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Fatma Ibrahim Abd El

Quality of life of type 2 diabetic patients attending family medicine outpatient clinic of Suez Canal university hospitals in Ismailia city thesis

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Dedication

This work is dedicated to my parents, my brothers, my sisters, my husband, my son Abdallah, and my daughter mariam for their continuous help and support.

God bless all of them.

Summary

According to the World Health Organization (WHO), the burden of diabetes mellitus in developing countries is increased compared to the developed world due to its low awareness among the public in developing countries, it is certain that they will face the impact of diabetes waves in coming years. Nowadays, the number of type 2 diabetes patients is increasing in every country, and of every 6 persons one at least dies from diabetes. Globally, the majority of the 382 million people with diabetes are aged between 40 and 59 years old; 80 % of them live in low and middle-income countries; and the percentage of people with type 2 diabetes will increase to 55 % in 2035.[192] Quality of life is an important aspect in diabetes because poor quality of life leads to a diminished self-care, which in turn leads to worsened glycemic control, increased risks for complications, and exacerbation of diabetes overwhelming in both the short run and the long run. Several studies demonstrated that diabetes has a strong negative impact on QOL, especially in the presence of complications. However, most of the studies on diabetes and QOL have been conducted in developed countries where there was access to better health care facilities. In developing countries, the morbidity associated with diabetes and its complications was certainly higher compared to developed countries, which adversely affects the QOL of those patients. Moreover, studies of the QOL in diabetic patients in developing countries were rare.[23] The aim of the current study was to evaluate the quality of life of type 2 diabetic patients attending Family Medicine Outpatient Clinic of Suez Canal. University Hospitals at Ismailia city. The study was conducted at the family medicine outpatient clinic of Suez Canal University Hospitals in Ismailia city, Egypt. 143 type 2 diabetic patients were included who agreed to participate in this study and were selected using probability systematic sampling technique. Data was collected through the use of two tools:

Tool 1: A structured- interview questionnaire which was developed by the researcher and included four parts: **Part I:** Socio-demographic data: It was constructed by the researcher and included socio-demographic characteristics of the study group such as gender, age, marital status…etc. The socio-economic scale was developed by El-Gilany et al.,[127] which included 7 domains with a total score of 84 such as education…etc.

Part II: History taking questionnaire which was constructed by the researcher to collect data regarding family history of DM, medical history…etc.

Part III: Medical data: This part included duration of the previous diagnosis of diabetes, physical activity…etc.

Part IV: Bio-physiological measurement which included body mass index (BMI) and random blood sugar test (RBS). **Tool 2: World Health Organization Quality of Life Questionnaire abbreviated version (WHOQoL-Bref):** This questionnaire consisted of 26 items: two individual items that evaluate overall quality of life and satisfaction with health, and 24 items clustered into four domains (physical health, psychological health, social relationships, and environment which were rated on a 5 – point likert scale (WHO, 1997). It was adopted from Abdel Hai et al.,[130] who carried out the translation into Arabic and a written approval for its use was obtained from the department of mental health, WHO-Geneva. All questions were concerned with the past two weeks.

The main results of the present study could be outlined in the following points:

I. The majority of the study group (86%) was females and the mean age was 54.74 years.

II. Approximately three quarters (72.7%) of the study group were married, (57.3%) of them were illiterate and (52%) of them lived in urban areas.

III. The majority of the study group (81.1%) had hypertension.

IV. Most of the study group (96.5%) had neurological complications and (81.8%) of them had ophthalmological complications.

V. More than three quarters (76.2%) of the study group had low socio- economic status level.

VI. Less than half (48.3%) of the study group were rated as low quality of life in physical health domain while less than half (45.5%) of them were rated as high quality of life in social relationships domain.

VII. Based on significance ($P< 0.0001$); low socio-economic status was associated with low QOL in all domains of the study group.

VIII. Based on significance ($P= 0.011$); men were reported to have better quality of life than women but this was only statistically significant in physical domain of QOL of the study group.

IX. Based on significance; there was a statistically positive relationship between age and psychological health ($P= 0.004$) and environmental domains ($P= 0.023$) of the study group.

X. Based on significance ($P= 0.039$); patients have been treated with oral hypoglycemic agents associated with low QOL in social relationships domain of the study group.

XI. Based on significance; obesity was associated with low QOL especially in physical health (P= 0.024) and psychological health domains (P= 0.021) of the study group.

XII. Based on significance (P= 0.021); smoking status was associated with low QOL especially in psychological health domain of the study group.

XIII. Based on significance (P= 0.004); physical inactivity was associated with low QOL especially in physical health domain of the studygroup.

XIV. Based on significance (P= 0.025); poor glycemic control was associated with low QOL especially in physical health domain of the study group.

XV. Based on significance; presence of complications of diabetes as ophthalmological complications (P= 0.003), peripheral vascular disease (P= 0.008) and diabetic foot ulcer (P= 0.025) were associated with low quality of life of the study group.

Based on the findings of the current study, it could be concluded that:

Type 2 DM has negatively affected all domains of quality of life of the study group. Factors related to lower quality of life in the present study were lower socio-economic status, poor glycemic control, self-administered oral hypoglycemic agents, obesity, cigarette smoking, physical inactivity, and presence of diabetes complications as ophthalmological complications, peripheral vascular disease and diabetic foot ulcers.

According to the results of the present study, the following recommendations could be deduced:

Health care providers should do their best to improve glycemic control for better quality of life for type 2 diabetic patients. Health education programs can be conducted to improve life style of those patients and further researches should be conducted to assess the impact of health education programs as well as how to improve quality of life of those patients.

Acknowledgments

First and foremost, praise be to Almighty Allah for the countless gifts I have been offered and for helping me and giving me the power to pass safely through all difficulties and overcome them.

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Special thanks to every diabetic patient who participated in the conduction of this study. Finally, I would also like to extend my deepest gratitude to all the team members of Family Medicine Outpatient Clinic at Suez Canal university Hospitals and to all those who helped me to fulfill this study.

Abstract

Background: Type 2 Diabetes mellitus, as one of the most important chronic diseases in the world, threats patients' quality of life. The aim of the study was to evaluate the quality of life of type 2 diabetic patients attending Family Medicine Outpatient Clinic of Suez Canal University Hospitals at Ismailia City.

Subjects and Methods: A cross-sectional analytic study design was used. The study included 143 type 2 diabetic patients. World Health Organization Quality of Life Questionnaire abbreviated version was used to collect data regarding quality of life. Also, socio-economic data was collected by using socio-economic scale.

Results: revealed that less than half of the study group were rated as low quality of life in physical health domain while less than half of them were rated as high quality of life in social relationships domain. Factors related to lower quality of life in the present study were lower socio-economic status, poor glycemic control, obesity, physical inactivity and presence of diabetes complications as ophthalmological complications and diabetic foot ulcers.

Conclusion: Type 2 diabetes mellitus has negatively affected all the quality of life domains of the study group.

Keywords: quality of life, type 2 diabetes mellitus, socio-economic status

Abbreviations

ADA, american diabetes association;

BMI, body mass index;

CDC, centers for disease control and prevention;

DCCT, diabetes control and complications trial;

DKA, diabetic ketoacidosis;

DM, diabetes mellitus;

FPG, fasting plasma glucose test;

HbA1c, glycated hemoglobin;

HDL, high-density lipoprotein;

HHNS, hyperglycemic hyperosmolar non ketonic syndrome;

HRQOL, health-related quality of life;

HTN, hypertension;

IDF, international diabetes federation;

MENA, middle east and north africa;

MODY, maturity-onset diabetes of the young;

NGSP, national glycohemoglobin standardization program;

OGTT, oral glucose tolerance test;

PAD, peripheral arterial disease;

POAG, primary-open angle glaucoma;

QOL, quality of life; RBS, random blood sugar;

RNs, registered nurses;

SES, socio-economic status;

Type 2DM, type 2 diabetes mellitus;

WHO, world health organization;

WHOQOL-100, world health organization quality of life questionnaire 100;

WHOQOL-BREF, world health organization quality of life questionnaire abbreviated version

Introduction

Diabetes mellitus (DM) is one of the most common chronic diseases worldwide. The prevalence of DM is rapidly rising all over the globe at an alarming rate. There were 415 million people or 8.8 % of adults aged between 20 and 79 living with diabetes globally, 192.8 million people with diabetes were undiagnosed and 75 % of them lived in low- and middle-income countries; this will rise to 642 million people by 2040. Every six seconds a person died from diabetes. This makes the anticipated impact of the condition greater and more damaging in these countries than in more affluent parts of the world. In Egypt, there were 7.8 million cases of diabetes among adults in 2015 and this will rise to 15.1 million cases by 2040. Type 2 diabetes mellitus (Type 2DM) is the commonest form of diabetes constituting nearly 90-95 % of the diabetic population in any country.[1] Hyperglycemia in type 2 DM results from resistance to insulin actions on peripheral tissues as well as inadequate secretion of insulin and an impaired suppression of glucagon secretion in response to ingested glucose. The prevalence of type 2 DM is increasing worldwide, probably due to a longer life expectancy of the general population, a sedentary lifestyle and above all, to increasing obesity.[2] It is a group of metabolic disorders characterized by hyperglycemia and is associated with abnormalities in carbohydrate, fat and protein metabolism. Chronic hyperglycemia initiates microvascular complications including nephropathy, retinopathy and neuropathy. These complications are predominantly seen in patients within the age group of 40 to 60 years.[3,4]

Approximately one third of mortalities in diabetic patients are due to cardiovascular diseases. It is estimated that more than 50% of diabetic patients die from a cardiovascular event – most likely coronary artery disease. Foot ulceration and infection in diabetic patients are considered two major causes of morbidity, hospitalization and foot amputation. This complication accounts for approximately 20% of hospital admissions in diabetic patients.[5,6] Socio-economic status (SES) may influence access to health care and quality of care, social support and availability of community resources. It may also influence diabetes-related knowledge, communication with providers, treatment choices and the ability to adhere to recommended medication, exercise and dietary regimens. Thus, low SES could be associated with multiple risks.[7] Diabetic care consists mainly of self-care. Diabetic patients themselves have to regulate their blood glucose levels by monitoring them together with balancing their food intake, physical activities and their intake of oral hypoglycemic agents and/or insulin. The overall treatment goal is to prevent acute and chronic complications, while preserving a good quality of life. Quality of life (QOL) is an important health outcome in its own right, representing the ultimate goal of all health interventions. People with diabetes have a poor QOL than people with no chronic illness. The goals of chronic care are not to cure but to enhance functional status, minimize distressing symptoms, prolong life through secondary prevention and enhance quality of life.[8,9]

Type 2 DM is developing into an international public health problem with a significant increase in the Middle East Region. The quality of life is an important aspect in diabetes because the poor quality of life leads to diminished self-care, which in turn leads to worsened glycemic control, increased risks for complications, and exacerbation of diabetes overwhelming in both the short run and the long run. Several studies showed that adult with type 2 diabetes mellitus rate their QOL lower than the general population.[10–12] Quality of life is of central concern in evaluative research and improved quality of life is probably the most desired outcome of all health care policies. QOL has been defined as a “descriptive term that refers to people’s emotional, social and physical well-being and their ability to function in the ordinary tasks of living”.[13,14] Health related quality of life (HRQL) is a concept and/or a form of assessment of health condition that has gained relevance in patient populations in recent decades. It has also been increasingly recognized as an important health outcome among healthy populations including workers. There is no widely accepted definition for HRQL, primarily because it is used in different contexts. HRQL is here defined as the impact of a health condition on aspects that affect quality of life.[15] Chronic diseases especially DM often have a relapsing and remitting course with substantial impact on function and QOL. For chronic illnesses where there is no cure, it is important to establish that therapy really makes people feel better. Thus, survival per se is no longer perceived to be the only end point; the goal is to improve, restore, or preserve QOL.

Goals of caring for patients with a chronic condition are to enhance their functional status, minimize symptoms, control pain, reduce disability and prolong life through secondary prevention.[16] The quality of life improvement is considered to be a major goal in diabetes control program. Improvement of quality of life is a primary purpose of health promotion. This can be achieved by preventive health programs with their greater impact on morbidity rather than mortality.[17] Unlike other chronic ailments, the treatment of type 2 DM depends to a great extent on day-to-day self-management of diet, exercise, and other factors; poor glycemic control caused by inadequate self-management can result in complications such as retinopathy, nephropathy, and neuropathy which markedly reduce patients’ quality of life.[18] Practical nurses have a vital role in the initial management of type 2 DM in primary care which is largely directed toward assisting patients to understand the nature and possible trajectory of the disease, besides self-managing. The approach taken by practice nurses involves assessments, goal-setting, and information-sharing about self-management in more extended face-to-face consultations which inevitably turn to conversations concerning lifestyle, behavior modification and risk reduction.[19]

Significance of the study

The prevalence of type 2 DM continues to increase, especially in developing countries, despite improvements in research and this disease constitutes a major public health problem worldwide, both by the number of people affected and by the socio-economic implications presented

by the management and treatment of the disease and its complications.[20,21] The incidence of type 2 DM and related complications are growing rapidly in Egypt and has become a major health care issue among our population.[22] Several studies have demonstrated that diabetes has a strong negative impact on HRQOL, especially in the presence of complications. However, most of the studies on diabetes and HRQOL have been conducted in developed countries where there is access to better health care facilities. In developing countries, the morbidity associated with diabetes and its complications is certainly higher as compared to developed countries, which adversely affects the HRQOL of those patients. Moreover, studies of the HRQOL in diabetic patients in developing countries are rare.[23] Hence, we planned a study to evaluate quality of life of type 2 DM.

Aim of the study

The present study was aimed to evaluate the quality of life of type 2 diabetic patients attending family medicine outpatient clinic of Suez Canal University Hospitals at Ismailia city through the following:

Specific objectives

a. To assess the quality of life of patients with type 2 diabetes mellitus.

b. To identify relationship between quality of life of type 2 diabetic patients and their socio-economic status.

c. To identify relationship between quality of life of type 2 diabetic patients and clinical factors related to diabetes mellitus.

Research questions

To achieve the above purpose of this study, the following questions should be answered:

a) What are the relations between socio-economic status, clinical factors and quality of life of those patients?

b) Does type 2 diabetes mellitus affect quality of life of diabetic patients?

Study hypothesis

Null hypothesis: There is no relationship between quality of life of type 2 diabetes, socio-economic status and clinical factors related to diabetes mellitus.

Alternative hypothesis: Diabetes mellitus affects negatively quality of life and socio-economic status affects negatively quality of life.

Review of Literature

Part I: Type 2 Diabetes mellitus

Definition of Diabetes Mellitus

Diabetes mellitus is defined as a metabolic disorder caused by different factors, and is characterized by hyperglycemia (elevated blood glucose level) with disturbances in carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, action or both. The chronic hyperglycemia is associated with long-term damage, dysfunction and failure of various organs, especially eyes, kidney, nerves, heart and blood vessels.[24]

Anatomy and Physiology of Pancreas

The pancreas is a large, an elongated and a retroperitoneal organ that lies in an oblique position, sloping upward from the C-loop of the duodenum to the splenic hilum in the left hypochondrium of the abdomen behind the stomach. In an adult, the pancreas weighs 75 to 100 g and is about 15 to 20 cm long. The right side of the organ termed the head lies in close proximity to the curve of the duodenum while the body of the pancreas extends slightly upwards resulting in the tail of the organ being situated close to the spleen. It consists of two functionally and morphologically distinct cell populations, the exocrine and endocrine cells (Figure 1). The exocrine cells make up around 95-99% of the total pancreas while the endocrine cells, composing the islets of Langerhans, are scattered in the exocrine tissue, make up about 1-5% of the pancreas.[25,26] The exocrine portion of the pancreas is composed of acinar cells and duct cells which play essential roles in the secretion of digestive enzymes. Acinar cells are dedicated to synthesis, storage and the regulated release of approximately 24 enzymes and accessory proteins while the endocrine portion of the pancreas is composed of five different hormone secreting cell types which are difficult to distinguish through standard staining techniques, but can be classified by their secretion. The five cell types include the glucagon secreting α-cell, insulin secreting β-cells, somatostatin releasing δ-cells, ghrelin-producing ε-cells and the pancreatic polypeptide producing PP-cells which all aggregate into the islets of Langerhans (Figure 2); where each islet is made up from a central core of beta cells surrounded by the other endocrine cells.[27,28] Insulin, produced by the β-cells, and glucagon, produced by the α-cells of the islets, are the main hormones involved in glucose homeostasis. During periods of elevated blood glucose, insulin is secreted from the pancreas to increase the uptake of glucose into insulin-responsive tissues such as adipose tissue, muscle and liver. Glucose is exploited by these organs as a source of cellular energy via glycolysis or is stored as glycogen or fat in the liver and muscle cells, and adipose tissues.[29] During periods of low blood glucose, the hormone glucagon raises glucose levels back to normal physiological levels. Glucagon acts principally on the liver where it acts to increase the breakdown of glycogen to glucose in a process known as glycogenolysis, resulting in the release of glucose back into the bloodstream alongside gluconeogenesis which involves the production of glucose from non-carbohydrate carbon substrates such as glucogenic amino acids, glycerol, lactate and pyruvate.[30]

Classification of diabetes mellitus

This classification includes four types: type 1 DM, type 2 DM, Other specific types of diabetes and gestational diabetes. Type 1– autoimmune or idiopathic β-cell destruction which usually leads to absolute insulin deficiency. It accounts

for 5-10% of all diagnosed cases; Type 2– may range from predominantly insulin resistance with relative insulin deficiency to a predominantly secretory defect with insulin resistance. It accounts for 90 - 95% of cases (ADA, 2011 a). Other specific types of diabetes due to other causes include genetic defects of β-cell function –such as: several forms of previously referred to as Maturity-Onset Diabetes of the Young (MODY) which usually occurs in individuals under the age of 25 years. All MODY genes have not been identified, but heterozygous mutations in six genes cause the majority of the MODY cases, genetic defects in insulin action, diseases of the exocrine pancreas–such as: pancreatitis, trauma, neoplasia, endocrinopathies–such as: acromegaly, Cushing's syndrome, hyperthyroidism, induced by drugs or chemicals–such as: glucocorticoids, thiazides, β-adrenergic agonists, infections–such as: cytomegalovirus, uncommon forms of immune-mediated diabetes and other genetic syndromes sometimes associated with diabetes –such as: Down's syndrome, Klinefelter's syndrome, Turner's syndrome (ADA, 2012). Gestational diabetes mellitus, diabetes diagnosed during pregnancy that is not clearly overt diabetes. It develops in 2-5% of all pregnant women, but it disappears after delivery. It is more prevalent in women with a family history of diabetes. Obesity is also a risk factor, which makes those women prone to developing diabetes later in life if proper treatment is not received.[31]

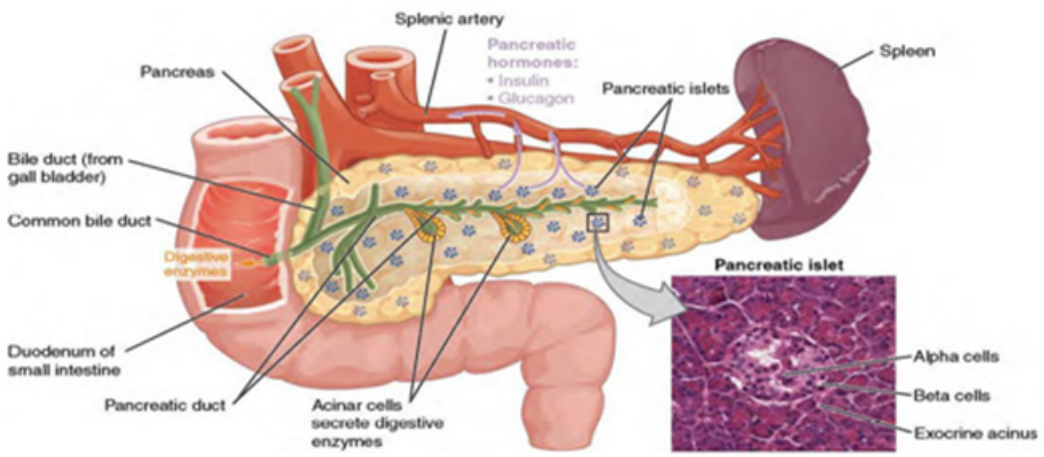

Figure 1 Anatomy of Pancreas.
Source: (OpenStax College, 2013).

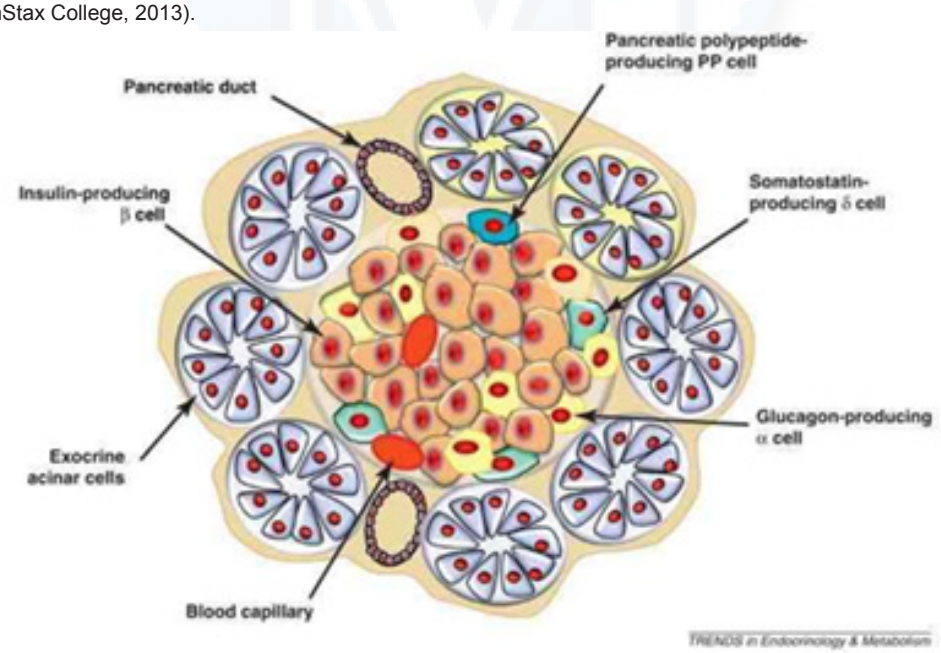

Figure 2 Pancreatic cells.
Source: (Efrat and Russ, 2012).

Type 2 diabetes mellitus

According to The Royal Australian College of General Practitioners and Diabetes Australia (2014) type 2 diabetes is a largely preventable, chronic and progressive medical condition that results from two major metabolic dysfunctions: insulin resistance and a relative insulin deficiency. Insulin resistance, in which clinical signs may include: acanthosis Nigerians–characterized by hyper pigmentation (darkening of skin pigment) especially in the neck and axillae; skin tags –benign (non-cancerous) skin growths on the body or face; central obesity–defined by a high waist-to-hip ratio, waist-to-thigh ratio and waist circumference; menstrual irregularities; and hirsutism– excess facial and body hair, especially on women. A relative insulin deficiency, in which chronic hyperglycemia with multiple disturbances in carbohydrate, protein and fat metabolism develops when a person's β-cell function is no longer sufficient to meet his/her insulin requirement.

Epidemiology of Type 2 diabetes mellitus

According to IDF (2013 a) diabetes mellitus is one of the most prevalent diseases that affect many individuals around the world in epidemic proportions. There were 382 million people aged between 40 and 59 living with diabetes globally, and 80% of them lived in low- and middle-income countries; by 2035 this will rise to 592 million people; and 175 million people with diabetes were undiagnosed. The numbers are projected to rise, type 2 diabetes mellitus in particular: the number of people with diabetes will increase by 55% by 2035. According to,[32] 382 million people had diabetes in the world, of which more than 34.6 million (9.2% of the adult population) were in the Middle East and North Africa (MENA) region, which is expected a rise up to 67.9 million by 2035. Diabetes killed more than 10% of all adults in the MENA region (368,000 deaths) in 2013, unevenly split between men (146,000) and women (222,000). Nearly half of all deaths from diabetes in the region occurred in people under the age of 60 years. These early deaths might be a result of a factor combination including the rapidly changing environments and lifestyles in the region, late diagnoses and health systems that are not equipped to bear the growing burden. The number of deaths had increased by 13.3% from estimates for the year 2010. The magnitude of the estimated number of deaths due to diabetes was similar to the combined deaths from several infectious diseases like HIV/ AIDS, malaria, and tuberculosis that were ranked as top public health priorities.[22] Type 2 diabetes-related mortalities accounted for 4.6 million deaths in 2011 for people aged 20–79 years, accounting for 8.2% of global all-cause mortality for people in this age group with an estimated rate of one death every seven seconds. An estimated 9.1% of the populations from the MENA region had type 2 DM (32.8 million) in 2011, and this was projected to reach 60 million in 2030. The explosion of type 2 DM in this region, within the 20–79 age groups accounted for about 280,000 annual deaths in the MENA region, with mortality attributable to diabetes being equal in males (141,000) and females (138,000). Approximately half of all diabetes related mortality in this region occurred in people under the age of 60 years.[33]

DM was one of the sixth leading causes of death in the United States, accounting for 3.0% of deaths each year. Similarly, diabetes was the sixth most important cause of disability burden in Egypt. It is estimated that by the year 2030, Egypt will have at least 8.6 million adults with diabetes which was the eleventh most important cause of premature mortality in Egypt, and it was responsible for 2.4 % of all years of life lost.[34–36] An updated report from IDF showed that as of 2013, approximately 387 million people aged 40-59 years had diabetes; resulting in a diabetes comparative prevalence of 8.3%, and 46.3% of those people did not know they have it. Every seven seconds a person died from diabetes; the diabetes caused 4.9 million deaths in 2014. In the MENA region in 2014, 1 out of 10 adults had diabetes; 36.8 million adults (aged 20-79 years) had diabetes and 17.9 million adults did not know they have it. In Egypt in 2014, there were 7.6 million cases of diabetes among adults, and 3.8 million adults did not know they have it.[37]

Risk factors of Type 2 diabetes mellitus

The risk factors associated with type 2 DM are divided into two categories; the first category (modifiable risk factors) and the second category (non-modifiable risk factors). Modifiable risk factors include diets rich in saturated fats and simple carbohydrates, high blood pressure (≥140/90mmHg), elevated plasma triglycerides (≥250 mg/dl) and low levels of physical activity (<3 times a week). The non-modifiable risk factors are age (older than 45 years), family history of diabetes, ethnicity and diabetes during a previous pregnancy.[38] Factors associated with diabetes in Arabic-speaking countries included obesity, socio-economic and demographic factors, food consumption and physical inactivity. Obesity which was the major risk factor for developing type 2 DM, as shown by the relationship between increases in body mass index (BMI) and the risk of developing type 2 DM. Socio-economic and demographic factors, in Egypt, the rate of type 2 DM in the low socio-economic status (SES) population in urban areas was 13.5% and the ratio of people with type 2 DM in urban and rural areas is 400 to 100 according to IDF estimates for the year 2011. Food Consumption, rich in high saturated fats and refined carbohydrate diets coupled with a low dietary fiber intake are associated with a steep rise in the prevalence of chronic diseases and obesity in the region. Physical inactivity such as the sedentary lifestyle increases the risk of developing type 2 DM and obesity.[39] Many studies have elaborated the associations between several risk factors and the risk of type 2 DM. Body mass index (BMI), lipids, hypertension, smoking, physical inactivity, low education, dietary patterns, family history, and recently also specific genes are the most frequently documented risk factors for type 2 DM.[41–42]

Pre-diabetes, a state when blood glucose is elevated, yet not high enough to be classified as overt diabetes; pre-diabetes usually occurs prior to the onset of type 2 DM. It is risk factors for type 2 DM. Individuals with pre-diabetes

are 10 to 20 times more likely to develop diabetes than those with normal blood glucose levels. It is associated with the simultaneous presence of insulin resistance and β-cell dysfunction abnormalities that start before glucose changes are detectable. Prevalence of pre-diabetes is increasing worldwide and experts have projected that more than 470 million people would have pre-diabetes by 2030.[43,44] This is alarming as it is estimated that up to 70% of those with pre-diabetes will progress to type 2 DM.[45] The American Diabetes Association (2011 a) defined pre-diabetes as having any one of the following: (1) Impaired Fasting Glucose (IFG) indicated by Fasting Plasma Glucose (FPG) of 100–125mg/dl without impaired glucose tolerance (IGT); (2) Impaired Glucose Tolerance (IGT) was defined as a 2-h plasma glucose level of 140-199 mg/dl; or (3) Glycated hemoglobin level (HbA1c) of 5.7–6.4%.

Pathophysiology of type 2 diabetes mellitus

The leading pathophysiological cause of type 2 DM is the failure of pancreatic β cells which leads to inadequate secretion of insulin, and increased insulin resistance which refers to decreased tissue (especially the liver, adipose tissues and muscle) sensitivity to insulin. Normally, insulin binds to special receptors on cell surfaces and initiates a series of reactions involved in glucose metabolism. In type 2 DM; these intracellular reactions are diminished, making insulin less effective at stimulating glucose uptake by the liver. Physical inactivity and obesity lead to insulin resistance, increased production of glucose by the liver and decreased glucose uptake in skeletal muscles. In order to compensate, β cells increase insulin secretion, but the progressive failure of β cells leads to hyperglycemia and finally type 2 DM.[46,47] Besides insulin resistance and beta-cell dysfunction, the inappropriately increased alpha-cell function and consequent hyperglucagonemia has long been recognized as a contributor to hyperglycemia in diabetic patients, by stimulating hepatic glucose production. In fasting state, hyperglycemia is directly related to increase hepatic glucose production while in postprandial state hyperglycemia result from the combination of insufficient suppression to glucose output and defective insulin stimulation of glucose disposal in target tissues, mainly skeletal muscles. Anti-hyperglycemic agents are directed to one or more of the pathophysiological defects of type 2 DM; they modify physiological processes related to appetite, nutrient absorption or excretion.[46–48]

Signs and symptoms of type 2 diabetes mellitus

The classic symptoms of diabetes are polyuria (the need to urinate frequently), polydipsia (increased thirst & fluid intake), polyphagia (increased appetite) and weight loss and the symptoms that may provide cause for testing for type 2 DM include increased thirst or urination, numbing of extremities, impotence, blurred vision and fatigue.[49] Other symptoms that are commonly present at diagnosis include; a history of blurred vision, itchiness, peripheral neuropathy, recurrent vaginal infections, poor healing skin wounds and fatigue Patients with type 2 DM may rarely present with non ketotic hyperosmolar coma, a condition of very high blood sugar associated with a decreased level of consciousness and low blood pressure. Many people however have no symptoms during the first few years are diagnosed on routine testing.[50]

Diagnosis of type 2 diabetes mellitus

Type 2 DM is typically diagnosed in individuals aged 40 years and over. Healthy adults who aged 45 or more should be tested for DM every three years. Patients who have certain risk factors should ask their doctors about testing at an earlier age and more frequently. These risk factors include; overweight (20.0% more than ideal body weight), sedentary lifestyle, high blood pressure (greater than 140/90) or unhealthy cholesterol level especially for patients with High-Density Lipoprotein (HDL) and high triglyceride level, history of heart disease, stroke, peripheral artery disease, close relative (parent, sibling) with DM.[51] The diagnostic criteria for diabetes mellitus are either one of the following: (1) Glycated hemoglobin test (HbA1c) ≥6.5%. This test should be performed in a laboratory using a method that is National Glycohemoglobin Standardization Program (NGSP) certified and standardized to the Diabetes Control and Complications Trial (DCCT) reference assay; (2) Fasting Plasma Glucose Test (FPG) ≥126 mg/dl. Fasting is defined as no caloric intake for at least 8 hours; and (3) 2 hour plasma glucose ≥200 mg/dl during an Oral Glucose Tolerance Test (OGTT). This test should be performed as described by the WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.[52] Glycated hemoglobin test: This test indicates the average blood sugar level for the past two to three months. It measures the percentage of blood sugar attached to hemoglobin, the oxygen-carrying protein in red blood cells. The higher blood sugar levels, the more hemoglobin will have with sugar attached. An HbA1c level of 6.5% or higher on two separate tests indicates diabetes. A result between 5.7% and 6.4% is considered pre-diabetes, which indicates a high risk of developing diabetes. Normal levels are below 5.7%.[53] Indications for diabetes screening in asymptomatic adults includes sustained blood pressure >135/80 mm Hg, overweight and one or more other risk factors for diabetes (e.g., first-degree relative with diabetes, BP >140/90 mm Hg, and High-density lipoprotein (HDL) < 35 mg/dl and/or triglyceride level >250 mg/dl) (ADA, 2012).

Complications of type 2 diabetes mellitus

Diabetes complications are divided into two major categories: (A) Acute complications such as hypoglycemia, Diabetic Ketoacidosis (DKA), and Hyperglycemic Hyperosmolar Non ketonic Syndrome (HHNS). (B) Chronic complications, either microvascular (diabetic retinopathy, nephropathy, and neuropathy) or macrovascular (coronary artery disease, peripheral arterial disease, and stroke).[54]

Acute complications

Hypoglycemia

Tight blood sugar (glucose) control increases the risk of low blood sugar (hypoglycemia). Hypoglycemia, also called

insulin shock, occurs if blood glucose levels fall below normal (i.e. below 70mg/dl), although this level may not necessarily cause symptoms in all patients. Hypoglycemia may also be caused by insufficient intake of food, or excess exercise or alcohol. Usually the condition is manageable, but occasionally, it can be severe or even life threatening, particularly if the patient fails to recognize the symptoms, especially while continuing to take insulin or other hypoglycemic drugs. The signs of hypoglycemia can vary from person to person, which can occur suddenly: hunger, perspiration, rapid heartbeat, weakness, feeling sleepy, feeling drunk, difficulty speaking, trembling, dizziness, confusion, and anxiety.[55]

Diabetic ketoacidosis (DKA)

Diabetic Ketoacidosis (DKA) is a condition, which the body produces abnormally high-level of blood acids called ketones, which are byproducts of fat breakdown that build up in the blood and appear in the urine. They are produced when the body burns fat instead of glucose for energy, whereas the buildup of ketones in the body is called ketoacidosis. Extreme stages of diabetic ketoacidosis can lead to death and coma (ADA, 2012).

Hyperglycemic hyperosmolar non ketonic syndrome (HHNS) Hyperglycemic Hyperosmolar Non ketonic Syndrome HHNS usually occur with type 2 DM, but it can also occurs with type 1 DM. It is often triggered by a serious infection, another severe illness, or by medications that lower glucose tolerance or increase fluid loss (especially in people who are not drinking enough fluids). Symptoms of HHNS include; high blood sugar levels, dry mouth, extreme thirst, dry skin and high fever. HHNS leads to loss of consciousness, seizures, coma and death **(IDF, 2010)**.

Chronic complications

Heart disease and stroke

There is a correlation between high blood pressure (hypertension), abnormal cholesterol level, and DM. People with DM are more likely than others to have heart problems, and to die from heart complications. Death percentage related to heart attack and stroke is increased in patients with DM (60.0% and 25.0%, respectively). DM is often associated with low HDL ("good" cholesterol) and high triglycerides, and this can lead to coronary artery disease, heart attack, or stroke.[56]

Peripheral arterial disease

Peripheral arterial disease (PAD) is referred to as peripheral vascular disease and is produced by narrowing of the calibre of the medium-sized arteries and its widest definition encompasses all extra coronary and extra cerebral vascular disease. However, the term PAD is usually restricted to involvement of the lower limbs, particularly in the iliac bifurcation, and the iliofemoral and popliteal arteries. The main cause of arterial stenosis in developed countries is atherosclerosis. It is characterized by 2 types of symptoms: intermittent claudication (or the intermittent pain, ache, or discomfort that may occur during exercise or walking but resolves with rest) and pain at rest (which is caused by ischemia in the limb, indicating inadequate blood flow to the affected limb). It may lead to bruises or injuries that do not heal, gangrene, and, ultimately, amputation.[57,58]

Kidney Damage (Nephropathy)

Kidney disease (nephropathy) is a very serious complication of DM. In this condition, the tiny filters in the kidney (called glomeruli) become damaged and leak protein into the urine. Urine test showing micro albuminuria (small amounts of protein in the urine) is important marker for kidney damage. An increased urinary microalbumin levels increase with duration of diabetes Diabetic nephropathy may result in end-stage renal disease. If kidney failure occur, hemodialysis is required. Patients usually have no symptoms early on, but as the disease progresses, they may feel tired, become anemic, not think clearly, and even develop dangerous electrolyte.[59,60]

Nerve disorders (neuropathy)

DM reduces or distorts nerve function, causing a condition called neuropathy. Neuropathy refers to a group of disorders that affect nerves. The two main types of neuropathy are Peripheral (affects nerves in the toes, feet, legs, hand, and arms) and Autonomic (affects nerves that help regulate digestive, bowel, bladder, heart and sexual function).[61]

Eye complications (retinopathy)

Diabetic retinopathy is an important cause of blindness, and occurs as a result of long-term accumulated damage to the small blood vessels in the retina. After 15 years of diabetes, approximately 2% of people become blind and about 10% develop severe visual impairment. Diabetic patients are also at high risk for developing cataract and certain types of glaucoma, such as Primary-Open Angle Glaucoma (POAG). The risk for POAG is especially high for women with type 2 DM.[62]

Foot ulcers (diabetic foot)

People with diabetes may develop a number of different foot problems as a result of nerve and blood vessel damage. These problems can easily lead to infection and ulcers which increase a persons' risk for amputation (WHO, 2009). People with diabetes carry a risk of amputation that may be more than 25 times greater than that of people without diabetes .These amputations tend to occur in patients of increasing age and those with peripheral neuropathy or chronic leg ulcers.[57]

Infections

People with DM are high risk for influenza and its complications, including pneumonia so everyone with DM should have annual influenza vaccinations and a vaccination against pneumococcal pneumonia. Women with DM face a significantly higher risk for urinary tract infections, which are likely to be more complicated and difficult to treat than in the general population. Patients with DM are high risk for hepatitis B virus, which is transmitted through blood and other bodily fluids whereas exposure to the virus can

occur through sharing finger-stick devices or blood glucose monitors. Adults newly diagnosed with type 1 or type 2 DM should get hepatitis B vaccinations.[63]

Male sexual dysfunction

Changes in sexual function is a common problem with aging, however, diabetes mellitus predisposes one to early onset and increased severity of these problems. Sexual dysfunction such as erectile dysfunction, impairs quality of life, and is associated with depression, increased anxiety and poor self-esteem in affected patients.[64]

Oral complications of diabetes

Gingivitis, an inflammatory condition of the gums surrounding the teeth, and periodontitis, the destruction of the ligament, bone, and soft tissues that support the teeth, is two of the most serious dental conditions identified in individuals with diabetes. Dry mouth, often symptom of undetected diabetes, can cause soreness, ulcers, infections, and tooth decay.[65]

Specific Complications in Women

Temporary DM that occurs during pregnancy (gestational diabetes) can increase the risk for birth defects. For women with type 2 DM who take insulin, pregnancy can affect their insulin dose. Insulin dose need to be adjusted during pregnancy and after delivery. The changes in estrogen and other hormonal levels that occur during per menopause can cause major fluctuations in blood glucose level. Women with DM also face an increased risk of premature menopause, which lead to higher risk of heart disease.[66]

Prevention of type 2 diabetes mellitus

Type 2 DM prevention is possible by adopting some healthy lifestyle habits and paying attention to a specific preventable DM complications associated with the disease. Some steps for prevention include; adopting healthy lifestyle and taking diabetes medication, if needed. Many doctors recommend that, screening for type 2 DM at age 30 among people at risk such as those with a family history of DM or those overweight.[67] Simple lifestyle measures have been shown to be effective in preventing or delaying the onset of type 2 diabetes. To help prevent type 2 diabetes and its complications, people should: Achieve and maintain healthy body weight; be physically active, at least 30 minutes of regular, and moderate-intensity activity on most days. More activity is required for weight control; eat a healthy diet of between three and five servings of fruit and vegetables a day and reduce sugar and saturated fats intake; and avoid tobacco use (WHO, 2010). The lifestyle modification programs, promoting increased physical activity, dietary change and weight loss, can substantially reduce the risk of type 2 diabetes in those patients with pre-diabetes.[68] Through the lifestyle and diet modification, studies have shown that there was significant reduction in the incidence of type 2 DM with a combination of maintenance of body mass index of 25 kg/m^2, eating high fiber and unsaturated fat and diet low in the saturated fats and glycemic index, regular exercise, abstinence from smoking and moderate consumption of alcohol suggesting that type 2 DM can be prevented by lifestyle modification.[69] Diabetes Prevention Program (DPP), which conducted by National Institutes of Health (NIH) showed that people who are high risk for developing type 2 DM (borderline DM or pre-DM) could reduce risk by 31.0% when using the prescribed DM drug (Metformin) with lifestyle and diet modifications, also NIH study showed that the risk of DM could be reduced even further by 58.0% through intensive lifestyle modifications alone (specifically, nutrition and exercise counseling). Patients have blood sugar level high than normal, but not yet high enough to be considered diabetes, called pre-diabetes or impaired glucose tolerance (IGT), often precedes DM in their advanced life if early detection and management not done.[67]

According to Centers for disease control and prevention (CDC) (2008) across all of diabetes related complications the three most significant risk factors are hyperglycemia, high blood pressure and hypercholesterolemia. It has been suggested that improvements in glycemic control, blood pressure and cholesterol level can reduce a person risk for complications. For example, in a person with diabetes, each percentage point reduction in glycosylated hemoglobin (HbA1c) level can reduce that person risk for microvascular complications by 40%. A 10 Hg decrease in blood pressure can reduce that person risk for any diabetic complication by up to 12%. Control of serum lipids can reduce that person risk for cardiovascular complications by 20% to 50%. The best way to prevent, or at least control, complications from diabetes is to keep blood sugar as close to normal as possible by reducing sugar intake. This includes foods with added sugar, as well as those that contain natural sugars, such as certain fruits and vegetables. Screening asymptomatic persons (those without signs or symptoms of hyperglycemia and no clinical sequel) may lead to earlier identification and earlier or more intensive treatments, potentially improving health outcomes. Strategies for screening include routine screening or targeted screening based on the presence of risk factors, such as obesity or hypertension. In 2008, the U.S. Preventive Services Task Force (USPSTF) recommended diabetes screening in asymptomatic adults with sustained blood pressure (BP) (treated or untreated) greater than 135/80 mm Hg.[70]

Management of type 2 diabetes mellitus

Goals of treatment of DM are complications reduction through control of glycaemia, blood pressure, macro vascular (i.e., coronary, cerebrovascular, peripheral vascular), control of lipids, hypertension and smoking cessation. Metabolic and neurologic complications can be reduced through control of glycaemia.[71] Individualized glycemic targets, glucose-lowering therapies, diet, exercise, and health education as the foundation of the treatment program, use of Metformin as the optimal first-line drug unless contraindicated, after Metformin, the use of one or two additional oral or injectable agents, with a goal of minimizing adverse effects as possible. Ultimately, insulin

therapy alone or with other agents if needed to maintain blood glucose control, where possible, all treatment decisions should be related to patients' condition, with a focus on patients, preferences, needs, and values major focus on comprehensive cardiovascular risk reduction.[72] Self-monitoring of blood glucose, both low blood sugar (hypoglycemia) and high blood sugar (hyperglycemia) are on concern, especially for patients who take insulin. Blood glucose level is generally more stable in type 2 DM than in type 1 DM, so doctors usually recommend measuring blood glucose level only once or twice a day. For patients who become insulin-dependent, more intensive monitoring is necessary (ADA, 2011 b).

In diabetes care, lifestyle modification can prevent complications or markedly delay their appearance, as well as decreasing the need for medication. Essential to the health of a person with diabetes are smoking cessation if any, physical activity as a part of lifestyle, and healthy eating habits.[73] Type 2 DM is usually first treated by increasing physical activity, and eliminating saturated fat and reducing sugar and carbohydrate intake with a goal of losing weight. These can restore insulin sensitivity even when the weight loss is modest.[74] In addition, exercise training improves cardiovascular status, body composition, and cardio-respiratory fitness, all strongly lead to better health outcome. Based on the evidence, it is advised that, patients with type 2 DM or pre-diabetes accumulate a minimum of 210 min per week of moderate-intensity exercise or 125 min per week of vigorous intensity exercise with no more than two consecutive days without training, vigorous intensity exercise is more time efficient and may also result in greater benefits in appropriate individuals with consideration of complications and contraindications.[75] On the other hand, nutrition is one of the key strategies against DM; most people with type 2 DM diabetes are overweight from eating an unhealthy diet. In the past, ADA (2008) set unrealistic goals about diet and weight control. Instead of ideal weight being based upon height and body type which most diabetics patients could never reach to ideal weight and this lead patient to being non-compliant. American Diabetic Association revised the goal, so diabetic patients need to lose 10-20 lbs to improve blood glucose level. They also changed the method of counting the total carbohydrates consumed instead of counting sugar and carbohydrates separately. An example of this is to count carbohydrates like rice, breads with milk or fruit. This makes it less confusing and when nurses teach these changes along with the food guide pyramid it makes it easier to come up with a nutrition plan that is individualized. Making these life-style changes lead to compliant and losing weight to aid in normalizing liver glucose production.[76]

Part II: quality of life

Quality of life (QoL) is important for people with diabetes and their health care providers for several reasons because many people who suffer from diabetes and who have poor quality of life, often have less attention to their self-care and disease management. When self-care is diminished in diabetes, it in turn leads to poor glycemic control and increase risk of complications. Thus, quality of life issues are crucially important because they may powerfully predict an individual's capacity to manage his disease and maintain long term health and well-being Anumol Mathew et al.[77] The concept of quality of life is not yet defined in a uniform way, lacks clarity and even creates confusion. It seems that in medicine, the term has become a bandwagon concept for all those human needs which are often neglected in a health care field increasingly dominated by technology. It is justifiable to say that it is a term describing a field of interest rather than a single variable. As a rule, "quality of life" is used in medicine for characterizing an individual patient's quality of life from his or her own subjective perspective Coelho et al.[78] Prutkein and Feinstein have revised the origins of the concept of QoL and its evolution in Medicine until 1986. Although the first mention to QoL is identified in the field of Nephrology in the late 1960's, the standard assessment of QoL was preceded by the evaluation of daily living in time diaries since the 1890's later incorporated to the social sciences study of human behavior.[79]

While health is considered an ancient concept, the term QoL was coined in the early twentieth century, as a political term. Soon a need for accurate measures of QoL emerged, which led to the development of several QoL questionnaires. WHO decided to develop an international measure of QoL, the WHOQOL-100 in 1990, and some years later also the shortened WHOQOL-BREF. During this work, the preceding process of concept clarification resulted in the WHO definition of QoL as: "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept affected in a complex way by the person's physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of their environment".[80,81] Quality of life is defined as the perception of individuals or groups that their needs are being fulfilled and they are not being denied opportunities to achieve happiness and satisfaction. It incorporates both a cognitive component (satisfaction) and an emotional component (happiness).[82] It is also defined as the state of well-being that is a composite of two components: the ability to perform everyday activities that reflect physical, psychological, and social well-being; and patient satisfaction with levels of functioning and control of the disease.[83]

Quality of life is a broad concept that incorporates all aspects of an individual's existence. Health-related quality of life is a subset relating only to the health domain of that existence. The World Health Organization has also defined Health Related Quality of Life (HRQoL) as an integrative measure of physical and emotional well-being, level of independence, social relationships and their relationship to salient features of their environment.[84,85] It is a multidimensional construct defined as patient's perceptions of the impact of physical symptoms, health perceptions, and functional ability on their daily life. Physical symptoms include disease-related

symptoms and the impact of those symptoms on functional ability and health perceptions. Health perceptions correlate strongly with mortality, as well as life satisfaction and well-being. Another major component of HRQoL is functional ability, which incorporates self-care activities, interpersonal areas, social support, sleep, intellectual functioning, coping and emotions.[86] Health related quality of life provides a multidimensional perspective that encompasses a patient's physical, emotional and social functioning.[16] These three domains follow the WHO definition of health as a state of complete physical, mental and social well-being not merely the absence of disease or infirmity. In addition to these domains, economic and spiritual domains are commonly included.[87] In health related quality of life dimensions, physical functioning refers to one's ability to perform various activities at the most basic level of daily living. Social functioning typically refers to a person's ability to interact with family and friends and to maintain social roles. Emotional functioning is commonly assessed as the negative effects of illness such as depression or anxiety.[88]

Quality of life domains

Domains of quality of life refer to areas of behavior that are measured. These domains include subjective and objective domains. The subjective domains of quality of life are: physical functioning (the capacity to perform physical tasks); occupational functioning (quality of life should focus on the ability to perform multiple essential roles and not just on return to work); perceptions about health status (health perceptions are personal beliefs and evaluations of general health status, they are the result of integration of information and feelings about health and health limitations from the self, the medical system, the family and the society); psychological functioning and social functioning. Social health defined as the dimension of an individual's well-being that concerns how the individual gets along with others, how other people react to him or her, and how the person interacts with social institutions and norms. The objective domain includes health status (measured by laboratory or diagnostic tests); psychopathology; socio-economic status and social support (number and quality of the contacts).[78] The quality of life construct consists of the eight domains that have been validated in a series of cross-cultural studies. These eight domains are personal development and self-determination (that reflect a person's level of independence); interpersonal relations, social inclusion, rights (that reflect a person's social participation); emotional, physical, and material well-being. The QoL literature does not define a hierarchy amongst those domains nor does it specify cause and effect relations amongst them.[89]

Quality of life assessment

Measures of the quality of life in chronically ill patients provide an important source of medical information in addition to laboratory or diagnostic tests and are becoming increasingly relevant to controlled clinical trials. Quality of life (QoL) measurements are increasingly recognized as important in the assessment of chronic diseases and in evaluating medical outcomes. One goal of the measurement of quality of life is to have objective evaluations of how and how much the disease influences patients' life and how patients cope with it. These evaluations may be useful as a baseline and outcome measures and should provide framework to determine the impact of any change on patients' quality of life.[90] Following the definition of HRQoL, assessment should be based on patients' self-report and should cover the relevant domains of daily functioning (physical, mental, social) for a particular disease and/or treatment regimen. In diabetes, relevant domains of QoL may include symptom distress, general physical functioning, mental/emotional state, social functioning, perceived burden of the treatment regimen, treatment satisfaction and an overall sense of well-being.[91] The conceptual and practical issues for assessing quality of life in diabetes have been reviewed. They described three categories of determinants influencing quality of life, including medical predictors as type and duration of diabetes, treatment regimen, level of glycemic control and presence of complications; attitudinal predictors as self-efficacy, locus of control and social support; and demographic predictors as gender, education, ethnicity, age and marital status.[92]

Part III: The effect of type 2 diabetes mellitus on quality of life

The effect of type 2 diabetes mellitus on quality of life:

Diabetes mellitus may also disturb the patients' quality of life in three aspects namely, physical function, psychological function and social function which may lead to the limitation of work productivity, social life, family relations and leisure interests.[93]

Physical functioning can be compromised by diabetes

Quality of life is of particular concern to those patients with chronic diseases. Type 2 diabetes mellitus is a chronic disease and it is usually associated with short term and long-term complications which can negatively affect patients' well-being, health status and quality of life. Compared to persons without diabetes, most studies have reported a worse quality of life for patients with diabetes, especially regarding physical functioning and well-being.[94] There are three major ways in which diabetes can negatively affect physical well-being of a patient. The most potent and first factor is the development of long-term complications on the diabetic patients. When a patient suffers from loss of vision, kidney damage, significant heart disease, erection problems, peripheral neuropathy resulting in chronic pain, amputation and/or difficulty in movement, or any of autonomic neuropathy problems such as gastro-paresis or loss of bladder function; this is likely to be a significant drop in perceived quality of life. The patient hence would be unable or partially able to work, or to complete household tasks, or at least unable to enjoy pleasurable activities. The patient's ability to function independently may be impaired.[95] The second factor is short-term complications. Chronically elevated blood glucose levels may lead to increased fatigue, sleeping problems, more frequent infections and other associated problems. Tight glycemic

control may lead to unwanted weight gain, more frequent hypoglycemia and/or loss of hypoglycemic warning signs.[95] The third major factor concerning physical symptoms and lifestyle changes is resulting from the demands of the diabetes regimen. Finally, when patients are forced to limit or curtail their activities in order to manage their diabetes effectively, quality of life is likely to be affected in turn. Examples include declining late-night social engagements as a means to avoid dietary lapses or losing one's license to drive due to frequent and severe hypoglycemia. Unpleasant side effects due to prescribed medications may also affect perceived well-being for instance, chronic gastrointestinal distress resulting from specific oral hypoglycemic agents or unsightly lypohypertrophy resulting from repeated insulin injections.[95] Indeed, for older people with diabetes, the threat of loss of independence due to progressing cognitive and physical decline may be of greater direct concern than the clinical progression of diabetes complications.[96] To assess this dimension most effectively, evaluation might focus on the patients' perceived distress due to diabetes specific symptoms as well as the perceived loss of physical function, interference with common role activities (including work, tasks at home in addition to social and recreational pastimes) and loss of independence.

Psychological functioning can be compromised by diabetes:

Diabetes is a demanding disease, so it can affect patients' life in many ways. Managing their diabetes can be stressful. The way a patient feels when his/her blood glucose levels are low or really high adds to the stress. On top of that, there are the worries that a patient might develop complications, and the burden of dealing with any complications he/she may already have. It is no wonder that many people feel that diabetes affects their quality of life (ADA, 2000). The demands of diabetes care can have a potent impact on mood, both in short-term and in long-term. Many patients may become chronically frustrated and discouraged with a disease that often does not seem to respond to their best efforts. They may also feel hopeless or despondent about the possibility of avoiding long-term complications. It can be a difficult, emotional struggle to find a way to include diabetes in one's life and to confront the sense of mortality that diabetes may represent. This may be especially problematic at those specific time points in the natural history of the illness when diabetes suddenly seems quite real such as at diagnosis, if and when insulin is first started and when long-term complications begin to occur. In addition, chronically elevated blood glucose levels may lead to persistent fatigue, which can exacerbate depressed mood. Similarly, frequent hypoglycemic episodes can be exhausting, debilitating, discouraging and potentially quite frightening .[97] Good quality of life activates a self-reinforcing positive cycle. As well as diabetes can affect the patient's quality of life, the quality of life can affect the diabetes itself. When a patient is feeling good about his/her life in general and about his/her life with diabetes in particular, the patient has more energy to take good care of his/her diabetes and when he/she takes good care of his/herself, a patient is likely to feel better day-to-day and to stay healthier in the long run. Feeling better and staying healthy give a further boost to the patient's quality of life (ADA, 2000). Facing a disease that is often difficult and confusing to manage, patients may feel a pervading sense of helplessness that detracts significantly from the overall sense of well-being. To assess this dimension, evaluation might focus on patients' perceived emotional distress due to diabetes-related symptoms, self-care, relevant problematic situations and broader diabetes issues.

Social functioning can be compromised by diabetes

The mere presence of diabetes can affect the quantity and quality of a patient's relationships. As patients begin to institute changes in daily habits in order to manage diabetes most effectively, loved ones may begin to rebel choosing not to participate in any necessary changes. Friends or family members may begin to push for self-care changes even when the patient is unwilling to make them. As loved ones begin acting like diabetes police, the opportunities for interpersonal conflict escalate. In either case, it is easy to begin feeling alone with diabetes, feeling different and unsupported believing that no one can understand what living with diabetes is really like.[97] Also, the patients may not satisfy with the sexual relation. Changes in sexual function become a common problem with aging; however, diabetes mellitus predisposes one to early onset and increased severity of those problems. Sexual dysfunction such as: erectile dysfunction impairs quality of life and it is associated with depression and increased anxiety[98] but it is clear that more work needs to be done to understand the role that the marital relationship may play both in physical and psychological outcomes. The Stronger family support relates to such varied outcomes as better psychological adjustment and enhanced compliance with medical regimens.[99] Social support helps the promotion of active coping and management behaviors, it affects a person's perceptions of personal risk or of severity of illness, bolsters beliefs about his/her ability to cope with stressful situations and manage difficult emotions, so acts as "stress-buffering".[100] To assess this dimension, evaluation might focus on a patient's perceived emotional distress due to diabetes-related social situations.

Part IV: Role of the family and community health nurse

Role of the family and community health nurse:

Diabetes is a chronic disease requiring lifelong medical and nursing intervention and lifestyle adjustment. The importance of regular follow-up of patients with the health care provider is of great significance in averting any long term complications. With the alarming soaring statistics of diabetes mellitus, the role of nurses in helping patients to control associated morbidity and mortality is becoming increasingly important. Nurses, on the front line, can screen patients for early diabetes identification, recognize and initiate corrective measures for inadequate treatment regimens, help patients set and achieve therapeutic

goals, and assess diabetes-related complications as they arise.[101,102] The World Health Organization (WHO) has established two main objectives in caring for diabetic patients: first, maintain the health and quality of life of individuals with diabetes through effective patient care and education and second, treat and prevent complications of the disease which should decrease morbidity and mortality as well as reduce treatment lost.[103] Diabetes is largely preventable especially type 2 diabetes and this is where health education and public awareness becomes critical. Health Care Workers especially nurses constitute important stake holders for the effective delivery of diabetic care and diabetic education.[104]

Diabetic education

One of the key nursing priorities for patients with type 2 diabetes mellitus is education, especially regarding their condition, treatment options and possible associated complications.[105] The aim of diabetes education is to improve metabolic control, prevent acute and chronic complications and improve the quality of life of the individual with diabetes.[106] According to Norris et al.,[107] a programme of diabetes education specifying main aspects of diabetes self-care and the rationale behind it should be available to anyone with diabetes in the months after diagnosis, and reviewed as needed according to assessed need. Self-care in diabetes has been defined as an evolutionary process of development of knowledge or awareness by learning to survive with the complex nature of the diabetes in a social context. There are seven essential self-care behaviors in people with diabetes which predict good outcomes. These are healthy eating, being physically active, monitoring of blood sugar, compliant with medications, good problem-solving skills, healthy coping skills and risk reduction behaviors. These seven behaviors have been found to be positively correlated with good glycemic control, reduction of complications and improvement in quality of life.[9] The World Health Organization recommends self-care education as a way to prevent and treat chronic diseases because it encourages the person's involvement in his/her care and produces better adherence to the treatment regimen, minimizing complications and disability associated with chronic problems.[108]

The first step in developing an individualized education plan is to gather information about the patient's current knowledge, skills, attitudes and behavior because continuity is so dependent on patient involvement and decision making. Careful educational assessment includes personal and socio-economic information such as age, educational level, family composition, cultural factors, resources, insurance and transportation. Also, information about diabetes should be included in the assessment, such as type and duration of diabetes, current management approaches, previous management approach, acute and chronic complications if any, previous diabetes education, besides successes and problems with adherence to management plan. Other medical information, such as blood pressure, weight, height, pertinent laboratory values (blood glucose level, glycosylated hemoglobin, lipid, micro-albumin), other illness, other medications, general health status, in addition to visual and hearing acuity should be included.[109] Moreover, assessment of lifestyle factors should be done, such as use of social drug, physical activity, stress or occupation, recreation, and social support system. Nutritional information about the patient should be included in the assessment as well, such as meal and snack times, typical food, food preference and intolerance, previous experience with diets, and previous nutrition education. Also, educational style, illiteracy, native language, readiness to learn, decision making skills, health habits coping pattern, fears, concerns, abilities, willingness to seek help, expectation and capacity to deal with failure, assertiveness, organizational skills, and response to an education plan and motivator should be assessed (ADA, 2002)[110,111] suggested that a selection of different teaching strategies should be used, such as demonstrating new skills, observing the patient's techniques in self-caring, as use of different informative methods promotes information retention. It is vital to create a trusting relationship between the nurse and patient, as rapport and respect are needed to create an appropriate learning environment. Nurses need to provide patients with the available resources for developing such a plan.

As assessment proceeds, the educator will identify topics and teaching approaches that are most appropriate for the patient. The plan for the education program becomes a negotiation between the teacher and learner. Although it is the educator responsibility to identify knowledge deficit, it is the learner's job to provide an accurate medical and educational history and to acknowledge what must be learnt to undertake the management safety. Often, the patient does not know what he/ she needs to know and may, in fact, be resistant to new information. Then, the educator's job is to gently challenge the patient's knowledge while presenting new information. The educator may need to remind the patient that medical knowledge about diabetes change rapidly, and that old information is being replaced with new ways of handling the disease.[112] Normal blood glucose level should be explained to the patient and how this compares to their current levels, the type of diabetes the patient has, the reasons for ketoacidotic episodes, and the relationship between high glucose level and insulin deficiency, as these provide a knowledge base from which the patient can make informed lifestyle choices. Acute and chronic complications of diabetes should also be explained to the patient, such as vascular and neurosensory changes, visual disturbances, hypertension and renal impairment, because awareness of these complications may encourage the patient to be more vigalent with care, hence delaying or eliminating their onset.[113] According to Amiel et al.,[114] medication especially Sulfonylureas is the primary cause of hypoglycemia in patients with type 2 diabetes. Therefore, it is vital for a diabetic to be able to identify symptoms of hypoglycemia, such as dizziness, weakness, headache and lethargy, as this will promote early detection and treatment, limiting or preventing reoccurrence. Most diabetic patients do not

understand the importance of knowing their blood glucose level and how to accurately perform the test. Nurses must teach them to prick one of their fingers and obtaining a drop of blood and place it on a test strip attached to a meter. It is important for them to understand why they are testing their blood, and how to interpret the test results. The nurse should have the diabetic patients to demonstrate proper testing techniques by pricking the lancet on the outer edge of fingers and showing how to place the blood and read the results, then with the results they should show their understanding of their sliding scale and how much insulin to administer.[115]

According to the ADA (2007) the nurse should also emphasize the importance of keeping a document of blood glucose readings, as this creates an overall picture of the patients' situation which allows achieving better control of their diabetes and promoting independence and self-care. It is also important for the nurse to discuss lifestyle factors which influence diabetic control such as stress, surgery, illness and exercise, as this information can promote the patients' control of their condition. The nurse should also help the patient to devise a dietary plan which limits sugar, fat, salt and alcohol, and is rich in complex carbohydrates, such as fruits, vegetables and whole grains. Medical nutrition therapy for patients with diabetes encourages meal choices based on the patient's own needs and preferences, while awareness of the importance of dietary control promotes planning of meals and adherence to dietary regimen (ADA, 2007). It is extremely important for nurses to educate diabetic patient who to use insulin, different types of insulin, self-injection, understand the importance of rotating sites to prevent fatty lumps in skin, proper storage of insulin at room temperature, disposing needles and to check expiration date. Diabetic patients should demonstrate to nurse; drawing up insulin, showing the proper amount and self-injection to make sure that the patient is doing it correctly. All of these instructions are important for diabetic patients to know and nurses must also teach people who reside with the diabetics in case of emergencies.[116]

Diabetic care

The care for diabetic patients includes a change in their life style, where the diet plan represents an important pillar of care so they can meet their goals. The management of people with diabetes mellitus is complex and good control significantly. Reduces the risk of complications yet studies from around the world concisely demonstrate inappropriate variations in care.[117] Continuity of care is the comprehensive, coordinated, integrated provision of health services.[118,119] Registered nurses play a key role in the provision of health care services and patient care. Given their critical role in long- term care, community care, public health, home are and acute care, and the fact that the profession is based on evidence-based practice; registered nurses can contribute significantly to decisions regarding the types of health services which provide the best patient outcomes. However, the nursing process in continuity of care is complex due to the number and variety of settings and people involved, as the patient moves within the health system.[120] Registered nurses (RNs) are leaders in implementing collaborative practice. Registered nurse, as a direct caregiver, has the most consistent presence in providing care to the patient and has knowledge of the patient's continuing care needs. Therefore, a registered nurse can contribute significantly to the coordination and planning for continuity of care for the patient. Activities of the registered nurse in continuity of care include, but are not limited to, conducting comprehensive assessments, including verification of the patient's health status; consideration of formal and informal support systems, environment, lifestyle, culture, values, beliefs, and community resources; and facilitating the coordination of care from all the providers, or may oversee the designation of a coordinator of care.

Also, activities of the RN include defining nurse's responsibility and the contribution of nursing to the overall plan of care providing direct patient care educating patient/ family to enable informed and knowledgeable choices; understanding the respective roles and clearly defined responsibilities of other caregivers; advocating for workplace policies that support continuity of care; participating in evaluation of care; and educating self and others regarding best practices in continuity of care.[121] Furthermore, continuity of care ensures that patient is a part of the decision-making team and that appropriate information and plans are clearly communicated to both formal and informal caregivers. In this, the registered nurse facilitates collaboration, coordination, and cooperation among caregivers. Moreover, many diabetes health care professionals are trained to help their patients adjust treatment regimens to ease the burden of diabetes management and to maintain good glycemic control and good health. These providers may also be able to help the patient improve his/ her day-to-day diabetes coping skills.[122] Nurses, specialize in foot care, are involved in the early stages of care and treatment. Nurses' role in diabetic foot care includes foot examination, wound dressing, also encouraged patients and families to appropriate care and follow-up visits regularly. Nurses should ask patients to remove their shoes and socks and then, examine their feet in order to screen patients at high risk for diabetic foot ulcers and report to other members of the multidisciplinary diabetic foot team. Diabetic patients' follow-up at specified intervals is part of the care plan which should be considered first.[123]

Subjects and methods

This section deals with the technical, operational, administrative and statistical designs. It covers the methodological approach used to evaluate the quality of life of type 2 diabetic patients attending family medicine outpatient clinic of Suez Canal University Hospitals at Ismailia city.

Technical design

The technical design involved the study design, study setting, target population, sample size & sampling technique, and tools for data collection.

Study design

A cross–sectional analytic design was used.

Study setting

The study was carried out at Family Medicine Outpatient Clinic of Suez Canal University Hospitals, which are teaching referral tertiary hospitals in Ismailia city. Ismailia is the capital of the Ismailia Governorate. The city has a population (including surrounding rural areas) of approximately 750,000 inhabitants. Ismailia governorate is located about 120 km from Cairo along the coast of Suez Canal, midway between Port Said and Suez.[124,125] The family medicine outpatient clinic consists of one room. Two nurses and one physician were worked in providing health care with supervision from a professor doctor of family medicine. Approximately 6-12 type 2 diabetic patients with the inclusion and exclusion criteria of both sexes regularly attending this outpatient clinic were enrolled on sixth working days (daily except Friday) per week during the working hours of the clinic.

Target population

The population of the designed study was Type 2 diabetic patients at Ismailia city

Study population

The Type 2 diabetic patients were investigated at population attending the family medicine outpatient clinic of Suez Canal University Hospitals at Ismailia city.

Study sample

The sample size was calculated according to the following equation:

$$n = (Z\alpha)^2_X \, pq / d^2$$

Sahai et al.,[126] Where: n = sample size. $Z\alpha$ = the value of standard normal distribution for type I error probability for the sided test and equals 1.96. p= Type 2 diabetes of the populations from the Middle Eastern/North African region = 9.1%.[39]

q= 1- p

d^2= the accuracy of estimate = $(0.05)^2$

N= $(1.9)^2$ $_x$ 9.1*(100-90.1) / $(0.05)^2$

According to the previous equation, the required sample size was 130 subjects. To compensate sample drop out, 10 % of the sample size was added. Therefore, the sample size of study was calculated to be 143 diabetic patients.

Sampling method

Systematic random sampling method was used. The study group was included in the study according to the following criteria:

Inclusion criteria

I. Patients with type 2 diabetes mellitus.

II. Age above 40 years old.

Exclusion criteria

I. Patients with type 1 diabetes mellitus or gestational diabetes.

II. Patients not suffering from other disease, except hypertension.

Tools of data collection

In order to collect the necessary data, two tools were used:

Tool (I): A structured- interview questionnaire was developed by the researcher and included the following parts:

The first part (Socio-demographic data)

It was constructed by the researcher and included socio-demographic characteristics of the study group such as gender, age, marital status, education level, occupation, residence and family type.

Socio-economic scale

This scale was developed by El-Gilany et al.,[127] which includes 7 domains with a total score of 84 such as education and cultural domain, occupation domain, family domain, family possessions domain, home sanitation domain, economic domain and health care domain. Socio-economic level was classified into very low, then low, middle and high levels depending on the quartiles of the score calculated to assess socio-economic status.

The second part (History taking)

It was constructed by the researcher to collect data regarding family history of DM, medical history of hypertension (HTN), previous surgical history, and duration of follow-up and smoking status.

The third part (Medical data)

This part included the duration of the previous diagnosis of diabetes, existence of diabetes complications, medical nutrition therapy, physical activity regularity, glycated hemoglobin (HbA1c) level and treatment regimen.

The fourth part (Bio-physiological measurement): This part included body mass index (BMI) and random blood sugar test (RBS).

A-Weight

Weighting was measured after the patients have taken off shoes and heavy clothes.

B-Height

After removing the shoes, the patient stood up as straight as possible on the flat floor with gathering his feet and heels, buttocks, shoulders and the back of the head touching the upright. The legs should be straight and the shoulders relaxed. The head has been looking straight forwards. The head piece of the Wall Height Meter/Scale has gently been contacted with the top of head. The reading has been recorded to the nearest cm El Badawy et al.,[127]

Body mass index (BMI) = (weight in kilograms) divided by (height in meters x height in meters)**.**[128] For adults over 20 years old, BMI falls into one of the following categories:

The international classification of adult underweight, overweight and obesity according to BMI

Classification	Principal cut-off points
Underweight	<18.50(kg/m^2)
Severe thinness	<16.00
Moderate thinness	16.00 - 16.99
Mild thinness	17.00 - 18.49
Normal range	18.50 - 24.99(kg/m^2)
Overweight	≥25.00(kg/m^2)
Pre-obese	25.00 - 29.99
Obese	≥30.00(kg/m^2)
Obese class I	30.00 - 34.99
Obese class II	35.00 - 39.99
Obese class III	≥40.00

Random blood sugar (RBS) test: It was a needle stick capillary blood sample test, which blood sample was analyzed at a random time. Blood sugar value was expressed in milligrams per deciliter (mg/dl). A random blood sugar level of 200 mg/dl or higher suggests DM, especially when concurrently with any signs and symptoms of DM, such as frequent urination and extreme thirst.[129]

Tool (II): World Health Organization quality of life questionnaire

Abbreviated version (WHOQoL-Bref): This questionnaire has been consisted of 26 items: two individual items that evaluated overall quality of life and satisfaction with health, and 24 items have been clustered into four domains (physical health, psychological health, social relationships and environment). The responses of each question were rated on a 5-point Likert scale and scored from 1 to 5. Each item had five levels of patients' responses very dissatisfied / very poor was coded as 1, dissatisfied / poor was coded as 2, neither dissatisfied nor satisfied / neither poor nor good was coded as 3, satisfied / good was coded as 4, and very satisfied / very good was coded as 5.[128] It was adopted from Abdel Hai et al.,[130] who carried out the translation into Arabic and a written approval for its use was obtained from the department of mental health, WHO-Geneva. All questions were concerned with the past two weeks. Abdel Hai et al.,[130]

Scoring system

The WHOQOL-BREF (Field Trial Version) produced four domain scores. There were also two items that were examined separately: question 1 asked about an individual's overall perception of quality of life and question 2 asked about an individual's overall perception of his or her health. Domain scores were scaled in a positive direction (i.e. higher scores denote higher quality of life). The mean score of items within each domain was used to calculate the domain score. Mean scores were then multiplied by 4 in order to make domain scores comparable with the scores used in the WHOQOL-100. The method for converting raw scores to transformed scores were the first transformation method converted scores to range between 4-20, comparable with the WHOQOL-100. A method for the manual calculation of individual domain scores was below:

Physical health domain= ((6-Q3) + (6-Q4) + Q10 + Q15 + Q16 + Q17 + Q18).

Psychological health domain= (Q5 + Q6 + Q7 + Q11 + Q19 + (6-Q26)).

Social relationships domain= (Q20 + Q21 + Q22).

Environmental domain= (Q8 + Q9 + Q12 + Q13 + Q14 + Q23 + Q24 + Q25).

The second transformation method converted domain scores to a 0-100 scale, using the formula shown below:

Transformed scale = (actual raw score – lowest possible raw score)*(100/possible raw score range) Where "actual raw score" was the values achieved through summation, "lowest possible raw score" was the lowest possible value that could occur through summation (this value would be 4 for all facets), and "possible raw score range" was the difference between the maximum possible raw score and the lowest possible raw score (this value would be 16 for all facets: 20 – 4), i.e. ([score – 4] * 100/16). Where more than 20% of data were missing from an assessment, the assessment should be discarded. Where up to two items were missing, the mean of other items in the domain was substituted. Where more than two items were missing from the domain, the domain score should not be calculated (with the exception of domain 3, where the domain should only be calculated if < 1 item is missing)**.**[131] A total score was determined by summing scores across all items. Thus, scores on the WHOQOL-BREF could range from 26 to 130. The following values of scores were extracted from the reviewed studies and were applied in the current study: score ≤ 45, low QOL; score 46–65, moderate QOL; and score > 65, relatively high QOL**.**[132]

WHO quality of life Bref Domains

Domain	Facets incorporated within domains
1. Physical health	Activities of daily living Dependence on medicinal substances and medical aids Energy

	Mobility
	Pain and discomfort
	Sleep and rest
	Work Capacity
	Bodily image and appearance
	Negative feelings
	Positive feelings
2. Psychological health	Self-esteem
	Spirituality / Religion / Personal beliefs
	Thinking, learning, memory and concentration
	Personal relationships
3. Social relationships	Social support
	Sexual activity
	Financial resources
	Freedom, physical safety and security
	Health and social care: accessibility and quality
	Home environment
	Opportunities for acquiring new information and
4. Environment	skills
	Participation in and opportunities for recreation /
	leisure activities
	Physical environment (pollution / noise / traffic /
	climate)
	Transport

Domain scores produced by the WHOQOL-BREF have been shown to correlate at around 0.9 with The WHOQOL-100 domain scores.[128]

Operational design

The operational design included the preparatory phase, content validity, pilot study and field work.

Preparatory phase

It included reviewing of literatures related to the problem and theoretical knowledge of various aspects of the problem using books, articles, periodicals and magazines to develop tools for data collection. It also appeared in writing the protocol.

Content validity

After developing tools and before data collection, the content had been tested from five expertise of professors and lecturers from the family and community health nursing and medical surgical nursing departments; Faculty of nursing, Suez Canal University and from the family medicine and community medicine departments, Faculty of medicine, Suez Canal University who revised the tools for clarity, relevance, comprehensiveness, understanding and ease for implementation. According to their opinion modifications were applied.

Reliability

Cronbach's Alpha of the World Health Organization Quality of Life Questionnaire abbreviated version (WHOQoL-Bref) was 0.852.

Pilot study

The pilot study was carried out on 10% of the sample (15 of type 2 diabetic patients) who were excluded from the study sample. It was conducted before data collection to test the applicability of the tools and techniques.

According to the results of the pilot study, items were corrected, modified, omitted, or added.

Field work

A full explanation about nature and objectives of the study was carried out to the study group. The aim of the study was explained to each patient before starting data collection. Patients were informed about what will be done for them. The investigator interviewed and filled the questionnaire for each diabetic patient individually at the family medicine outpatient clinic, Suez Canal University Hospitals. The present study included 143 type 2 diabetic patients and the field work was conducted for duration of four months between November 2014 and February 2015. An average of 3-4 patients / day was enrolled on three working days (Saturday, Sunday and Monday) per week during the working hours of the clinic (from 9.00 to 12.00 am). The average time taken for filling each sheet was approximately 20-25 minutes depending on the response of the patient. Systematic random sampling method was used in which every 3rd patient according to equation; rank (kth element) = (population size/sample size) i.e. kth= 429/143= 3, according to their order of attendance at the reception desk, presenting to the family medicine outpatient clinic for regular treatment. Each patient was reassured that the information obtained was confidential and would be used only for the purpose of the study. In addition to interviewing, random blood sugar test was done to the study group by the investigator regardless meal time before their admission to the clinic. Also height and weight were measured for the study group by the investigator before their admission to the clinic then the BMI was calculated.

Administrative design

An official letter was issued from the Dean of the Faculty of Nursing, Suez Canal University to the director of Suez Canal University Hospitals and the director of outpatient clinics to obtain their permission to conduct the study.

Ethical considerations

An agreement with the patients was held before participation in this study, verbal consent was taken, and they were assured about confidentiality of the information obtained and about their rights to withdraw at any time they want throughout the study.

Statistical design

Data entry and analysis were done using the Statistical Package for Social Sciences version 22, (SPSS Inc., and Chicago, IL). Data collected were coded and analyzed. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables together with means and standard deviations for quantitative variables as well as inferential statistics. Tests of significance that were used to test hypotheses have included independent one-sample t-test, One-Way ANOVA analysis, Pearson Correlation Coefficient and multiple linear regression analysis. Values were considered as statistically significant at $P< 0.05$.

Obstacles of the study

The studied populations were not available all the time because they had taken much time to finish their requirements to receive their regular treatment, so the researcher had to get them before their admission to the physician or after receiving their regular treatment to complete the questionnaire sheet, some of the studied populations have refused to participate in the study. There was a lack of data base filling system in outpatient clinic.

Results

The findings of the current study were presented in the following five parts:

Part I: Distribution of socio-demographic and baseline characteristics of the study group (Table 1–3 & Figure 3).

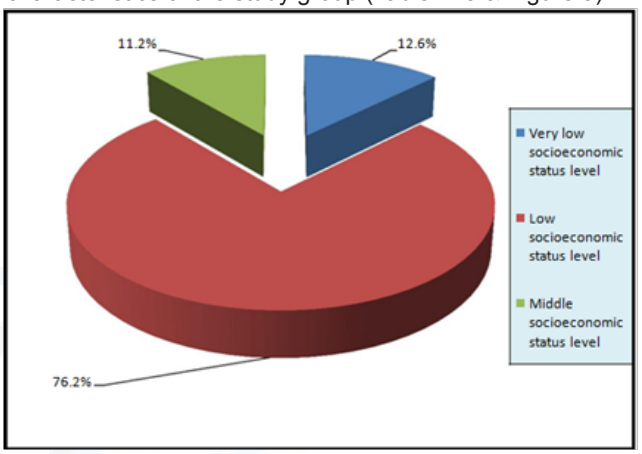

Figure 3 Distribution of the study group according to levels of socio-economic status (n=143).

Table 1 Frequency distribution of Socio-demographic characteristics of the study group (n=143)

Socio-demographic characteristics		Total population (n=143)	
		No.	%
Gender	Male	20	14
	Female	123	86
Age (years)	<50 years	47	32.9
Range (41-72)	50- 60 years	66	46.2
	>60 years	21	21
Marital Status	Single	2	1.4
	Married	104	72.7
	Divorced	8	5.6
	Widowed	29	20.3
Educational level	Illiterate	82	57.3
	Basic education	57	39.9
	High education	4	2.8
Occupational status	Non-working (unemployed)	120	83.9
	Working (employed)	23	16.1
Family income	Insufficient income	48	33.6
	Just sufficient income	78	54.5
	Sufficient and more	17	11.9
Type of family	Nuclear	93	65
	Extended	50	35
Residence	Rural	68	47.6
	Urban	75	52.4

Table 2 Baseline characteristics of the study group (n=143)

Baseline characteristics	Total (n=143)		Female (n=123)		Male (n=20)		t-test	p-value
	Mean	SD	Mean	SD	Mean	SD		
Age (years)	54.74	7.32	54.6	7.1	55.6	8.8	0.53	0.59
Total score of socio-economic status	31.35	9.87	30.4	8.5	36.95	15.2	2.8	0.006**
Physical health domain	46.27	16.55	44.9	15.8	54.9	18.7	2.6	0.011*
Psychological health domain	45.61	11.94	45.1	11.2	49	15.9	1.4	0.17
Social relationships domain	58.1	16.64	58.3	16.9	56.7	15.6	0.42	0.68
Environmental domain	49.45	10.55	49.1	10.1	51.4	12.98	0.89	0.37
Glycated hemoglobin (HbA1c) level*(%)	9.42	1.94	9.3	1.9	10	2	0.8	0.43
Random blood sugar(mg/dl)	273.53	104.08	271.2	102.7	288.2	114.1	0.68	0.49
Body mass index (kg/m2)	34.37	6.16	34.9	6.2	30.9	5.1	2.8	0.006**
Duration of diagnosis of diabetes (years)	10.44	6.22	10.6	6.4	9.4	4.8	0.81	0.42
Duration of follow- up (years)	4.63	4.38	5	4.6	3	2.5	1.9	0.063

*Significant at p- value <0.05 level (2-tailed); **highly significant at p value <0.01 level (2-tailed). N.B: HbA1c level*Based on the number of cases, HbA1c was conducted on 54 female and 7 males of the study group. SD: Standard deviation.

Table 3 Socio-economic domain scores of the study group (n=143)

Socio-economic domains	Mean	SD
Educational and culture domain	6.13	6.86
Occupational domain	2.46	1.66
Family possessions domain	4.44	1.15
Family domain	7.01	1.67
Home sanitation domain	6.78	1.55
Economic domain	1.82	0.83
Health care domain	2.71	0.47

Total socio- economic domains score of 84 include the following: Education and cultural domain (for both husband & wife) (Score = 30), occupation domain (for both husband & wife) (score = 10), family domain (score = 10), amily possessions domain (score = 12), home sanitation domain (score = 12), economic domain (score = 5) and health care domain (score = 5).

Part II: Distribution of clinical factors and diabetes complications of the study group (Table 4) (Table 5) and (Figure 4) (Figure 5).

Part III: Assessment of quality of life of the study group (Table 6) (Table7).

Part IV: Relationship between quality of life and socio-economic status levels in the study group (Table 8) and (Figure 6).

Part V: Relationship between quality of life and clinical factors in the study group (Tables 9–13).

Table 1 describes the distribution of socio-demographic characteristics of the study group, the majority of the study group (86%) were females, less than half of them (46.2%) were in age group (50-60) years and their mean age was 54.74 years (Standard deviation (SD) =7.32). Regarding marital status, less than three quarters (72.7%) of them were married, more than half (57.3%) of them were illiterate, the majority of them (83.9%) were unemployed (non-working) and more than half (54.5%) of them had just a sufficient income. As regard to their family type, the results revealed that less than two thirds (65%) of them were nuclear family and more than half (52%) of them were living in urban areas.

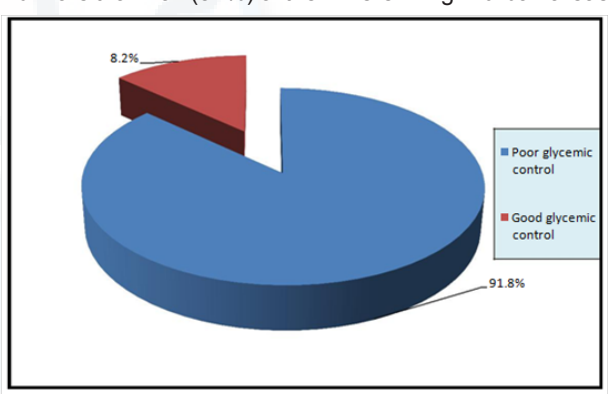

Figure 4 Distribution of the study group according to glycemic control (HbA1c level) (n=61).

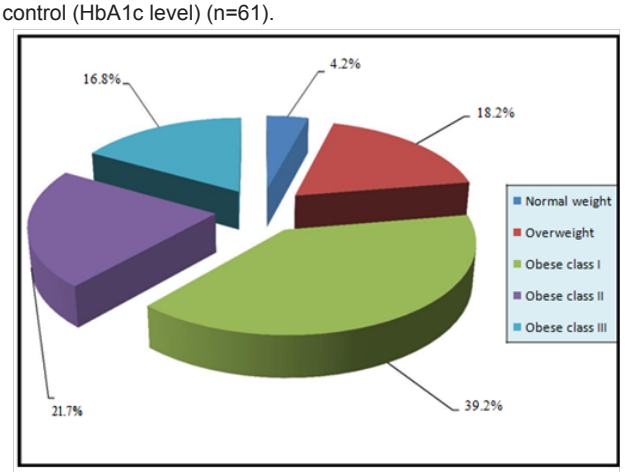

Figure 5 Distribution of the study group according to body mass index (n=143).

Table 2 revealed that there was highly statistical significant difference in the mean of total score of socio-economic status in males than females and in the mean of body mass index in females than males. Also, there was statistically significant difference in the mean of physical health domain scores in males than females.

Table 3 indicated that the mean of educational and culture domain scores of the study group was 6.13 (SD= 6.86) and their mean of occupational domain scores was 2.46 (SD=1.66). Also, the mean of economic domain scores of them was 1.82 (SD=0.83) and their mean of health care domain scores of them was 2.71 (SD=0.47). Figure 3 illustrates that more than three quarters (76.2%) of the study group had low socio-economic status level while the minority of them (11.2%) had middle socio-economic status level.

Table 4 demonstrates that less than three quarters (71.3%) of the study group had a family history of diabetes; more than one third (38.6%) of them had a family history of diabetes in 1st. degree relatives, the majority of them (81.1%) had hypertension; less than two thirds (64.3%) of them had uncontrolled blood pressure, more than two thirds (67.3%) of them had previous surgical history, less than one third (30.8%) of them were smokers, the minority of them (18.9%) did not do physical activity and the vast majority of them (92.3%) were not following medical nutrition therapy. Approximately less than half (47.6%) of them have taken oral hypoglycemic agents by themselves.

Table 4 Frequency distribution of the study group according to risk factors and current status of diabetes mellitus (n=143)

Risk factors and current status of diabetes mellitus		Total population (n=143)	
		No.	%
Family history of diabetes*	Family History in 1st degree relatives	73	38.6
	Family History in 2nd degree relatives	51	27
	Family History in 3rd degree relatives	24	12.7
	No Family History of Diabetes	41	21.7
Hypertension	Controlled blood pressure	24	16.8
	Uncontrolled blood pressure	92	64.3
	No hypertension	27	18.9
Previous surgical history	Present	97	67.8
	Absent	46	32.2
Smoking status	Smoker	44	30.8
	Non smoker	99	69.2
Physical activity	Regularly done	71	49.7
	Irregularly done	45	31.5
	Not done	27	18.9
Medical nutrition therapy	Yes	11	7.7
	No	132	92.3
Pharmacological treatment	Oral hypoglycemic agents	68	47.6
	Insulin	24	16.8
	Oral hypoglycemic agents and insulin	51	35.7

*Family history of diabetes results based on the number of responses (n= 189)

Figure 4 illustrates that the vast majority of the study group (91.8%) had poor glycemic control (HbA1c≥7%). It should be noted that HbA1c results were conducted only on 61 patients from 143 (the study group).

Figure 5 illustrates that more than three quarters (77.7%) of the study group were obese (BMI =≥30 kg/m^2); more than one third (39.2%) of them were Obese class I (BMI =30–34.9 kg/m^2) while the minority of them (4.2%) were normal weight (20- 24.9 kg/m^2).

Table 5 shows that most of the study group (96.5%) had neurological complications, the majority of them (81.8%) had ophthalmological complications, one quarter (25.2%) of them had renal complications, one third of them (35%) had cardiovascular complications, less than half of them (47.6%) had peripheral vascular disease, the minority of them (19.6%) had diabetic foot ulcers and the majority of them (84.6%) had hypoglycemia. Table 6 shows that for overall quality of life and general health related questions (48.3% and 69.2%, respectively) of the study group were rated as good. With regard to physical, psychological, social and environmental domains, the majority of the study group responded from “poor” to “good”.

Table 5 Distribution of the study group according to diabetes-related complications (n=143)

Diabetes-related complications		Total population (n=143)	
		No.	%
Neurological complications	Present	138	96.5
	Absent	5	3.5
Ophthalmological complications	Present	117	81.8
	Absent	26	18.2
Renal complications	Present	36	25.2
	Absent	107	74.8
Cardiovascular complications	Present	50	35
	Absent	93	65
Peripheral vascular disease	Present	68	47.6
	Absent	75	52.4
Diabetic foot ulcers	Present	28	19.6
	Absent	115	80.4
Hypoglycemia	Present	121	84.6
	Absent	22	15.4

Table 6 Distribution of responses of the study group for items of likert scale regarding WHO Quality of Life-Bref (n=143

Scale points/domains and facets	1 very poor		2 very good		3 neither poor nor good		4 good		5 very poor	
	No.	%	No.	%	No.	%	No	%	No.	%
General QOL	1	0.7	60	42	12	8.4	69	48.3	1	0.7
General health	2	1.4	35	24.5	5	3.5	99	69.2	2	1.4
Physical health										
Pain	14	9.8	64	44.8	40	28	22	15.4	3	2.1
Energy	7	4.9	48	33.6	68	47.6	48	33.6	0	0
Sleep and rest	13	9.1	75	52.4	5	3.5	26	18.2	2	1.4
Dependence on	12	8.4	55	38.5	46	32.2			4	2.8
medical aids							75	52.4		
Mobility	3	2.1	52	36.4	12	8.4	73	51	1	0.7
Activities of	3	2.1	59	41.3	5	3.5			3	2.1
daily living							76	53.1		
Working capacity	0	0	60	42	6	4.2			1	0.7
Psychological health										
Positive feelings	5	3.5	29	20.3	89	62.2	19	13.3	1	0.7
Negative feelings	36	25.2	54	37.8	43	30.1	10	7	0	0
Self-esteem	2	1.4	27	18.9	6	4.2	107	74.8	1	0.7
Concentration	10	7	54	37.8	48	33.6	29	20.3	2	1.4
Bodily image	28	19.6	44	30.8	53	37.1	17	11.9	1	0.7
Personal beliefs	3	2.1	12	8.4	87	60.8	39	27.3	2	1.4
Social relationships										
Personal relationships	3	2.1	22	15.4	8	5.6	106	74.1	4	2.8
Sexual activity	18	12.6	37	25.9	37	25.9	51	35.7	0	0
Social support	4	2.8	23	16.1	12	8.4	102	71.3	2	1.4
Environment										
Financial Support	4	2.8	41	28.7	93	65	5	3.5	0	0
Accessibility	2	1.4	52	36.4	57	39.9	32	22.4	0	0

of information										
Leisure activity	33	23.1	86	60.1	16	11.2	8	5.6	0	0
Home environment	4	2.8	13	9.1	1	0.7	124	86.7	1	0.7
Access to health care	20	14	26	18.2	8	5.6	89	62.2	0	0
Security	4	2.8	17	11.9	88	61.5	33	23.1	1	0.7
Physical environment	3	2.1	10	7	81	56.6	47	32.9	2	1.4
Transport	13	9.1	43	30.1	5	3.5	82	57.3	0	0

Table 7 reveals that regarding physical health domain less than half (48.3%) of the study group were rated at low level, while psychological health domain and environmental domain (51.7% and 63.6%, respectively) of them were rated at moderate level. As regard to social relationships domain less than half (45.5%) of them were rated at high level. One-way ANOVA analysis was conducted to test the statistical significance difference of quality of life domains score between socio-economic status levels for the study group. Table 8 reveals that there was highly statistical significant difference between physical health domain scores regarding socio-economic status groups (P=0.001). Also, there was highly statistical significant difference between environmental domain scores regarding socio-economic status groups (P=0.001). As regard to psychological health domain scores, there was statistically significant difference among socio-economic status groups (P=0.02)

Table 7 Distribution of the study group according to quality of life domains (n=143)

Quality of life domains	Low quality of life		Moderate quality of life		High quality of life	
	No.	%	No.	%	No.	%
Physical health domain	69	48.3	57	39.9	17	11.9
Psychological health domain	62	43.4	74	51.7	7	4.9
Social relationships domain	34	23.8	44	30.8	65	45.5
Environmental domain	43	30.1	91	63.6	9	6.3

N.B: score ≤ 45, low QOL; score 46–65, moderate QOL; and score > 65, relatively high QOL

Table 8 Relation between quality of life domains and socio-economic status levels in the study group (n=143)

Quality of the domains	Socio-economic Status levels						F	P Value
	Very low (n=18)		low (n=109)		Middle			
	Mean	SD	Mean	SD	Mean	SD		
Physical health domain	38.8	16	45.7	16	58.7	15.4	6.9	0.001**
Psychological health domain	40.7	11.6	45.4	11.6	52.4	11.9	4.3	0.02*
Social Relationships domain	50.5	17.3	59	16.2	60.4	17.3	2.2	0.11
Environmental domain	41.6	8.7	49.8	10.1	56.2	10.6	9.3	0.001**

*Significant at p value <0.05 level (2-tailed), **highly significant at p value <0.01 level (2-tailed). SD: Standard deviation.

Figure 6 illustrates that there was statistically significant positive correlation between total score of quality of life and total score of socio-economic status of the study group (P< 0.0001).

Table 9 shows that the statistical significant independent negative predictors in the model were physical health domain of the quality of life (P=0.025) and marital status (P=0.047). As regard to the regression co-efficient for the significant predictors, the change in Physical health domain with a single unit would change the dependent variable,

HbA1c with a -0.046 units. This meant that there was a negative dependency between HbA1c and Physical health domain. Also, when the marital status change from married to others (single, divorced and widowed), the value of HbA1c level change by about -1.239.

Table 10 demonstrates that the statistical significant independent positive predictors in the model were total score of socio-economic status (P=0.001) and physical activity (P=0.004). Conversely, body mass index (P=0.024), ophthalmological complications (P=0.003) and diabetic foot ulcers (P=0.025) were statistically significant independent negative predictors in the model.

Table 11 indicates that the statistical significant independent positive predictors in the model were age (P=0.004) and total score of socio-economic status (P=0.015). Conversely, smoking status (P=0.021), body mass index (P= 0.021), ophthalmological complications (P=0.0001) and peripheral vascular disease (P=0.008) were statistically significant independent negative predictors in the model.

Table 12 reveals that the statistical significant independent positive predictor in the model was total score of socio-economic status (P=0.019). Conversely, pharmacological treatment (P=0.039) was statistically significant independent negative predictor in the model.

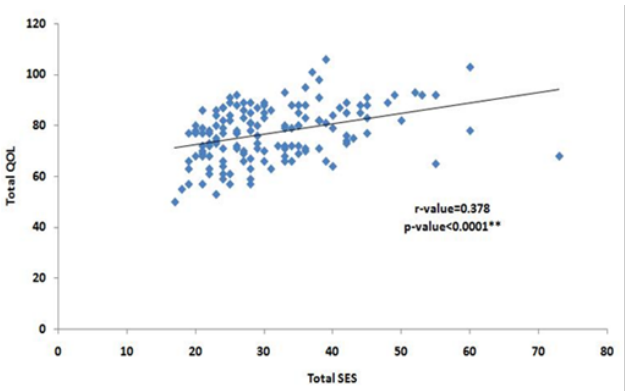

Figure 6 Correlation between total score of quality of life and total score of socio-economic status of the study group (n=143).

Table 13 shows that the statistical significant independent positive predictors in the model were age (P=0.023) and total score of socio-economic status (P=0.0001).

Table 9 Multiple linear regression analysis: The predictors of glyclated hemoglobin level (HbA1c) in the study group (n= 61)

Variables	Glycated hemoglobin level (HbA1c)				
	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value
	B	Std. Error	Beta		
(Constant)	8.459	2.09		4.047	0.000**
Physical health domain	-0.046	0.02	-0.356	-2.306	0.025*
Psychological health domain	0.024	0.028	0.152	0.834	0.408
Social Relationships domain	-0.014	0.017	-0.121	-0.828	0.411
Environmental domain	0.033	0.029	0.187	1.139	0.26
Gender	0.599	0.797	-0.099	-0.752	0.456
Age	0.023	0.034	0.094	0.684	0.497
Marital status	-1.239	0.609	-0.27	-2.035	0.047*

*Significant at p value <0.05 level (2-tailed). **Highly significant at p value <0.01 level (2-tailed). NB: Gender was coded as (female= 0 & male= 1), marital status was coded as (married= 0 & others (single, divorced and widowed) = 1).

Table 10 Multiple linear regression analysis: The predictors of Physical health domain in the study group (n=143)

Variables	Physical health domain				
	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value
	B	Std. Error	Beta		
(Constant)	50.93	9.058		5.623	0.000**
Total score of socio-economic status	0.431	0.129	0.257	3.35	0.001**
Body mass index(kg/m2)	-0.466	0.204	-0.174	-2.285	0.024*

Ophthalmological complications	-9.782	3.216	-0.229	-3.041	0.003**
Diabetic foot ulcers	-7.083	3.134	-0.17	-2.26	0.025*
Medical nutrition therapy	0.606	4.733	0.01	0.128	0.898
9.249	3.199	0.22	2.891	0.004**	
Pharmacological treatment	-0.645	2.541	-0.02	-0.254	0.8

*Significant at p value <0.05 level (2-tailed). **Highly significant at p value <0.01 level (2-tailed). NB: Diabetes complications (ophthalmological and diabetic foot ulcers) were coded as (yes= 1 and no= 0), medical nutrition therapy was coded as (yes=1 & no= 0), physical activity was coded as (yes= 1 and no=0) and pharmacological treatment was coded as (self-administered oral hypoglycemic agents= 1 & others (insulin injection only and combined with oral hypoglycemic agents= 0).

Table 11 Multiple linear regression analysis: The predictors of Psychological health domain in the study group (n=143)

	Physical health domain				
Variables	**Unstandardized Coefficients**		**Standardized Coefficients**	**t-test**	**p-value**
	B	**Std. Error**	**Beta**		
(Constant)	39.732	9.204		4.317	0.000**
Total score of socio-	0.341	0.116	0.209	2.933	0.004**
economic status	0.22	0.089	0.182	2.475	0.015*
Smoking status	-4.313	1.853	-0.167	-2.327	0.021*
Body mass index(kg/m2)	-0.32	0.137	-0.165	-2.334	0.021*
Ophthalmological	-8.501	2.167	-0.276	-3.922	0.0001**
complications	-4.906	1.827	-0.206	-2.686	0.008**
Diabetic foot ulcers	-3.302	2.261	-0.11	-1.46	0.147
Medical nutrition therapy	1.335	3.221	0.03	0.415	0.679
9.249	3.535	2.16	0.116	1.637	
Pharmacological treatment	-0.831	1.711	-0.035	-0.486	0.628

*Significant at p value <0.05 level (2-tailed). **Highly significant at p value <0.01 level (2-tailed). NB: Smoking status was coded as (yes= 1 & no=0), diabetes complications (ophthalmological, peripheral vascular and diabetic foot ulcers) were coded as (yes= 1 & no= 0), medical nutrition therapy was coded as (yes=1 & no= 0), physical activity was coded as (yes= 1 & no= 0) and pharmacological treatment was coded as (self-administered oral hypoglycemic agents= 1 & others (insulin injection only and combined with oral hypoglycemic agents= 0).

Table 12 Multiple linear regression analysis: The predictors of Social relationships domain in the study group (n=143)

	Physical health domain				
Variables	**Unstandardized Coefficients**		**Standardized Coefficients**	**t-test**	**p-value**
	B	**Std. Error**	**Beta**		
(Constant)	58.934	6.319		9.326	0.000**
Total score of socio- economic status	0.338	0.142	0.2	2.382	0.019*
Ophthalmological complications	-4.755	3.511	-0.111	-1.354	0.178
Diabetic foot ulcers	-6.405	3.455	-0.153	-1.854	0.066
Medical nutrition therapy	-5.051	5.207	-0.081	-0.97	0.334
Physical activity	-3.837	3.492	-0.091	-1.099	0.274
Pharmacological treatment	-5.82	2.795	-0.175	-2.082	0.039*

*Significant at p value <0.05 level (2-tailed). **Highly significant at p value <0.01 level (2-tailed). NB: Diabetes complications (ophthalmological and diabetic foot ulcers) were coded as (yes= 1 & no= 0), medical nutrition therapy was coded as (yes=1 & no= 0), physical activity was coded as (yes= 1 & no= 0) and pharmacological treatment was coded as (self-administered oral hypoglycemic agents= 1 & others (insulin injection only and combined with oral hypoglycemic agents= 0).

Table 13 Multiple linear regression analysis: The predictors of environmental domain in the study group (n=143)

Variables	Environmental domain				
	Unstandardized Coefficients		Standardized Coefficients	t-test	p-value
	B	Std. Error	Beta		
(Constant)	23.404	6.565		3.565	0.000**
Age (years)	0.251	0.109	0.174	2.306	0.023*
Total score of socio-economic status	0.428	0.081	0.4	5.282	0.0001**
Pharmacological treatment	-2.302	1.595	-0.109	-1.443	0.151

*Significant at p value <0.05 level (2-tailed). **Highly significant at p value <0.01 level (2-tailed). NB: pharmacological treatment was coded as (self-administered oral hypoglycemic agents= 1 & others (insulin injection only and combined with oral hypoglycemic agents= 0).

Discussion

The risk of diabetes continues to increase worldwide due to population growth, aging, urbanization, increasing prevalence of physical inactivity and obesity. International Diabetes Federation (IDF) indicated that the Middle East and North Africa (MENA) region has the highest prevalence of diabetes prevalence in the world. Also, IDF estimated that by 2030; patients with diabetes will double to current estimates of up to 59.9 million in the MENA region.[133] Diabetes Mellitus negatively impacts health related quality of life. This negative impact affects many aspects of a person's life, including the psychological impact of being chronically ill, dietary restrictions, changes in social life, symptoms of inadequate metabolic control, chronic complications and ultimately lifelong disabilities. Many variables have been associated with HRQoL in patients with DM as: age, gender, socio-economic status, obesity, treatment, chronic complications, health insurance, quality of care, patient education and type of diabetes mellitus, Pichon-Riviere et al.,[134] so this study aimed to evaluate the quality of life of type 2 diabetic patients attending family medicine outpatient clinic of Suez Canal University Hospitals at Ismailia city. The current study revealed that the age of the study group ranged between 41 and 72 years old, less than half of them were in age group (50- 60) years and the mean age was 54.74 years (SD = 7.32). This result agreed with Abd Elaziz et al.,[135] who reported similar mean age of the study group which was 53.2 years (SD = 10.8) years. This result agreed also with Genga et al.,[136] who found that the mean age of the study group was 56.37 years. This result was also in agreement with Al-Byati et al.,[137] who found that the mean age of both study groups was close around 55.99 years (SD = 9.27). This indicates that type 2 diabetes mellitus is more commonly observed among the middle-aged. This could be explained as diabetes can go silently, undetected for a long time, without symptoms and many people first became aware that they had diabetes when they developed one of its potentially life-threatening complications, such as heart disease.

The majority of the study groups were females. This reflects the fact that the females' attendance to family medicine outpatient clinic is higher than males' and this result is supported by the study conducted in Egypt by[35] who found that the prevalence of diabetes increased with age, and was higher among females aged (50-59). This result agreed with[135] who reported that females represented more than two third of their study group. This result also was in agreement with[136,137] who found that females represented more than half of their study group. On the contrary to this result[77] in their study found that more than half of the study groups were males. This could be due to their low family income which made them depending on regular treatment in governmental hospitals.Regarding marital status, less than three quarters of the study group were married; more than half of them were illiterate and more than half of them had just sufficient income. These results were in agreement with a study done by[35] who reported that the prevalence of illiteracy or low education was high among female diabetic patients. These results were in agreement with who found that the majority of their study group were married, and three quarters of them were illiterate and more than half of them had just a sufficient income. These results were consistent with the study conducted in the United Arab Emirates by[132] who found that less than three quarters of the participants were married and more than half of them had an average level of income but less than one third of them were illiterate. Also these results were in accordance with the previous study conducted in Oman by Al-Maskari et al.,[138] who found that less than three quarters of the study group were married but more than one third of them were illiterate. The present study revealed that the majority of the study groups were unemployed (non-working). This result was consistent with the study conducted by Al Hayek et al.,[139] who found that less than three quarters of diabetic patients were non-working. Also this result was in agreement with[140,141] who found that less than two thirds of diabetic patients were non-working. This result disagreed with Genga et al.,[136] as they reported that less than two thirds of the study group had some employment whether part or full time. This may be due to the fact that the majority of the study group was females (housewives & unemployed) and their low educational level gave them no chance for employment.

Approximately more than half of the study group was living in urban coming in accordance with[97] who found that nearly two thirds of the study group were of urban environment. This result was in agreement with who reported that the prevalence of diabetes was higher in urban than rural areas. This could be due to their dependence on advanced technology such as different means of transportation rather than walking which leads to insufficient physical exercise and sedentary life. The current study revealed that more than three quarters of the study group had low socio-economic status level. This result agreed with who found that less than half of the study group had low socio-economic status level. This could be confirmed in the study conducted by[142,143] who mentioned that low educational attainment possibly limits information and resources linking to healthy behaviors and environment exposures where the mean of educational and culture domain scores of the present study group was 6.13 and it has been established that low socio-economic status is associated with low health status. As concerning to risk factors of diabetes mellitus, it was observed that less than three quarters of the study group had a family history of diabetes. This reflects a high role of inheritance of type 2 DM. This result agreed with[144] who found that the majority of the participants had a family history of diabetes. This result agreed with[138] who reported more than half of the study group had family history of diabetes. This result agreed with who reported that only one third of the study group had family history of diabetes. This result agreed with the results of a United Kingdom study by Adamson et al.,[145] who found that first-degree relatives of people with type 2 diabetes consumed diets high in fat and cholesterol, increasing their risk of developing diabetes. Also, the majority of the study group had hypertension coming in accordance with the previous studies conducted by[146–148] who reported that less than three quarters of the patients had hypertension. This result agreed with[135–149] who found that (39%, 45.3% and 48%, respectively) of the patients had hypertension. This result agreed also with

Jahanlou et al.,[150] who concluded that less than one third of the patients who undertakes type 2 DM had hypertension. This result supported with Weycker et al.,[151] who found that patients with hypertension had a 2.5-fold risk of developing diabetes compared to their non-hypertensive counterparts. Regarding smoking status, less than one third of the study group were smokers (active or passive smokers). This may be due to the high proportion of females for whom smoking is culturally considered not acceptable. This result agreed with[144] who found that less than one third of the study group were smokers. This result was similar to another study result that was conducted by who reported a prevalence of 37% of smoking among diabetic males in Egypt. This result agreed also with Avramopoulos et al.,[152] who found that more than two fifths of the study groups were smokers. This result agreed with Jahanlou et al.,[150] who found that only14.3% of the study group were currently smoking. As regard to physical activity, it was observed that the minority of the study group did not perform physical activity. This result agreed with Avramopoulos et al.,[152] who found that less than one quarter of patients did not perform any physical activity. This result agreed also with Bosić-Zivanović et al.,[153] who found that less than one third of patients could not perform daily activities. This result agreed with[144] who found that less than two thirds of the patients were living in a sedentary lifestyle. This could be explained by advanced technology since most of the aged studied group especially females spent their times in watching TV or snacking, and most of them rely on the mean of transportation rather than walking. Approximately less than half of the study groups have taken oral hypoglycemic agents by themselves while less than two fifths of them have been treated with oral hypoglycemic agents and insulin and 16.8% of them have been treated with insulin injections. These results coming on the same line with[71] who mentioned that metformin remains the optimal drug for monotherapy and its low cost its low cost, proven safety record, weight neutrality, and possible benefits on cardiovascular outcomes have secured its place as the favored initial drug choice and in any patient not achieving an agreed HbA1c target despite intensive therapy, basal insulin (which usually in combination with metformin and sometimes an additional agent) considered as an essential component of the treatment strategy. These results agreed with[153] who found that less than half of the patients have taken oral hypoglycemic preparations by themselves, less than one third of them have been treated with oral drugs and insulin while less than one quarter of them have been treated with insulin injections. These results agreed with[154] who found that two thirds of the patients were self-administered of oral hypoglycemic agents.

Also, more than three quarters of the study group were obese; more than one third of them were class I obesity. This result agreed with[155] who found that less than three quarters of the study group were obese; more than two fifths of them were class I obesity. This result agreed with Abd Elaziz et al.,[135] who found that more than half of the study group were obese. This result agreed with who found that more than two fifths of the study group was obese. This result agreed also with[156] who found that less than one quarter of the study group was obese. This may be attributed to consuming foods rich in high saturated fats and refined carbohydrate diets coupled with a low dietary fiber intake which are associated with a steep rise in the prevalence of obesity, which is considered the major risk factor for developing type 2 diabetes mellitus. Concerning to diabetes-related complications, most of the study group had neurological complications and the majority of them had ophthalmological complications. These results were in agreement with who found that the majority of the study group had neuropathy and the majority of them had retinopathy. These results agreed with Bosić-Zivanović et al.,[153] who found that less than one quarter of the study group had neuropathy and less than one quarter of them had impaired vision. This may be attributed to the variations in clinical care, healthcare resources, diagnostic criteria (late diagnosis of diabetes, late initiation of treatment) and lifestyle factors.

Regarding overall quality of life and general health, less than half of the study group had their quality of life rated as

good and less than two thirds of them were satisfied about their health coming in accordance with Bakry who nearly two thirds of the study group had their quality of life rated as good and less than three quarters of them were satisfied about their health. These results agreed with Genga et al.,[136] who found that one third of the study group had their quality of life rated as good and more than one third of them were satisfied about their health. These results disagreed with the study of Khongsdir et al.,[157] who reported that two fifths of the study group had their quality of life rated as poor and one third of them were satisfied about their health. These results can be explained that culture promotes endurance, acceptance and adaptation to one's fate (patients do believe that all their life affairs are controlled by God (Almighty Allah); including presence of illness which could be the reason of these results. Concerning to the quality of life domains, this study identified that the study group had low QOL in physical health domain and moderate quality of life in relation to the psychological health and environmental domains. These results were consistent with Bosić-Zivanović et al.,[153] who found that diabetic patients had low scores in all four domains of quality of life while the physical health domain was the most affected domain. These results were inconsistent with Gholami et al.,[158] who reported that the lowest scores of quality of life for the study group was psychosocial domain. Also, these results contradicted who reported that the lowest scores was social relationships domain among type 2 diabetic patients. This could be explained as type 2diabetic patients had higher rate of complications that affect the Physical function. Physical function limitations especially due to vision difficulties, peripheral neuropathy, and or heart disease can have a negative impact on quality of life.

Also, less than half of the study group had high quality of life in social relationships domain. This implied that the participants had relatively more satisfaction of their personal relationships and social support which has a positive influence on physical and psychological well-being of patients, which is reflected in better QoL. This result was in accordance with Khongsdir et al.,[157] who found that patients had the highest scores in social relationships domain. On the other hand, the result of the present study was inconsistent with the study of who observed that the most affected domain was social relationships. The difference in the impact of diabetes on social relationship can be attributed to a great extent on difference in culture and tradition (This could be attributed to intimate family relationships in our society). The present study revealed that there was highly statistical significant difference in the mean of total score of socio-economic status in males than females. The existing literature shows mixed findings on the role of income and education on the prevalence of type 2 diabetes. On the same line,[143] mentioned that individuals who had completed college education and had a higher income were approximately 30% less likely to have diabetes than those of lower SES, so low literacy rates leads to low SES in the female subjects prevents them from receiving the care needed to achieve adequate QOL. Besides, there was highly statistical significant difference in the mean of body mass index in females than males. This finding disagreed with Somappa et al.,[159] who reported that there was no statistically significant difference between males and females with respect to mean of body mass index. The exact explanation of such gender variations was not entirely clear, it may be attributed to unhealthy eating habits especially the housewives, often eat the remaining food after meals and did not engage in any type of exercise outdoors which results in extra weight gain (lack of knowledge on selecting a healthy diet, the vast majority of the study group not followed medical nutrition therapy).

Moreover, there was statistically significant difference only in the mean of physical health domain scores in males than females. This finding could be explained by their worse situation in respect to the disease in the study group but this is still an evidence for gender inequalities. This finding agreed with[160] who found that females had lower score of QOL than males only for physical health domain. This finding was supported with[161] who found that female diabetic patients had consistently lower QOL but for all domains than male diabetic patients. This finding was inconsistent with the study conducted by Odili et al.,[98] who found that there was no statistically significant difference between diabetic males and females in all QOL domains. Regarding the relation between quality of life domains and socio-economic status, high socio-economic status level had a positive effect on QoL of patients, with great significant association between all quality of life domains and total score of socio-economic status. This finding agreed with[162] who found that belonging to high socio-economic status led to better QoL compared to their counterparts. This finding agreed with[163] who found that quality of life score had significant association with socio-economic status. This finding was in accordance with[165] who observed that low socio-economic status (social class) correlated with lower quality of life. This finding disagreed with[166] who found that there was an inverse relationship between socio-economic status and quality of life in patients with diabetes. Also, this finding was supported by[167] who added that, in large relatively low socio-economic families/communities, it was clear that, considerable number of members belonging to those families/communities had negative or unfavorable attitudes and self-care health practices towards chronic diseases in general and diabetes in particular.

Concerning to the relation between quality of life domains and age of the study group, this study revealed a significant positive relationship between age and psychological health and environmental domains. These finding agreed with[168] who both showed that increased age was associated with better quality of life. These findings disagreed with[169] who found that with the increase of age there was a statistically significant decline in the mean score of psychological health domain. These findings disagreed with Genga et al.,[136] who found that the age of the participants has emerged as a significant association with quality of life, on the social domain and not in the three other domains. This finding disagreed with who found that younger patients had better QOL than older patients and this relation was statistically

significant. These findings have reassured the findings of[170] who mentioned that older adults may be better at regulating emotion than younger adults because they tend to direct their eyes away from negative events or toward positive events and they have fewer responsibilities to think about such as work and family. As regard to glycated hemoglobin (HbA1c) values and quality of life domains of the study group, the finding of this study was agreed with Akinci et al.,[165–171] who found that higher HbA1c levels were negatively associated with QoL. This finding was in agreement with[172] who found that HbA1c and QoL have a significant association. This finding was in contradiction to who found that the quality of glycemic control by HbA1c did not influence the HRQoL and its domains among type 2 diabetic patients. This finding disagreed with Abd Elaziz et al.,[135] who found that there was no statistically significant difference between controlled diabetics and uncontrolled diabetics in all parameters of health related quality of life. This could be explained as the vast majority of the study group had poor glycemic control because of their poor adherence to self-monitoring of blood glucose levels where actually more than half of them had no idea what HbA1c was while other common reasons were poor adherence to treatment regimens, lack of access to therapy, their poor adherence to dietary and exercise recommendations which impacted on the quality of life.

Concerning to the relation between quality of life domains and body mass index, this study revealed a significant negative relationship between BMI and physical and psychological health domains. These findings agreed with Hussein et al.,[160] who found that there was statistically significant negative relationship between BMI and physical and psychological health. This finding agreed with found that lower BMI was associated with higher QoL in psychological health domain. This finding agreed with Papadopoulos et al.,[147] who observed a relationship between BMI and physical functioning domain. This finding agreed with[173] who found that lower BMI was associated with higher QoL. This came in agreement with Bourdel-Marchasson who found that body mass index < 30 was independently related with the QOL of diabetics in several statistical models. This came in agreement with Abd Elaziz who found that obese diabetic patients had poorer quality of life in all domains compared to normal or overweight patients and the difference was highly significant on the basis of statistics. These findings disagreed with Kazemi-Galougahi et al.,[174] who found that there was no significantly relationship between BMI and QOL domains. This finding confirmed by Akinci et al.,[165] who found that overweight and obesity have been found both as important negative factors in determining the QoL.

The present study revealed that there was statistically significant positive relationship between physical activity and physical health domain of the study group. This finding agreed with who found that patients who had no physical activity or irregular physical activity were at risk to have poor physical status more than those with regular physical activity. This finding was congruent with Al-Shehri et al.,[141,142] who found that exercise of a 30 minutes exercise for 3 days a week or more produced positive changes in QOL. This finding agreed with who found that quality of life score had significant association with physical activity. This result confirmed by[175]who mentioned that physical activity alone can contribute to a significant weight loss with improvement of glycemic control and insulin sensitivity in type 2 DM and in recent studies combination of dietary intervention and regular exercise training was even at great benefit which is reflected on quality of life. This finding agreed with[176] who mentioned that patients with diabetes should be physically active to improve disease control and quality of life.

Regarding the relation between quality of life domains and ophthalmological complications, this study revealed a significant negative relationship between ophthalmological complications and physical and psychological health domains. These findings agreed with who found that complications such as neuropathy and retinopathy affected physical and psychological domains. These findings agreed with who found that type 2 diabetic patients who had retinopathy had low QOL in physical, psychological and social domains more than diabetes only and this difference was statistically significant. This finding agreed with Georgios et al. who found that diabetic retinopathy was associated with visual impairment has a significant impact on HRQOL. This result could be explained as diabetic retinopathy can result in vision impairment, which in turn has been linked to reduce physical activity, dependency in activities of daily living, social isolation and visual impairment which itself causes ill-effects on the emotional well-being of such patients. There were statistically significant negative relationship between diabetic foot ulcers and physical health domain of the study group. This finding agreed with Nyanzi et al.,[177] who found that foot ulcers were statistically significant independent negative predictor to physical health and functioning dimensions. This finding agreed with Zeleníková et al.,[178] who found that patients with diabetic foot ulcers have a poorer quality of life in the domain of physical health. This was supported with Goodridge et al.,[179] who mentioned that diabetic ulceration which may result in lower mobility, falls, higher dependence on others, loss of employment, lower income, higher risk of amputation, repeated medical check-ups, and higher living costs.

Regarding smoking status and psychological health domain of the study group, the finding of this study was agreed with Hussein et al.,[71] who found that smoking had a significant effect on the level of independence and spiritual QOL domains. This finding agreed also with Al-Byati et al.,[137] who found that there was no statistically significant association between quality of life and smoking. This finding confirmed by[180,181] who found that smoking if co-existent with diabetes can worsen all the complications of diabetes and the use of tobacco have often been associated with low scores for the different dimensions of HRQOL, particularly in patients with diabetes. Concerning peripheral vascular disease and psychological health domain of the study group, the finding of this study was agreed with a study done by Javanbakht et al.,[182] who found that patients with lower extremity lesions were significantly associated with

low quality of life scores. This finding agreed with[183] who found that presence of diabetes-related complications (e.g., neuropathy, retinopathy, peripheral vascular disease, and coronary artery disease) were associated with low quality of life scores. This finding could be explained as those patients were less able to complete household tasks, or to enjoy pleasurable activities.

Regarding pharmacological treatment and social relationships domain of quality of life for the study group, the finding of this study was agreed with a study done by Al Hayek et al.,[139] who observed that insulin treated patients had better HRQOL than those treated with oral hypoglycemic agents. This finding was supported by the study of[184] who mentioned that using insulin among diabetes patients has demonstrated improvement in mood scores and has reported fewer visual symptoms, less symptom distress, and improved scores for cognitive function, cognitive distress, and fatigue distress. This could be confirmed in the study conducted by Grunberger[185] who mentioned that earlier use of insulin could reduce and/or delay diabetes complications, increase QoL and survival. This finding agreed with Okanovic et al.,[186] who mentioned that introducing insulin therapy in patients with type 2 diabetes mellitus and sustained elevated HbA1c levels might positively affect their quality of life. This finding also agreed with Andayani et al.,[187] who found that self-administered triple oral therapy was associated with a low HRQoL. This finding disagreed with Fal et al.,[188] who found that there was no statistically significant difference between pharmacological treatment and social relationships domain. This finding disagreed with Shim et al.,[171] who found that the insulin was the only type of treatment associated with worsening of diabetic QOL. This finding disagreed with Demirci et al.,[189–191] who found that insulin treatment reduced the quality of life especially for the following domains: family relationships, sex life, travel, own and family future.

Conclusion

Based on the findings of the current study, it could be concluded that:

Type 2 DM has negatively affected all domains of quality of life of the study group. Factors related to lower quality of life in the present study were lower socio-economic status, poor glycemic control, self-administered oral hypoglycemic agents, obesity, cigarette smoking, physical inactivity, and presence of diabetes complications as ophthalmological complications, peripheral vascular disease and diabetic foot ulcers.

Recommendations

Based on the previous conclusion, this study recommends the following:

1. Increasing health awareness of diabetic patients regarding diabetic care and how they can improve their quality of life.
2. Controlling the patients' weight by weight reduction programs and improving their physical activity levels.
3. Health education programs can be conducted to improve life style for diabetic patients through better nutrition, a healthy weight, physical activity, smoking cessation and regular checkups of blood sugar.
4. In service training program for health care providers should be offered at regular intervals about quality of life of type 2 diabetic patients.
5. Health care providers should do their best to improve glycemic control for better quality of life of those patients.
6. Screening for diabetes complications is essential for the management of patients with Type 2 DM.
7. Further researches should be conducted to assess the impact of health education programs as well as how to improve quality of life of type 2 diabetic patients.

Summary

According to the World Health Organization (WHO), the burden of diabetes mellitus in developing countries is increased compared to the developed world due to its low awareness among the public in developing countries, it is certain that they will face the impact of diabetes waves in coming years. Nowadays, the number of type 2 diabetes patients is increasing in every country, and of every 6 persons one at least dies from diabetes. Globally, the majority of the 382 million people with diabetes are aged between 40 and 59 years old; 80 % of them live in low and middle-income countries; and the percentage of people with type 2 diabetes will increase to 55 % in 2035.[192] Quality of life is an important aspect in diabetes because poor quality of life leads to a diminished self-care, which in turn leads to worsened glycemic control, increased risks for complications, and exacerbation of diabetes overwhelming in both the short run and the long run. Several studies demonstrated that diabetes has a strong negative impact on QOL, especially in the presence of complications. However, most of the studies on diabetes and QOL have been conducted in developed countries where there was access to better health care facilities. In developing countries, the morbidity associated with diabetes and its complications was certainly higher compared to developed countries, which adversely affects the QOL of those patients. Moreover, studies of the QOL in diabetic patients in developing countries were rare.[193,194]

The aim of the current study was to evaluate the quality of life of type 2 diabetic patients attending Family Medicine Outpatient Clinic of Suez Canal University Hospitals at Ismailia city. The study was conducted at the family medicine outpatient clinic of Suez Canal University Hospitals in Ismailia city, Egypt. 143 type 2 diabetic patients were included who agreed to participate in this study and were selected using probability systematic sampling technique. Data was collected through the use of two tools: ***Tool 1:*** **A structured-interview questionnaire** which was developed by the researcher and included four parts: ***Part I:*** Socio-demographic data: It was constructed by the researcher and included socio-demographic characteristics of the study

group such as gender, age, marital status…etc. The socio-economic scale was developed by El-Gilany et al.,[127] **(2012)** which included 7 domains with a total score of 84 such as education…etc. ***Part II:*** History taking questionnaire which was constructed by the researcher to collect data regarding family history of DM, medical history…etc. ***Part III:*** Medical data: This part included duration of the previous diagnosis of diabetes, physical activity…etc. ***Part IV:*** Bio-physiological measurement which included body mass index (BMI) and random blood sugar test (RBS). ***Tool 2:*** **World Health Organization Quality of Life Questionnaire abbreviated version (WHOQoL-Bref):** This questionnaire consisted of 26 items: two individual items that evaluate overall quality of life and satisfaction with health, and 24 items clustered into four domains (physical health, psychological health, social relationships, and environment which were rated on a 5–point likert scale **(WHO, 1997).** It was adopted from **Abdel Hai et al., (2004)** who carried out the translation into Arabic and a written approval for its use was obtained from the department of mental health, WHO-Geneva. All questions were concerned with the past two weeks.

The main results of the present study could be outlined in the following points:

1. The majority of the study group (86%) was females and the mean age was 54.74 years.
2. Approximately three quarters (72.7%) of the study group were married, (57.3%) of them were illiterate and (52%) of them lived in urban areas.
3. The majority of the study group (81.1%) had hypertension.
4. Most of the study group (96.5%) had neurological complications and (81.8%) of them had ophthalmological complications.
5. More than three quarters (76.2%) of the study group had low socio-economic status level.
6. Less than half (48.3%) of the study group were rated as low quality of life in physical health domain while less than half (45.5%) of them were rated as high quality of life in social relationships domain.
7. Based on significance (P< 0.0001); low socio-economic status was associated with low QOL in all domains of the study group.
8. Based on significance (P=0.011); men were reported to have better quality of life than women but this was only statistically significant in physical domain of QOL of the study group.
9. Based on significance; there was a statistically positive relationship between age and psychological health (P=0.004) and environmental domains (P= 0.023) of the study group.
10. Based on significance (P=0.039); patients have been treated with oral hypoglycemic agents associated with low QOL in social relationships domain of the study group.
11. Based on significance; obesity was associated with low QOL especially in physical health (P=0.024) and psychological health domains (P=0.021) of the study group.
12. Based on significance (P=0.021); smoking status was associated with low QOL especially in psychological health domain of the study group.
13. Based on significance (P=0.004); physical inactivity was associated with low QOL especially in physical health domain of the study group.
14. Based on significance (P=0.025); poor glycemic control was associated with low QOL especially in physical health domain of the study group.
15. Based on significance; presence of complications of diabetes as ophthalmological complications (P=0.003), peripheral vascular disease (P=0.008) and diabetic foot ulcer (P=0.025) were associated with low quality of life of the study group.

Based on the findings of the current study, it could be concluded that:

Type 2 DM has negatively affected all domains of quality of life of the study group. Factors related to lower quality of life in the present study were lower socio-economic status, poor glycemic control, self-administered oral hypoglycemic agents, obesity, cigarette smoking, physical inactivity, and presence of diabetes complications as ophthalmological complications, peripheral vascular disease and diabetic foot ulcers.

According to the results of the present study, the following recommendations could be deduced:

Health care providers should do their best to improve glycemic control forbetter quality of life for type 2 diabetic patients. Health education programs can be conducted to improve life style of those patients and further researches should be conducted to assess the impact of health education programs as well as how to improve quality of life of those patients.[195–218]

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