONI**
Evaluation of physical activity	Weak/absent (1)	15.00	61.11	37.20	11.58	5.371***	**0.001***	**3>1, 3>2**
	a little (2)	16.67	70.56	38.54	10.71			
	good/moderate (3)	19.44	65.00	44.84	11.08			
	Frequent/very good (4)	18.89	70.00	42.30	12.75			

*p<0.05, **One-way analysis of variance

5. DISCUSSION

Discussion -distribution of diabetic patients in primary health centers in Al-Qadisiyah city in Iraq by their demographic data

The results of this study showed that (51.5%) of the participants were male; this result is in agreement with the previous study conducted in Iraq Mohammed-Ali and Hamza, (2016), where the results showed that (52.5 %) of the participants were males. The result of this current study differs from the previous study Darawad *et al.*, (2018), where (51.8%) of the participants were females. The results of the study also showed that (48.5%) of the participants were (over 44) years old; this is in agreement with the previous study conducted in Turkey by Gökdeniz and Akgün Şahin (2022), where the results of the study that the age group from (40 to 50) was (38.4%). My opinion is Because most patients with diabetes are type 2, and often type 2 diabetes affects the elderly Organization, (2019). As for the marital status of the patients participating in the study, (70.5%) of them were married. This agrees with the previous study Çalli and Kartal (2021). The results showed that (70%) of the participants were married. It was found that the number of family members with diabetes for the patients participating in the study (more than 6) was (36.5 %) of the total participants; my opinion is because one of the reasons that lead to diabetes is genetic factors. The results of the current study also showed the educational level of the participating patients (34%) who received (Bachelor). This is in agreement with the previous study conducted in Malaysia Jamani (2012), which showed that most of the participants (50%) had (Bachelor).

The majority of occupation most patients had a Employee (38.5%) were employees, This is in agreement with the previous study Mahdalena and Ningsih (2016), where (5.62%) of the participants in this study were working (employee). It was found that the work experience (36%) is less than six years; my opinion because the highest age group in the study results was (40 to 50) years, and most of the participants in the study also worked as employees. As for the percentage of Income satisfaction, (43%) of the participants in the current study were somehow satisfied. This result differs from previous studies conducted in Iraq Abd and Hamza (2022). As a result, showed (46%)

of the participants in the study had a monthly income that was Insufficient. The current study's results showed that the patients participating in the study (63%) had no previous diseases for previous diseases. This differs from the previous study conducted in Turkey Gökdeniz and Akgün Şahin (2022), where (70.8%) of the participants had other diseases. As for the percentage of duration of diagnosis, it was (1 to 5) years (43.5 %) of the total patients participating. This is in agreement with the previous study conducted in Egypt S Ewais *et al.* (2021), where the duration of the diagnosis of diabetes among the participants (70%) (1-10) years.

The results showed that the physical activity assessment among the participants in the current study was (38.5) little. This is in agreement with the previous study conducted in Jordan Darawad and Khalil (2013), the physical activity of the participants in this study (74.7%) was Poor/none or Little. My opinion was the reason for the poor physical activity of the patients participating in the current study because the majority of the disease are elderly, as well as because of the lack of awareness and guidance about the importance and benefits of physical activity for diabetic patients.

Discussion -distribution of the exercise self-efficacy among diabetic patients in primary health centers in Al-Qadisiyah city in Iraq

The results of the current study showed that the self-efficacy exercise of the total diabetic patients participating in this study (30%) was (Do not trust), (55.5%) were moderate, while (14.5%) were (Very confident). Through the results mentioned above, it was found that exercise self-efficacy was 55.5% (Moderate); this differs from the results of the previous study conducted in Jordan Darawad *et al.* (2018), in which exercise self-efficacy was 29.5% (poor). My opinion is that this weakness in the exercise of self-efficacy is due to many factors of which old age and diseases associated with the sample, weakness in providing facilities that help to exercise, weakness in awareness and guidance, lack of primary health care centers in the city of Al-Qadisiyah, anxiety, and depression among people with diabetes, social and economic situation in the city of Al-Qadisiyah.

Discussion -the association relationship between exercise self-efficacy and the demographic data of diabetic patients in primary health centers in Al-Qadisiyah city in Iraq

The result showed a non-significant between exercise self-efficacy and the age of diabetic patients in primary health centers in Al-Qadisiyah city in Iraq because the ($p > 0.05$). Through the results mentioned in the current study, it was found that there is no effect of age on exercise self-efficacy. The results showed non significance between self-efficacy exercise and gender for diabetic patients because($p>0.05$). This means that sex does not affect exercise self-efficacy. The results also showed non significance between the self-efficacy of exercise and the marital status of diabetic patients Study participants because ($p > 0.05$).

In contrast, the results showed non significance between the self-efficacy of exercise and the family number of diabetics because ($p > 0.05$). The results also showed non significance between the self-efficacy of exercise and the educational status of diabetic patients in primary health centers in the city of Qadisiyah in Iraq because ($p > 0.05$). This indicates that the educational level does not affect the self-efficacy of exercise. As for the occupational, there was no significant correlation between self-efficacy and occupational for diabetic patients because ($p > 0.05$).

The result showed a non-significant between exercise self-efficacy and work experience of the diabetic patients in primary health centers in Al-Qadisiyah city in Iraq because ($p > 0.05$). As for monthly income, there was no statistically significant relationship between exercise self-efficacy and income satisfaction because ($p > 0.05$). The results also showed no statistically significant association between self-efficacy exercise and previous diseases of diabetic patients because the ($p > 0.05$). As for the diagnostic age of diabetic patients, there is no statistically significant association between exercise self-efficacy and the diagnosis age of diabetic patients. This indicates that the age of the diagnosis of diabetes does not affect exercise self-efficacy. The results showed a statistically significant association between self-efficacy exercise and physical activity for diabetic patients in primary health centers in Qadisiyah in, Iraq because($p < 0.05$).

This indicates that physical activity affects exercise self-efficacy, whereby the higher the degree of self-efficacy, the more physical activity. This is in agreement with the previous study Darawad *et al.* (2018).

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusions

In light of the results obtained, the study concluded the following: The study results showed that more than half of the participants ranged in age from 50 to 60 years, half of them were males, most of them were married, and half of them had secondary education or above. More than half of the study participants had a physical activity evaluation ranging from poor to low. The result showed that the majority of exercises of self-efficacy were moderate. My opinion is that this weakness in the exercise of self-efficacy is due to many factors, of which old age and diseases associated with the sample, weakness in providing facilities that help to exercise, weakness in awareness and guidance, lack of primary health care centers, anxiety, and depression among people with diabetes, the social and economic situation in the city of Qadisiyah. The results showed a statistically significant association between exercise self-efficacy and the evaluation of physical activity because of ($p< 0.05$). In contrast, the results showed insignificance between the self-efficacy of exercise and (age, gender, marital status, family number, educational status, job, work experience, satisfaction with income, previous diseases, and duration of diagnosis) for diabetic patients in the primary health centers in the city of Al-Qadisiyah in Iraq because ($p > 0.05$). Levels of self-efficacy among diabetic patients can be improved through community awareness, training programs, and continuous guidance.

6.2. Recommendations

Based on the study's findings, the researcher recommended the following:

1. The study recommended conducting a new survey for diabetics in the city of Qadisiyah because of the importance of such studies in determining the physical activity of diabetic patients and increasing guidance and counseling to reduce the effects on the sufferers.

2. Healthcare providers should primarily assess levels of self-efficacy in order to acquire positive health behaviors in promoting patients' health.
3. Healthcare providers should plan and implement interventions for patients with low self-efficacy using their roles, including health education and counseling.
4. Increasing interest in primary health care centers and providing essential supplies and capabilities in order to provide an appropriate environment for diabetic patients and to promote their health for them.
5. Provide a booklet on the importance of physical activity and self-management for diabetic patients, which includes a brief explanation of the steps, and it will be distributed to patients during their visit to health institutions.
6. Follow regular health care with a current management policy because diabetes is a chronic disease that needs to be supported with social and economic resources.

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Care, D. 2016. In the print version of the article listed above, the A1C range in IFCC units (mmol/mol) is not correct in Table 2.3,"Categories of increased risk for diabetes (prediabetes)," on page S16. The A1C range is listed as 5.7–6.4%(39–46 mmol/mol). The correct range is 5.7–6.4%(39–47 mmol/mol). The same error occurs in the text on page S15. The section reads:"Hence, it is. Diabetes Care, 39, 1653.

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APPENDICES

Appendices (A1) Approval of the ınstitute of health sciences at the university of çankiri karatekin

Appendices (A2) Ethics committee approval at the university of çankiri karatekin

Appendices (A3) :Approval of the ethics committee and facilitating the task of research in ıraq

Appendix (B1) The questionnaire form in english

Appendix (B2) The questionnaire form in turkish

Appendix(C1) -Permission to use the questionnaire

Appendix(C1) -Approval of the co-supervisor

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Personal Information

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