

T.C.
YEDİTEPE UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
DEPARTMENT OF NUTRITION AND DIETETICS

**THE RELATIONSHIP BETWEEN DIETARY FIBER
AND DEPRESSION AND QUALITY OF LIFE IN
ADULT PATIENTS WITH TYPE 2 DIABETES WHO
APPLIED TO THE PRIMARY HEALTH CARE
CENTER IN KARTAL DISTRICT OF ISTANBUL**

MASTER THESIS

Aybüke Merve DEMİRCİ

ISTANBUL, 2023

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THESIS APPROVAL FORM

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APPROVAL

This thesis has been deemed by the jury in accordance with the relevant articles of Yeditepe University Graduate Education and Examinations Regulation and has been approved by Administrative Board of Institute with decision dated and numbered

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DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.

Date

Signature

Aybüke Merve DEMİRCİ



DEDICATION

I dedicate to my son, Kerem Ayaz.



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LIST OF SYMBOLS AND ABBREVIATIONS

ACTH	Adrenocorticotrophic Hormone
ADA	American Diabetes Association
ALA	Alpha Linolenic Acid
BDI-PC	Beck Depression Inventory for Primary Care
BEBIS	Nutrition Information Systems Package Program
BMI	Body Mass Index
COPD	Chronic Obstructive Pulmonary Disease
CRF/CRH	Corticotropin Releasing Factor/Hormone
CRP	C-Reactive Protein
CVD	Cardiovascular Disease
DALYs	Disability Adjusted Life Years
DHA	Docosa Hexaenoic Acid
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders
EFSA	The European Food Safety Authority
EPA	Eicosa Pentaenoic Acid
FAO	Food and Agriculture Organization
FPG	Fasting Plasma Glucose
GLP-1	Glucagon Like Peptide-1
HbA1c	Hemoglobin A1c
HDL	High-Density Lipoprotein
HPA axis	Hypothalamus Pituitary Adrenal axis
IL-6	Interleukin-6
LDL	Low-Density Lipoprotein
NCDs	Non-communicable Diseases
OGTT	Oral Glucose Tolerance Test
ONS	Oxidative-Nitrosative Stress
PCOS	Polycystic Ovary Syndrome
PG	Random Plasma Glucose
PYY	Peptit YY
SCFA	Short chain fatty acid
SNS	Sympathetic Nervous System
TG	Triglyceride

TNF-Alpha	Tumor Necrosis Factor-alpha
TUBER	Turkey Nutrition Guide
TURDEP	Turkish Diabetes Epidemiology
WHO	World Health Organization



ABSTRACT

Demirci, A.M. (2023). The Relationship Between Dietary Fiber and Depression and Quality of Life in Adult Patients with Type 2 Diabetes who Applied to the Primary Health Care Center in Kartal District of Istanbul. Yeditepe University, Institute of Health Science, Department of Nutrition and Dietetics, Master's Thesis, Istanbul.

This study aimed to examine the influence of dietary fiber intake on depression and quality of life in adult patients with type 2 diabetes. The research was conducted at Kartal 3rd Family Health Center between March and May 2023, involving 120 patients (mean age: 56.7 ± 10.44 , M/F= 38/82) diagnosed with type 2 diabetes. Data collection included participants' completed forms and retrospective records of their three-day food intake. Anthropometric measurements were taken during the interviews. The study utilized the "Beck Depression Inventory for Primary Care" and the "SF-36 Quality of Life Scale." The dietary fiber intake over three days for the participants was found to be 17.27 ± 6.56 g. The mean depression scale score was 3.79. Significant negative correlations were observed between depression and the sub- dimensions of the quality of life scale ($p < 0.05$). According to the study's findings, good quality of life is associated with reduced depression. Depression scale scores showed a statistically significant difference across various levels of physical activity ($p < 0.05$), providing evidence of the positive impact of regular physical activity on reducing depression and improving the quality of life. However, there was no significant relationship between dietary fiber intake and quality of life or depression ($p > 0.05$). Despite this, dietary fiber remains crucial in managing diabetes and its complications. Hence, adhering to recommended levels of dietary fiber intake could prove beneficial. Additionally, "physical activity" holds significant importance for this patient group as it enhances their quality of life through mental health benefits.

Key words: Type 2 diabetes, Depression, Dietary fiber intake, Quality of life

ÖZET

Demirci, A.M. (2023). İstanbul İli Kartal İlçesi Birinci Basamak Sağlık Kuruluşuna Başvuran Tip 2 Diyabetli Yetişkin Hastalarda Diyet Lifi ile Depresyon ve Yaşam Kalitesi İlişkisi. Yeditepe Üniversitesi, Sağlık Bilimleri Enstitüsü, Beslenme ve Diyetetik Anabilim Dalı, Yüksek Lisans Tezi. İstanbul

Bu çalışmanın amacı, tip 2 diyabetli yetişkin hastalarda diyet lifi alımının depresyon ve yaşam kalitesi üzerindeki etkisini incelemektir. Araştırma Mart-Mayıs 2023 tarihleri arasında Kartal 3. Aile Sağlığı Merkezi'nde tip 2 diyabet tanısı almış 120 hasta (ort. yaş: 56.7 ± 10.44 , E/K= 38/82) üzerinde yürütülmüştür. Veri toplama, katılımcıların doldurduğu formları ve üç günlük besin alımlarının retrospektif kayıtlarını içermiştir. Antropometrik ölçümler görüşmeler sırasında alınmıştır. Çalışmada "Birinci Basamak Beck Depresyon Tarama Ölçeği" ve "SF-36 Yaşam Kalitesi Ölçeği" kullanılmıştır. Katılımcıların üç günlük ortalama diyet lifi alımı $17,27 \pm 6,56$ g, ortalama depresyon ölçeği puanı ise 3,79 olarak bulunmuştur. Depresyon ile yaşam kalitesi ölçeğinin alt boyutları arasında anlamlı negatif korelasyonlar gözlenmiştir ($p < 0,05$). Çalışmanın bulgularına göre, iyi bir yaşam kalitesi depresyonun azalması ile ilişkilidir. Depresyon ölçeği puanları çeşitli fiziksel aktivite düzeyleri arasında istatistiksel olarak anlamlı bir farklılık göstermiştir ($p < 0,05$) ve bu da düzenli fiziksel aktivitenin depresyonu azaltma ve yaşam kalitesini iyileştirme üzerindeki olumlu etkisine dair kanıt sağlamaktadır. Bununla birlikte, diyet lifi alımı ile yaşam kalitesi veya depresyon arasında anlamlı bir ilişki bulunmamıştır ($p > 0,05$). Buna rağmen, diyet lifi diyabet ve komplikasyonlarının yönetiminde önemini korumaktadır. Bu nedenle, diyet lifi alımında önerilen seviyelere uyulması faydalı olabilir. Buna ek olarak, "fiziksel aktivite" bu hasta grubu için ruh sağlığı faydaları yoluyla yaşam kalitelerini artırmaya katkıda bulunduğundan büyük önem taşımaktadır.

Anahtar kelimeler: Tip 2 Diyabet, Depresyon, Diyet Lifi Alımı, Yaşam Kalitesi

1. INTRODUCTION AND AIM

Chronic or non-communicable diseases (NCDs) are caused by the interaction of genetic, physiological, environmental, and behavioral factors (1). Type 2 diabetes is a chronic metabolic disease characterized by high blood sugar levels resulting from a disturbance in the secretion of insulin, the effect of insulin on the body, or two of these factors (2). Type 2 diabetes is the fourth leading NCDs (1).

One of the most significant public health problems of our time is type 2 diabetes (3), which increases overall mortality by two times and mortality from cardiovascular diseases by 2-3 times (4). Nearly 537 million adults aged 20-79 worldwide are living with diabetes, estimated to climb to 643 million by 2030 and 783 million by 2040 (5). Type 2 diabetes is the most common type of diabetes, responsible for about 90% of all diabetes cases, and its prevalence is increasing rapidly due to the increasing incidence of obesity, declining levels of physical activity, and population aging (6). The worldwide prevalence of diabetes is 8.8% (7). According to the results of the Turkish Diabetes Epidemiology (TURDEP-II) study, the prevalence of diabetes in adults in Turkey is 13.7% (8).

Significant complications affecting health, work performance, and quality of life are associated with type 2 diabetes (9). Type 2 diabetes has many chronic complications, such as retinopathy, neuropathy, and nephropathy, and many acute complications, such as ketoacidosis coma, non-ketotic hyperosmolar coma, lactic acidosis coma, and hypoglycemic coma (10).

Type 2 diabetes is a significant risk factor for mental illnesses and the micro and macro complications it brings (11). Depression prevalence in type 2 diabetes (a diagnosis of clinical depression in one out of every four people) is quite high (12); the risk of developing depression increases in these patients and may progress more severely (13). People with diabetes are twice as likely to develop depression than people without diabetes (14). Another critical factor is that the lifetime prevalence of depression in people with diabetes is 14.4%-32.5% (15).

When the biological origins of depression and type 2 diabetes are examined, it has been determined that the overactivation of immunity, which leads to a cytokine-mediated inflammatory response, and potentially the dysregulation of the hypothalamic-pituitary-adrenal axis are the common points of the two diseases (16). Type 2 diabetes patients have low-grade systemic inflammation. As with depression, circulating levels of

tumor necrose factor alpha (TNF- α) and interleukine-6 (IL-6) were statistically significantly higher (17). Hypothalamus-pituitary-adrenal axis (HPA axis) dysregulation, which is an important mechanism for depression and type 2 diabetes illness, is thought to be a critical link in the high prevalence of co-occurring depression and diabetes (18). Chronic stress hypothalamus-pituitary-adrenal axis (HPA axis) increases cortisol production by activating the sympathetic nervous system (SNS). Chronic hypercortisolemia promotes insulin resistance and visceral obesity and leads to type 2 diabetes, in addition to impairing neurogenesis in the hippocampus, a region associated with depression (19).

Basic components of managing type 2 diabetes include eating well, getting more exercise, staying at the ideal weight (5), and lifestyle change. To this end, one of the main strategies is medical nutrition therapy, which includes improving blood glucose levels, lipid profiles, and blood pressure control to reduce the risk of cardiovascular disease in these patients (8).

The co-occurrence of diabetes and depression also leads to poor diabetes management and quality of life. The fact that depression prevalence is higher in diabetic patients than in the general population has led to a significant decrease in the quality of life of these patients (20). In depressed and anxious individuals, adherence to diet is low, and adherence to medication intake is more complex (21).

It has been found that the intestinal microbiota changes in patients with depression (22) and that there is a decrease in intestinal dysbiosis and butyrate-producing bacteria in diabetes (23). Dietary fiber can positively affect the course of these two diseases by restoring the deteriorated microbiota with its possible antioxidant role, inflammation-reducing effect, and protective role in intestinal health (24). Short-chain fatty acids (SCFA's) like acetate, propionate, and butyrate, which are formed by the fermentation of dietary fiber by the microbiota, are the main nutritional source of cells in the colon (25), and these metabolites protect the intestinal barrier through tight junction proteins (26), stimulate glucose homeostasis by stimulating the production of glucagon-like peptide 1 (GLP-1) and peptide YY (PYY), regulates emotional-cognitive behavior and improves beta cell function (12). The American Diabetes Association recommends a high-fiber diet to improve glycaemic control and reduce plasma lipid concentrations in Type 2 diabetes patients (17), and the recommended daily fiber intake is determined as 14 g/1000 kcal/day for these patients (27).

It has been shown that whole grain and/or fiber intake effectively reduces serum levels of inflammatory markers like IL-6, TNF- α , and C reactive protein (CRP), thus improving the inflammatory response (28).

In addition, lifestyle factors such as increased physical activity, reduced smoking, and lower alcohol consumption are associated with high fiber intake. Thus, it has been shown to affect quality of life positively (25). People with diabetes need effective and continuous care and follow-up program to improve their quality of life, protect them from complications and achieve metabolic control (29).

In light of all this information, the study, which was designed to reveal the known and unknown aspects more clearly and to make a contribution to the literature on this subject, was carried out to determine the relationship between dietary fiber intake and depression and quality of life in adult people with type 2 diabetes.

2. LITERATURE REVIEW

2.1. Definition of Type 2 Diabetes

Type 2 diabetes is a group of metabolic disorders characterized by high blood glucose levels (30). In other words, type 2 diabetes is a non-infectious chronic disease caused by the pancreas not producing enough insulin and/or the body's inability to use the insulin it does produce effectively, resulting in hyperglycemia (31). There is peripheral resistance to insulin action due to relative or absolute impairment in insulin secretion (32).

2.2. Epidemiology and Prevalence of Type 2 Diabetes

Chronic diseases or NCDs occur due to a combination of genetic, physiological, environmental, and behavioral factors. Type 2 diabetes stands out as the 4th most common disease among NCDs (1). The global prevalence of diabetes is 8.8% (7). According to the results of the Turkish Diabetes Epidemiology (TURDEP-II) study, the prevalence of diabetes in adults in Turkey is 13.7% (8).

The aging of the world population and the increase in obesity have created this negative picture. Global changes in lifestyles, declining physical activity as industrialization increases, aging of the population, and lower-quality diets have all contributed to an increased prevalence of type 2 diabetes. Accordingly, it is known that type 2 diabetes is an in both high- and low-income countries; the problem is growing rapidly (7, 11). The highest prevalence among income groups was observed in middle-income countries (33).

Approximately 537 million adults aged 20-79 live with type 2 diabetes worldwide. The total number of people with type 2 diabetes is estimated to reach 643 million by 2030 and 783 million by 2040. These numbers are shown in Figure 2.1 and Figure 2.3 (5).

Type 2 diabetes accounts for about 90% of all diabetes cases and is the most common form of diabetes (6). A significant proportion of the diabetes burden is due to type 2 diabetes (30).

Type 2 diabetes is a preventable public health problem and is known to appear mainly after the age of 30, but the incidence of type 2 diabetes begins to increase as a consequence of growing obesity in childhood and adolescence (1).

At a glance	2021			2045		
World Bank income classification	Number of people with diabetes (millions)	Diabetes prevalence ⁱ (%)	Comparative diabetes prevalence ⁱⁱ (%)	Number of people with diabetes (millions)	Diabetes prevalence ⁱ (%)	Comparative diabetes prevalence ⁱⁱ (%)
World	536.6	10.5%	9.8	783.2	12.2%	11.2
High-income countries	103.9	11.1%	8.4	117.7	12.4%	10.3
Middle-income countries	414.0	10.8%	10.5	623.3	13.1%	12.0
Low-income countries	18.7	5.5%	6.7	42.2	6.1%	7.0
Number of deaths due to diabetes	6.7 million		–		–	

i Prevalence is standardised to each national population for the respective year

ii Prevalence is standardised to world population for the respective year

Figure 2.1. Number of adults (20–79 years) with diabetes per World Bank income classification in 2021 and 2045

Source: International Diabetes Federation. International Diabetes Federation Diabetes Atlas 10th edition, 2021.

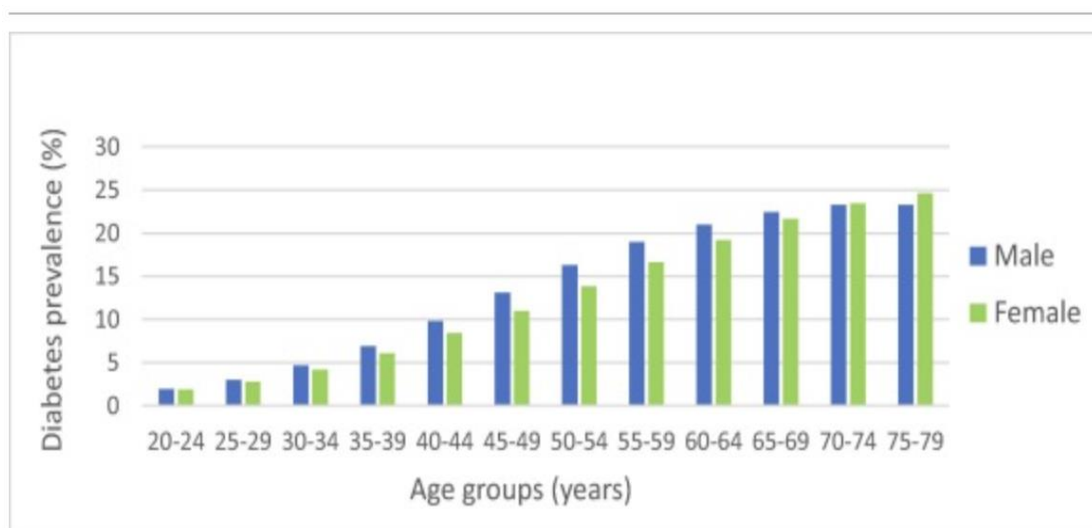


Figure 2.2. Diabetes prevalence by age and sex in 2021

Source: Sun H, Saeedi P, Karuranga S, et al. IDF Diabetes Atlas: Global, regional, and country-level diabetes prevalence estimates for 2021 and projections for 2045. Diabetes Res. Clin. Pract. 2022; 183.

In 2021, it is estimated that there are 536.6 million diabetics among 20-79 years old adults in 215 countries and territories. It is estimated that 783.2 million people will have diabetes in 2045, and the prevalence increases with the age of the patient, with the highest diabetes prevalence (24.0%) observed between the ages of 75-79. The prevalence of diabetes by age and sex in 2021 is shown in Figure 2.2 (33).

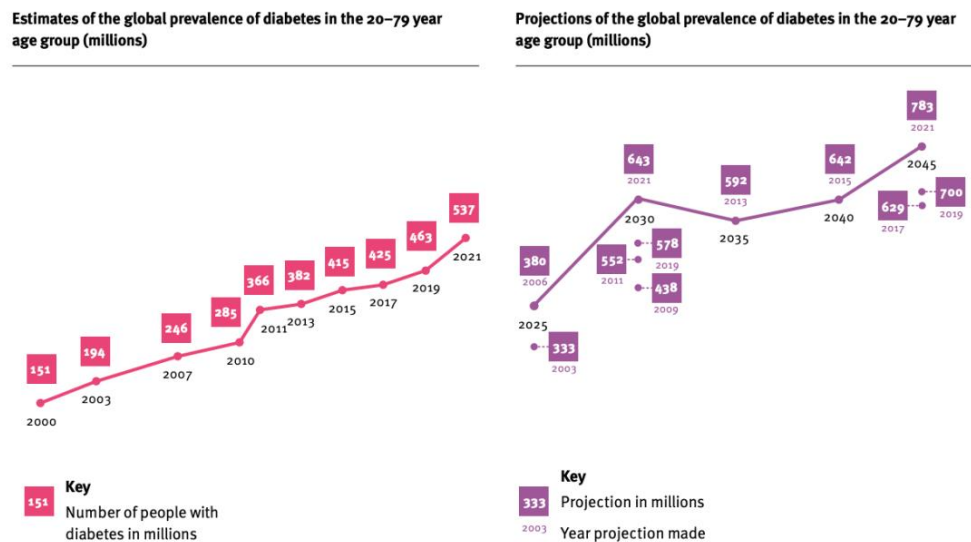


Figure 2.3. Estimated and projections of the global prevalence of diabetes in the 20-79 year age group in millions

Source: International Diabetes Federation. International Diabetes Federation Diabetes Atlas 10th edition. 2021.

2.3. Symptoms and Risk Factors of Type 2 Diabetes

In type 2 diabetes, the most common form of diabetes in adults, many patients are asymptomatic, and hyperglycemia is not detected until routine laboratory tests are performed. It is observed that the symptomatic diabetes prevalence is gradually decreasing with the widespread use of early screening tests (32).

Typical symptoms of type 2 diabetes include polyuria, polydipsia, polyphagia or decreased appetite, weakness, fatigue, numbness and inflammation in the feet, dry mouth, and nocturia. Polyuria occurs at glucose concentrations above 180 mg/dL, the renal threshold for glucose. Glucosuria causes osmotic diuresis and hypovolemia, leading to polydipsia (34).

Less common symptoms include blurred vision, unexplained weight loss, persistent infections, recurrent fungal infections, and itching (2, 35). Many modifiable

and non-modifiable risk factors have been found to be associated with type 2 diabetes (30). While age, genetics, race, ethnicity, gender, and family history are accepted as unchangeable risk factors, smoking, eating habits, sedentary lifestyle, and obesity are modifiable (9, 36).

Type 2 diabetes risk factors with proven causality: High body mass index (BMI), smoking, low physical activity, environmental particulate matter pollution, a diet rich in processed meat, red meat, sugar-sweetened beverages, and a diet low in fruit, nuts, and seeds and whole grains (30).

Risky Patients Needing Diabetes Screening:

- Being overweight (Body Mass Index (BMI) ≥ 25 kg/ m²) or obesity (BMI ≥ 30 kg/ m²)
- Having a family history of type 2 diabetes
- Being more than 45 years of age, even if there is no risk factor
- Presence of cardiovascular disease
- Having a sedentary lifestyle
- High Density Lipoprotein (HDL) ≤ 35 mg/dL and/or triglyceride (TG) ≥ 250 mg/dL
- Impaired glucose tolerance, impaired fasting glucose
- Presence of polycystic ovarian syndrome, acanthosis nigricans, nonalcoholic steatohepatitis
- Hypertension blood pressure $\geq 140/90$ mmHg
- Using antipsychotic and/or antipsychotic treatment for severe bipolar illness
- Chronic corticosteroid use
- Women with polycystic ovarian syndrome (PCOS)
- Those who have a diet rich in saturated fats and low in fiber
- Those with coronary, peripheral or cerebral vascular disease
- People born with a low birth weight
- Presence of sleep disorders such as obstructive sleep apnea syndrome, insomnia, and frequent waking at night in the presence of glucose intolerance (2, 37)

Since more than 10% of the population over the age of 40 has diabetes in our country, regardless of their weight, diabetes screening should be done every 3 years, preferably with fasting plasma glucose (FPG), starting from the age of 40. It is important to perform diabetes screening once a year in individuals with previously

diagnosed prediabetes and to perform diabetes screening every three years in women who have been diagnosed with gestational diabetes in the past (2).

2.4. Type 2 Diabetes Diagnostic Criteria

Diagnosis of type 2 diabetes is made according to fasting plasma glucose (FPG), HbA1c, and Oral Glucose Tolerance Test (OGTT) values (2). FPG, HbA1c, random plasma glucose (PG) measurement in the diagnosis of type 2 diabetes, and limit values for OGTT are given in the tables below. There is no consensus on the superiority of one glycemic test over the other in detecting individuals at increased risk of diabetes. OGTT is more sensitive in many populations, while FPG and A1c are more practical (32).

Diabetes is diagnosed if the blood glucose level measured randomly with the classic symptoms of hyperglycemia is 200 mg/dL or above. Diabetes mellitus is diagnosed in asymptomatic individuals in the presence of any of the following criteria:

- FPG ≥ 126 mg/dL
- 2nd-hour plasma glucose ≥ 200 mg/dL in OGTT
- HbA1c $\geq 6.5\%$ (32)

In the presence of suspected or diabetes-related symptoms, the diagnosis is made by performing FPG, random PG and/or A1C tests. The diagnosis should be confirmed by the same (or a different) method on a later day, except when very severe diabetic symptoms occur (35). In the absence of symptoms of hyperglycemia, the same test must be confirmed the next day to confirm the diagnosis of diabetes. However, if two tests (e.g., FPG and HbA1c) can be done together and the results are consistent with a diagnosis of diabetes, no additional tests are needed (32).

Random PG measurement is a blood glucose measurement at any time of the day without taking into account the meal (2). Values of 200 mg/dL and above in a random measurement lead to the diagnosis of diabetes mellitus if diabetes symptoms are also present (35).

A fasting of at least 8 hours is required to measure FPG. OGTT should be performed with 75 g oral glucose intake (2).

The roadmap for monitoring and diagnosis of type 2 diabetes in asymptomatic people is shown in Figure 2.4. (38) and details of the diagnostic criteria for type 2 diabetics are shown in Figure 2.5. (34).

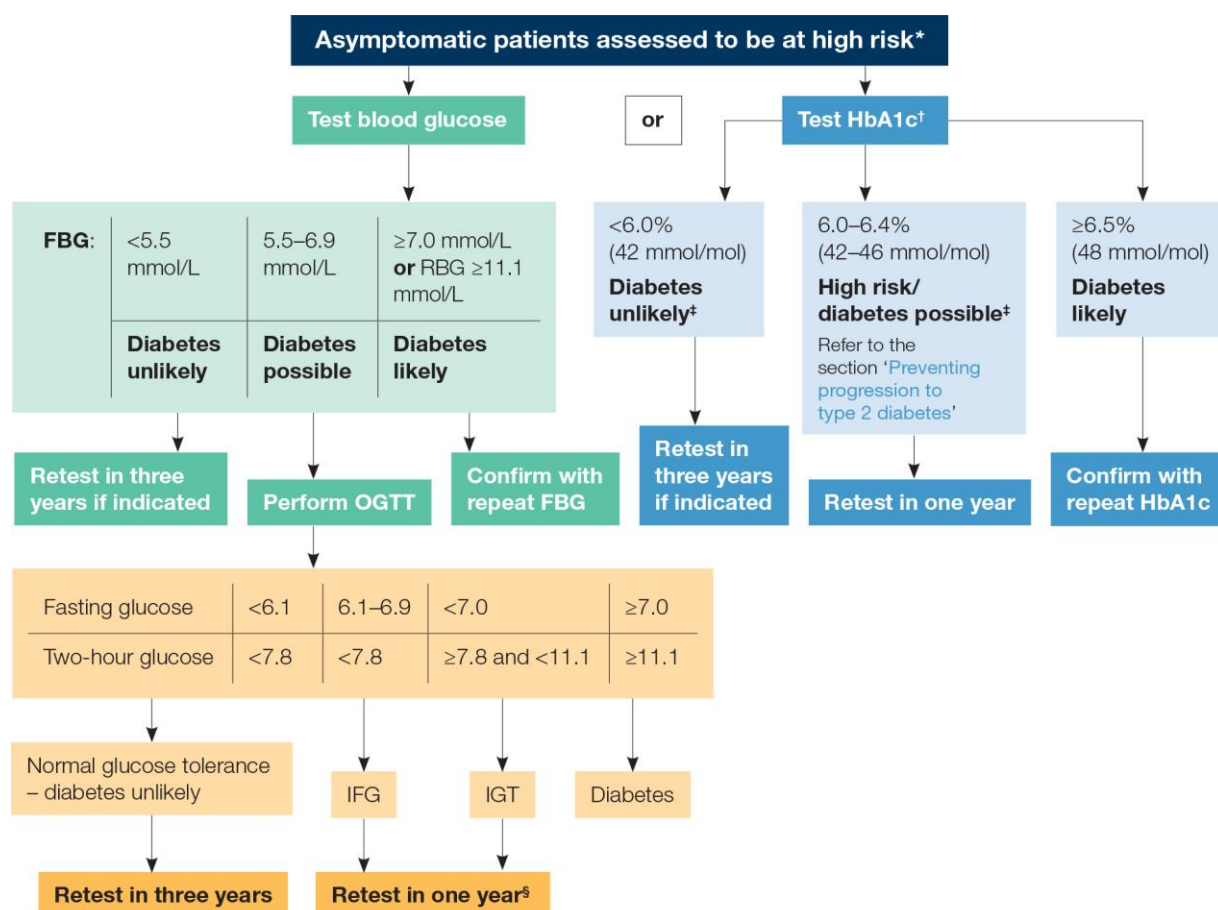


Figure 2.4. Screening and diagnosing type 2 diabetes in asymptomatic people

Source: Arthur I, Barlow J, Jagadeesan S, et al. Management of Type 2 Diabetes: A handbook for general practice. Australia; 2020.

FPG ≥126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 h.*
OR
2-h PG ≥200 mg/dL (11.1 mmol/L) during OGTT. The test should be performed as described by WHO, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.*
OR
A1C ≥6.5% (48 mmol/mol). The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.*
OR
In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥200 mg/dL (11.1 mmol/L).

DCCT, Diabetes Control and Complications Trial; FPG, fasting plasma glucose; OGTT, oral glucose tolerance test; NGSP, National Glycohemoglobin Standardization Program; WHO, World Health Organization; 2-h PG, 2-h plasma glucose. *In the absence of unequivocal hyperglycemia, diagnosis requires two abnormal test results from the same sample or in two separate test samples.

Figure 2.5. Criteria for the diagnosis of diabetes

Source: Kahn SE, Anderson CA, Bakris G, et al. Standart of Care in Diabetes. Diabetes Care. 2023; 46(1).

2.5. Importance and Complications of Type 2 Diabetes

Type 2 diabetes is related to serious complications that affect the patient's health, efficiency, and quality of life (9). Acute complications are listed as nonketotic hyperosmolar coma, ketoacidosis coma, hypoglycemia coma, and lactic acidosis coma. Retinopathy, neuropathy, and nephropathy (microvascular complications); cerebrovascular disease, coronary artery disease, and peripheral artery disease (macrovascular complications) are counted. Other complications: Diabetic foot, hyperlipidemia, fungal infections, etc. (10).

Type 2 Diabetes is one of the significant public health problems of our time (3). It stands out as one of the most severe and widespread chronic diseases of the current period, potentially fatal, crippling, inducing costly complications, and diminishing life expectancy (33).

Diabetes is a chronic, wide-ranging metabolic disorder that requires continuous medical care, characterized by the body's inability to properly utilize carbohydrates, fats, and proteins as a result of insulin deficiency or impaired insulin effectiveness. Reducing the risk of acute complications and preventing long-term chronic (retinal, renal, neural, cardiac, and vascular) complications of the disease that increase the cost of treatment will be beneficial for a wide range of patients (35).

The global increase in unhealthy lifestyles, population aging, and rising obesity rates among the adult and child demographics may partially clarify the diabetes pandemic. In addition, the incidence of diabetes is escalating rapidly in developing countries as a result of economic development and urbanization (39). A sedentary lifestyle, insulin resistance, hyperinsulinemia, latent diabetes mellitus (pre-diabetes), and a history of gestational diabetes are significant risk factors for the occurrence of type 2 diabetes (1).

Especially the group of developing countries, including our country, is a population in which cardiometabolic disorders, a significant complication of Type 2 Diabetes, are commonly seen due to genetic predisposition as well as changes in lifestyle and nutritional preferences (40).

Type 2 diabetes is a standalone risk factor for cardiovascular disease (CVD) (41). Type 2 diabetes increases the overall mortality by almost two times and the mortality from CVD by 2 to 3 times (4). CVD is the leading factor behind morbidity and mortality in people diagnosed with type 2 diabetes, where it manifests around 15

years earlier in individuals with diabetes compared to those without diabetes (39). A substantial share of the health burden resulting from diabetes can be linked to diabetes-associated macrovascular and microvascular complications like coronary artery disease, cerebrovascular accident, peripheral vascular disease, cardiac insufficiency, and diabetic retinopathy (DR), kidney disorder and cardiac autonomic neuropathic condition (42). A significant portion exceeding 50% of individuals diagnosed with diabetes face fatality due to CVD (primarily heart conditions and cerebrovascular events), and this represents the solitary cause of end-stage kidney failure necessitating dialysis or kidney transplant (9).

Failure to successfully control type 2 diabetes can impair different organs, particularly the eyes, kidneys, nervous system, and cardiovascular system (9). It is also known as a significant contributor to vision loss caused by retinal damage in adults, known as diabetic retinopathy (DR). People diagnosed with type 2 diabetes have a significantly elevated risk of lower extremity amputation, which could be as much as 25 times greater than individuals without the sickness (42).

Diabetes that remains undiagnosed for an extended period can elevate the risk of complications directly related to the condition, increased healthcare use, and increased cost of the disease. Early recognition of people at risk of disease is necessary to prevent or at least delay the disease as much as possible to reduce the individual and societal burden of diabetes (1).

Since diabetes causes 6.7 million deaths in the world, the burden on health expenditures is quite high (5). The number of individuals with diabetes is over 7 million in our country, and diabetes-related health expenditures constitute 25% of Turkey's total health expenditures (6). Individuals affected by diabetes are at increased vulnerability to a diverse array of serious and life-threatening health ailments, ultimately resulting in higher medical costs, compromised quality of life, and increased fatality rates (30).

Diabetes is an important global cause of death, mainly due to its vascular complications. The International Diabetes Federation estimates that in 2017, four million people died from diabetes, and diabetes is responsible for 10.7% of all-cause deaths worldwide in people aged 20-79 years. Worldwide, diabetes-related deaths in women are higher than in males (2.1 vs. 1.8 m), and this surplus danger is thought to be mainly related to an increased hazard of cardiovascular death among women. It is estimated that CVD-related deaths represent 50.3% of all deaths in type 2 diabetics (39).

Diabetes imposes a significant health expenditure burden on society, both due to higher direct healthcare expenditure, including inpatient treatment, medications, outpatient visits, and non-direct costs associated with medical care, such as impaired work performance and absence from work (43). A recent research study conducted in Europe demonstrated that individuals with diabetes use nearly twice as many health care resources as those without diabetes, start using resources at an earlier age, and health care costs increase significantly as complications develop (39).

2.6. Nutrition in Type 2 Diabetes

It is known that nutrition therapy, physical activity, and medical treatment are the three main components of type 2 diabetes management (41).

Taking care of people with diabetes: It includes lifestyle changes focused on sleep, healthy eating, and exercise. Achieving the intended result with lifestyle changes can prevent complications of diabetes that will damage the eyes, kidneys, heart, and nervous system (44).

With the weight loss that will occur in patients with effective medical nutrition therapy, blood glucose level, blood pressure, and blood lipids are improved (8).

Medical nutrition therapy has been shown to lower HbA1c levels in people with type 2 diabetes. A 1% reduction in HbA1c is known to reduce all diabetes-related complications by 21%, all deaths by 27%, myocardial infarction by 14%, and microvascular complications of type 2 diabetes by 37%. Medical nutrition therapy has been found to provide glycemic control and reduce complications of type 2 diabetes (8).

Data from the Global Burden of Disease Study, conducted in 188 countries, show that an unhealthy diet is the primary cause of death and disease worldwide. Therefore, nutritional therapy is essential for the prevention of type 2 diabetes (41).

Type 2 diabetes; can be controlled in ways such as increasing the patient's nutritional knowledge and improving diet practices. These factors are considered an integral part of comprehensive diabetes care (9).

Practices aimed at reducing energy, trans and saturated fats, sodium, and cholesterol intake and increasing physical activity in their lifestyles should be supported in order to improve glycemia, dyslipidemia, and blood pressure values of individuals with type 2 diabetes patients (35).

Energy Intake

Over 80% of people with type 2 diabetes are obese. Therefore, losing weight is often the primary goal of nutritional therapy. In this context, reducing 500-750 kcal from nutrition programs suitable for lifestyle and metabolic needs is necessary, providing an average of 1200-1500 kcal per day for women and 1500-1800 kcal per day for men (8). For all individuals who are overweight or obese, it is appropriate to the recommendation of behavioral changes for the achievement and maintenance of a minimum weight loss of 5% (34).

Eating Pattern

There is no ideal macronutrient model and no “one-size-fits-all” eating pattern for patients with type 2 diabetes; individualizing meal plans, taking into account food quality, total calories, and metabolic goals (34).

Carbohydrates

According to the Diabetes Diagnosis and Treatment Guidelines prepared by the Turkish Diabetes Foundation, 45%-55% of daily energy needs should be met from carbohydrates (2).

For individuals with diabetes, reducing overall carbohydrate intake is the most appropriate attempt to improve blood sugar levels and can be applied to a wide variety of eating patterns to meet the needs and preferences of individuals. In the carbohydrate pattern of the daily diet plan, nutrient-rich sources of carbohydrates with high content of dietary fiber (a minimum of 14 g of dietary fiber per 1,000 kcal) and carbohydrates with minimal processing should be prioritized (2). Diet plans should include non-starchy vegetables, fruits, whole grains, and legumes, as well as dairy goods with minimal added sugars. Patients with or at risk of type 2 diabetes are advised to minimize their intake of foods with added sugars and to replace sugar-sweetened drinks, including fruit juices, with water or non-caloric beverages whenever possible to maintain glycaemic control and reduce the risk of cardiometabolic disease (34).

In people with type 2 diabetes, carbohydrate intake should not be less than 130 g per day; It should be provided with the consumption of low glycemic index carbohydrate sources such as non-starchy vegetables, unrefined carbohydrates, and foods containing resistant starch (27). Foods recommended as a source of carbohydrates for individuals with diabetes; whole grain cereals, bread, legumes, vegetables, fruits, milk and dairy products (8).

Protein

Among people diagnosed with type 2 diabetes, consumed protein seems to enhance insulin response without elevating plasma glucose levels. Accordingly, it is important to avoid carbohydrate sources with high protein content when trying to treat or prevent hypoglycemia (34).

Although there is no data supporting the different (more or less) protein intake of individuals with diabetes than healthy individuals, the protein content of the diet should be limited if diabetes-related kidney problems have developed (8). Protein intake; It is planned as 0.8-1.0 g/kg (ideal weight)/day or 15-20% of daily energy requirement, considering the quality of dietary protein (protein ratio of animal and vegetable origin) as recommended for the population without diabetes (2).

Fat and Cholesterol

A diet that emphasizes the elements of the Mediterranean diet, which is rich in monounsaturated and polyunsaturated fats, is considered to promote glucose metabolism and decrease the risk of cardiovascular disease. To prevent or treat CVD caused by type 2 diabetes, it is recommended to eat foods such as oily fish (eicosapentaenoic acid (EPA) and docosahexaenoic Acid (DHA)) and nuts and seeds (alpha-linolenic acid (ALA)), which are rich in long-chain n-3 fatty acids (34).

However, it is recommended to consume fish at least twice weekly, along with reducing the total fat and saturated fat content of the diet (<7% of energy from saturated fat, minimal trans fatty acid intake, and <200 mg cholesterol intake per day) (27). Fat intake; It is calculated as 30% of the daily energy requirement, <7% of the daily energy requirement is planned as saturated fat and 12-15% as monounsaturated fat. Trans fat intake should not exceed <1% of the general energy requirement (2 g/day) (2).

Micronutrients

There is no strong evidence that dietary supplements containing vitamins, minerals (like vitamin D and chromium), herbs, or spices (like aloe vera or cinnamon) can enhance the outcome of type 2 diabetes in type 2 diabetics who do not have any deficiencies. Generally, vitamin or mineral supplementation is not recommended unless the patient needs it for glycemic control (34).

Sodium intake is recommended at <2400 mg/day (approximately 5 g salt) (2). Sodium intake is recommended at 1500 mg/day in people with diabetes with hypertension (8).

In the overall management of type 2 diabetes, nutritional therapy plays an important role, and every person with type 2 diabetes should be an active participant in education, self-management, and treatment planning with the experience and knowledge of their healthcare team, with a personalized nutrition plan. These recommendations are shown in Figure 2.6. (34).

	Recommendations
Effectiveness of nutrition therapy	5.10 An individualized medical nutrition therapy program as needed to achieve treatment goals, provided by a registered dietitian nutritionist, preferably one who has comprehensive knowledge and experience in diabetes care, is recommended for all people with type 1 or type 2 diabetes, prediabetes, and gestational diabetes mellitus. A 5.11 Because diabetes medical nutrition therapy can result in cost savings B and improved cardiometabolic outcomes A, medical nutrition therapy should be adequately reimbursed by insurance and other payers. E
Energy balance	5.12 For all people with overweight or obesity, behavioral modification to achieve and maintain a minimum weight loss of 5% is recommended. A
Eating patterns and macronutrient distribution	5.13 There is no ideal macronutrient pattern for people with diabetes; meal plans should be individualized while keeping nutrient quality, total calorie, and metabolic goals in mind. E 5.14 A variety of eating patterns can be considered for the management of type 2 diabetes and to prevent diabetes in individuals with prediabetes. B 5.15 Reducing overall carbohydrate intake for individuals with diabetes has demonstrated the most evidence for improving glycemia and may be applied to a variety of eating patterns that meet individual needs and preferences. B
Carbohydrates	5.16 Carbohydrate intake should emphasize nutrient-dense carbohydrate sources that are high in fiber (at least 14 g fiber per 1,000 kcal) and minimally processed. Eating plans should emphasize nonstarchy vegetables, fruits, legumes, and whole grains, as well as dairy products, with minimal added sugars. B 5.17 People with diabetes and those at risk are advised to replace sugar-sweetened beverages (including fruit juices) with water or low calorie, no calorie beverages as much as possible to manage glycemia and reduce risk for cardiometabolic disease B and minimize consumption of foods with added sugar that have the capacity to displace healthier, more nutrient-dense food choices. A 5.18 When using a flexible insulin therapy program, education on the glycemic impact of carbohydrate A, fat, and protein B should be tailored to an individual's needs and preferences and used to optimize mealtime insulin dosing. 5.19 When using fixed insulin doses, individuals should be provided with education about consistent patterns of carbohydrate intake with respect to time and amount while considering the insulin action time, as it can result in improved glycemia and reduce the risk for hypoglycemia. B
Protein	5.20 In individuals with type 2 diabetes, ingested protein appears to increase insulin response without increasing plasma glucose concentrations. Therefore, carbohydrate sources high in protein should be avoided when trying to treat or prevent hypoglycemia. B
Dietary fat	5.21 An eating plan emphasizing elements of a Mediterranean eating pattern rich in monounsaturated and polyunsaturated fats may be considered to improve glucose metabolism and lower cardiovascular disease risk. B 5.22 Eating foods rich in long-chain n-3 fatty acids, such as fatty fish (EPA and DHA) and nuts and seeds (ALA), is recommended to prevent or treat cardiovascular disease. B
Micronutrients and herbal supplements	5.23 There is no clear evidence that dietary supplementation with vitamins, minerals (such as chromium and vitamin D), herbs, or spices (such as cinnamon or aloe vera) can improve outcomes in people with diabetes who do not have underlying deficiencies, and they are not generally recommended for glycemic control. C There may be evidence of harm for certain individuals with β carotene supplementation. B
Alcohol	5.24 Adults with diabetes who drink alcohol should do so in moderation (no more than one drink per day for adult women and no more than two drinks per day for adult men). C 5.25 Educating people with diabetes about the signs, symptoms, and self-management of delayed hypoglycemia after drinking alcohol, especially when using insulin or insulin secretagogues, is recommended. The importance of glucose monitoring after drinking alcoholic beverages to reduce hypoglycemia risk should be emphasized. B
Sodium	5.26 Sodium consumption should be limited to <2,300 mg/day. B
Nonnutritive sweeteners	5.27 The use of nonnutritive sweeteners as a replacement for sugar-sweetened products may reduce overall calorie and carbohydrate intake as long as there is not a compensatory increase in energy intake from other sources. There is evidence that low- and no-calorie sweetened beverages are a viable alternative to water. B

Figure 2.6. Medical nutritional therapy recommendations

Source: Kahn SE, Anderson CA, Bakris G, et al. Standart of Care in Diabetes. Diabetes Care. 2023; 46(1).

2.7. The Relationship Between Depression and Quality of Life in People with Type 2 Diabetes

Depressive disorders, type 2 diabetes, and obesity constitute a significant part of the disease burden on society. Among mental disorders, major depressive disorder has the highest burden and has a significant impact on individuals, their families, and society as a whole. More than 300 million people suffer from depressive disorders, according to the World Health Organization (WHO) (45).

Diabetes is a risk for mental health problems, and it is known that this relationship is not unidirectional. Depression prevalence is high in type 2 diabetes, but depressive patients are also more prone to develop diabetes (12).

One in four people with type 2 diabetes has clinically significant depression symptoms (13). A meta-analysis revealed that individuals with diabetes had a twofold increased risk of developing depression compared to those without diabetes, with no difference by gender, type of diabetes, or assessment method (14). Depression is more common in people with diabetes, according to a recent epidemiological study involving 90686 people (19).

Diagnosed with type 2 diabetes may increase the risk of developing depression and lead to a more severe course of depression (13). In the relationship between depression and diabetes duration, It has been determined that there are more depression cases immediately after the diagnosis; the incidence decreases over time and increases again at an advanced stage with the progression of diabetes-related complications (18).

Depression is associated with an increased risk of developing type 2 diabetes, followed by hyperglycemia, insulin resistance, non-compliance with medical nutrition therapy, and micro- and macrovascular complications (13, 14). Depression is associated with poor blood glucose control and higher HbA1c (18). Depression increases hyperglycemia and causes higher mortality. In older adults, comorbidity also leads to an earlier onset of complications (14). Compared to non-depressed patients, patients with depressive diabetes have difficulty in complying with dietary recommendations, poor glycemic control, and an increased incidence of complications and mortality (21).

Considering the relationship between diabetes and mental disorder, the important point is the presence of chronic stress (12). Chronic psychological stress can be defined as a state of mental or emotional tension in which the individual perceives that he/she exceeds his/her capacity to tolerate environmental stimuli (14). High levels

of daily exposure to stress are closely associated with decreased energy expenditure and increased insulin secretion. People's responses to chronic stress may differ; While some tend to overeat due to stress, others may significantly reduce their food intake. Stress-induced binge eating and an unhealthy lifestyle elevate the likelihood of developing type 2 diabetes and also raise blood pressure, insulin secretion, and inflammatory processes. Stress also increases cortisol levels and calorie intake, triggering visceral adiposity (12).

The co-occurrence of diabetes and depression leads to deficient diabetes management and poor quality of life. Type 2 diabetics have significant drug nonadherence compared to patients without depression, resulting in poorer diabetes control (18). The fact that the prevalence of depression is higher in people with diabetes than in the general population reduces their quality of life (46).

Diabetes and depression both impair an individual's quality of life, but their combined presence magnifies the adverse effects (19). Due to the negative impact on health and increased complications, both conditions should be identified and treated in the same individual to reduce depression and improve diabetes control (13).

Complications are conditions that affect patients' quality of life and escalate the financial strain of hospital care, leading to a growth in the number of medical appointments and hospitalizations (31). Complications of type 2 diabetes affect patients' quality of life in almost every aspect (16). A study conducted on hospitalized patients with diabetes revealed that depression was present in 50% of the patients, and the severity of depression was moderate to severe in half of them. Depressive symptoms in these populations were significantly associated with complications such as advanced age, low income, and nephropathy (18). The emotional and physical consequences of complications in individuals with type 2 diabetes bring about changes in personal life and the well-being of their families (31).

Complications affect the quality of life of type 2 diabetics; they can affect in many ways, such as increasing physical discomfort and reducing physical activity. In addition, these various complications can prolong the duration of treatment, affect treatment modalities, and increase the cost of treating type 2 diabetes. For this reason, there is a possibility that complications will increase the material and moral burden of this patient group. Also, depression can lead to more complications. Therefore, depression is thought to cause worse quality of life in type 2 diabetics. Worrying about the disease is seen as one of the factors that can cause a worse quality of life (16).

Mood and self-esteem can be influenced by the chronicity of type 2 diabetes and the inherent difficulties in its control, giving rise to feelings of frustration and depression; In addition, the attitude developed towards food may lead to food restrictions or overnutrition and may negatively affect the people's quality of life (31).

In a study conducted with diabetic patients over the age of 18, type 2 diabetics were found to have a poor quality of life, and the conditions most affected by poor quality of life were: functional capacity, bodily aches, and psychological state. Among the contributing factors, depression exerts the most significant influence on diminished quality of life, significantly affecting glycemic control. The study's findings show that these patients frequently report depression, which is associated with a perception of poor quality of life (31). Symptoms of depression are associated with adverse clinical outcomes that may reduce the quality of life in type 2 diabetics, including disordered eating habits and poor exercise compliance. Depression and distress caused by diabetes are also associated with poorer diabetes health literacy and reduced adherence to self-care measures among individuals with diabetes. All these effects are essential to the quality of life (18).

When all these are evaluated, it is clear that type 2 diabetics are faced with the risks of depression and low quality of life. Approaching the diabetic patient with a Utilizing a multidisciplinary strategy can lead to improved disease outcomes, a decrease in Disability Adjusted Life Years (DALYs), and potentially even lower mortality rates (19). Figure 2.7. shows the psychosocial challenges people with diabetes face at different stages of their lives (47).

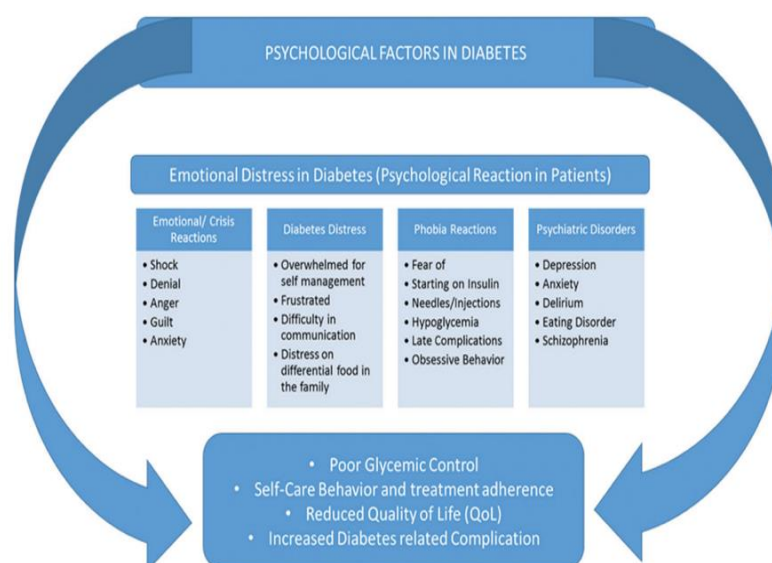


Figure 2.7. Psychosocial challenges experienced by people with diabetes at different phases of life

Source: Kalra S, Jena BN, Yeravdekar R. Emotional and Psychological Needs of People with Diabetes. Indian J Endocrinol Metab. 2018; 22(5): 696–704.

2.8. Common Points in the Pathogenesis of Type 2 Diabetes and Depression

The dysregulation of the hypothalamus-pituitary-adrenal axis (HPA axis), which occurs in both depression and insulin resistance, is postulated to be a vital pathway connecting the high prevalence of depression and diabetes comorbidity (18). The adrenal axis is proposed as a critical factor contributing to the change in sympathetic nervous system tone towards enhanced sympathetic activity and promoting a proinflammatory state (14).

The HPA axis functions as a homeostatic network connecting the brain and body, primarily involved in immune regulation, metabolic balance, reproductive control, and psychological well-being. Initiation of HPA axis activation occurs in the paraventricular nucleus of the hypothalamus in the brain, which can be activated by both threat perceptions and intrinsic physiological processes. Threat perceptions lead to the release of corticotropin-releasing factor/hormone (CRF/CRH), which stimulates the release of adrenocorticotrophic hormone (ACTH) from the pituitary gland into the vascular system. In times of stress, the system activates the adrenal glands above the kidneys that secrete the glucocorticoid hormone cortisol to synchronize temporary fight-or-flight reactions (e.g., adrenaline release, increased heart rate, etc.). Secretion of cortisol; It operates on a daily cycle that regulates various physiological processes, such

as awakening, glucose consumption, and immune system function. Prolonged activation of the HPA axis beyond normal daily levels can result in eventual disruption of cortisol regulation and negative physiological outcomes. The presence of depression and type 2 diabetes has been linked to these changes in HPA axis function (48).

Chronic stress induces the functioning of the hypothalamus-pituitary-adrenal axis (HPA axis) and the sympathetic nervous system (SNS), amplifying cortisol secretion in the adrenal cortex and noradrenaline, adrenaline secretion in the adrenal medulla. Chronic excessive cortisol secretion and extended SNS activation trigger visceral obesity and insulin resistance and bring about type 2 diabetes. However, chronic stress has behavioral implications: noradrenaline, cortisol, and other hormones trigger the fear system, leading to anorexia, anxiety, or hyperphagia; the same mediators induce tachyphylaxis of the reward system, which causes depression and cravings for food, other substances. Elevated cortisol disrupts neurogenesis in the hippocampus, a brain area linked to both depression and type 2 diabetes (19).

Collectively, the findings indicate that dysfunction in brain insulin signaling may hinder the typical stress response of the HPA axis, potentially promoting the onset of depression (45).

Moreover, chronic stress causes immune system dysfunction, either through straight mechanisms or indirectly by activating the HPA axis and SNS, thereby augmenting the synthesis of inflammatory cytokines. Elevated levels of inflammatory cytokines disrupt the regular operation of pancreatic β -cells, trigger insulin resistance, and consequently contribute to type 2 diabetes. Inflammatory responses are also implicated in the pathophysiology of depression, as many recent studies have shown. Proinflammatory cytokines have been discovered to engage with numerous pathophysiological domains associated with depression, such as neurotransmitter metabolism, neuroendocrine function, and synaptic plasticity (19, 45).

People with type 2 diabetes have low-grade systemic inflammation. Just like in depression, circulating TNF- α and IL-6 concentration levels were statistically significantly higher (17). The augmented occurrence of TNF- α and IL-6 in depression is remarkable because they are the main messengers concerning immune regulation of the HPA axis (48). Active innate immunity and acute phase inflammatory response also play a role in the pathogenesis of type 2 diabetes. Specifically, increased proinflammatory cytokine concentrations lead to apoptosis and insulin resistance in pancreatic beta cells (16).

The literature shows that inflammatory cytokine release and C-reactive protein levels increase in individuals suffering from depression. High amounts of inflammatory eicosanoids were found in patients with major depression. An upsurge of oxidative, nitrosative stress (ONS), and inflammation is observed in depressed individuals (20).

For type 2 diabetics, circulating proinflammatory markers are elevated, particularly the cytokine TNF- α . Clinical research demonstrates a correlation between increased blood levels of the proinflammatory cytokine TNF- α and the presence of depression as well as diminished memory test results. In a cohort of patients with a history of depression, elevated blood levels of TNF- α and diabetes were commonly observed (45).

Similar to type 2 diabetes, circulating TNF- α and IL-6 concentration levels were discovered to be statistically considerably higher in individuals with depression compared to individuals without depression (8). It has been shown that TNF- α contributes to depressive states by changing the serotonin system (45). Elevated cytokine serum concentrations trigger the hypothalamic adrenal axis. It increases oxidative stress in the brain. This condition causes depression by activating the tryptophan-kynurenine pathway and decreasing the secretion of serotonin (8). It can also degrade the precursor molecule tryptophan by activating the TNF- α indoleamine 2,3-dioxygenase enzyme and indirectly reduce brain serotonin levels (45).

There is growing evidence that depression and type 2 diabetes share their biological origins, primarily through immoderate activation of the immune system resulting in a cytokine-induced inflammatory response and potential dysregulation of the hypothalamic-pituitary-adrenal axis (19).

2.9. Definition of Dietary Fiber

There are many different definitions of dietary fiber or fiber. Dietary fiber is a food component that is resilient to the effects of digestive enzymes, most common in vegetables, fruits, and grains (49).

With another definition, dietary fiber comprises a blend of non-starch polysaccharides, non-digestible oligosaccharides, lignin, and resistant starch, constituting the structural framework of the plant cell wall (50).

According to the definition in Turkey's Nutrition Guide (TUBER), Dietary fiber refers to the consumable portions of plants or carbohydrates that resist digestion and absorption, playing a crucial role in a well-balanced diet (1).

According to Codex Alimentarius Commission, fiber; is described as carbohydrates and lignin-containing at least 3 monosaccharides, found internally and intact in plants, not metabolized or absorbed by the small intestine (51). As per the widely embraced definition established by Codex Alimentarius Alinorm in 2009, dietary fiber is characterized as consumable carbohydrate polymers consisting of three or more monomeric units that exhibit resistance to endogenous digestive enzymes, thereby remaining unhydrolyzed and unabsorbed in the small intestine (52).

Polysaccharides (PS) and oligosaccharides (OS) were defined by the American Association of Cereal Chemists in 2001 as the consumable parts or digestion-resistant plant carbohydrate analogs, and absorption in the anterior part of the human intestinal tract can be fermented partially or completely in the large intestine. Containing lignin and related plant substances, stated as components that balance serum cholesterol and glucose levels and also have laxative effects (52).

The European Food Safety Authority (EFSA) defines dietary fiber as non-digestible carbohydrates and lignin (53).

Although dietary fiber is in the category of carbohydrates, it cannot undergo energy conversion in the human body like other carbohydrates and is excreted from the body without undergoing any fundamental changes through the digestive system (1).

Dietary fiber, which stands out in all these definitions, is an indigestible compound (52).

2.10. Classification of Dietary Fiber

When fiber is classified according to solubility, it is divided into two as soluble and insoluble fiber, which have different functions in the body, and foods contain a mixture of both (52).

Soluble fiber ranges from 15-20 percent of total dietary fiber. In general, the majority of dietary fiber is insoluble fiber (50). Soluble fibers; apple, quince, etc. pectic elements in foods, gum in resin, oligosaccharides in β -glucan structure, mucilage and water-soluble pentosans found mostly in oats, resistant starch (54). Legumes and many vegetables also contain soluble fiber (1). The best source of beta-glucan is oats, and the best source of resistant starch is legumes (50).

Fruits and vegetables are the primary reservoirs of soluble fiber, while grains and whole grain products are key contributors of insoluble fiber. Nevertheless, it's

important to note that most high-fiber foods found in nature contain diverse proportions of both soluble and insoluble fiber (53).

Soluble fiber tends to ferment more easily than insoluble grain fiber, although fermentation of most dietary fiber (through the effect of gut microbiota) occurs to some extent in the gastrointestinal tract (53)

Soluble fiber is found in foods to be sticky or viscous (gum, mucilage, and pectin), as in oat bran. Types of water-insoluble fiber are cellulose, hemicellulose, and lignin, and they make up most of all dietary fiber. They are involved in the structure of plant cell walls and make up the majority of the total fiber (1). Most fiber or fiber foods contain about one-third soluble and two-thirds insoluble fiber. Foods that provide a substantial amount of soluble fiber may also include a certain proportion of insoluble fiber. For instance, fruits and vegetables contain pectin (soluble) and cellulose (insoluble). However, fruits tend to contain a higher content of pectin, while vegetables tend to have a higher concentration of cellulose (55).

When categorizing dietary fibers based on their structural characteristics, they can be grouped into non-starch polysaccharides, resistant starches (RSs), and resistant oligosaccharides. Furthermore, the non-carbohydrate polymer lignin, found in conjunction with cellulose in plant cell walls, is also recognized as a form of dietary fiber (52). The types and sources of dietary fiber are shown in Table 2.1. (54, 56)

Table 2.1. Dietary fiber types and sources

Dietary Fiber	Features	Source
Soluble Fibers		
Pectin	Galacturonic acid, ramnosis, arabinosis, and galactose content are found in the center lamina and on the primary wall.	Whole cereals, apples, cabbage, root vegetables, legumes
Gamut	It is commonly composed of hexoses and pentose monomers.	Oatmeal, dry beans, legumes
Mucilages	They are components that can contain glycoprotein synthesized in plants.	Food contributions
Insoluble Fibers		
Cellulose	Consisting of glucose monomers, it is the major component of cell walls.	Full grains, root vegetables, bran, apple, peas, beans
Hemicellulose	Major and secondary cell walls	Dandruff, full grains
Lignin	Composed of aromatic alcohols and other cell wall constituents	Flour, vegetables

Salçın N, Ercoşkun H. Diyet Lifi ve Sağlık Açısından Önemi. Akademik Gıda. 2021; 19(2): 234-243.

Dülger D, Şahan Y. Diyet Lifi Özellikleri ve Sağlık Üzerine Etkileri. Uludağ Üniversitesi Ziraat Fakültesi Dergisi. 2011; 25(2): 147-157.

As can be seen in the Table 2.2., legumes are the natural food group with the highest fiber content. These are followed by nuts, whole grain products, vegetables, and fruits. The fiber content of the fruits consumed with the shell is higher than the ones without the shell (50). The dietary fiber contents of various foods (Dietary fiber g /100 g edible part) are shown in Table 2.2. (55).

Table 2.2. Dietary Fiber Contents of Various Foods (Dietary fiber g /100 g edible part)

Food	Solute	Insoluble	Grand total
wheat bran	-	-	33.75
wheat (bread)	2.92	9.75	12.66
haricot bean	-	-	32.17
lentil	-	-	25.99
pea	1.92	21.73	23.65
kidney bean	4.03	19.18	23.21
chickpeas	-	-	23.03
barley	1.93	19.10	21.11
oat	2.05	10.27	12.24
rice	-	-	3.46
bulgur wheat	1.70	5.09	6.79
almond	1.02	10.98	12.00
hazelnut	-	-	11.54
walnut	2.03	9.49	11.50
fig	-	-	10.06
carrot	0.82	1.76	2.58
plum	0.98	1.23	2.20
mulberry	0.40	1.76	2.16
apple	0.62	1.29	1.91
orange	0.72	1.17	1.89
cherry	0.28	1.61	1.89
banana	0.45	1.24	1.69
watermelon	0.12	0.42	0.54
purslane	0.49	1.10	1.59
potatoes	0.41	1.13	1.54
tomatoes	0.17	0.94	1.10
cucumber	0.19	0.32	0.52
pepper	0.67	1.19	1.86
green beans	0.57	1.51	2.08
spinach	0.67	1.60	2.27
aubergine	0.65	1.85	2.51
flaxseed	0.28	34.78	35.06
black cumin	-	-	37.14
carob	2.68	23.14	25.83
Siyez wheat	-	-	11.30
avocado	0.33	9.37	9.70
pikan walnut	1.32	6.93	8.25

Salçın N, Ercoşkun H. Diyet Lifı ve Sağlık Açısından Önemi. Akademik Gıda. 2021; 19(2): 234-243.

Food groups with the highest natural fiber content are legumes (11-26%), nuts (5-14%), cereal products (4-7.5%), vegetables (3-4%), and fruits (1-2%). Raw foods contain more fiber than cooked foods, and those with shells than those without shells. As the bran removal processes increase in cereals, the pulp content is significantly reduced (1).

2.11. Roles of Dietary Fiber in the Body

The main site of action of dietary fibers, which have both local and systemic effects, is the gastrointestinal tract, especially the large intestine. Fiber's presence in the gastrointestinal tract gives rise to localized effects. Systemic effects are metabolic changes caused by local effects (49).

Among the numerous advantageous effects of dietary fiber, one that garners significant attention and is widely recognized is its impact on intestinal motility, effectively preventing constipation. Extensive research consistently supports this beneficial effect. The available evidence supports the positive impact of dietary fiber on intestinal motility, establishing it as an effective approach to managing and addressing constipation (53). Insoluble fiber positively affects the functioning of the intestine with its laxative effect (50).

Water-insoluble fiber keeps water in its structure and increases the movement of waste materials in the intestine without being digested. Insoluble fiber adds softness and volume to the stool, ensures regular functioning of the intestines, and prevents constipation, shortening the transit time of substances that contain waste and substances that will damage the intestinal wall. They are important for the health of the intestinal flora, as they contain prebiotics, which are essential nutrients for beneficial bacteria (probiotics) in the intestine. In addition, Its ability to increase stool volume in the intestine contributes to the prevention of constipation, while its capacity to shorten the time it takes for waste to pass through the intestines reduces the risk of colon cancer (1).

Literature has verified that fibers, specifically soluble fibers, have the potential to beneficially modulate the gut microbiota and undergo metabolism to produce valuable substances, predominantly SCFAs. Consequently, they offer a wide array of health benefits to humans (52).

Soluble fibers control blood cholesterol and triglyceride levels (1). According to reports increasing the amount of soluble or viscous fiber may have a beneficial effect on total cholesterol and low-density lipoprotein (LDL) cholesterol levels in the daily diet

(57). It is established that societies are characterized by a lower prevalence of elevated serum cholesterol levels and a decreased mortality rate associated with ischemic heart diseases that consume cereals and legumes with high fiber content (50) provides control of cholesterol and triglyceride levels. Soluble pulps are found in foods as sticky or viscous (gum, mucilage, and pectin) as in oat bran. Soluble fibers are effective in lowering blood cholesterol levels (55).

Soluble fiber reduces glucose and lipid absorption, while insoluble fiber enhances fecal bulk and accelerates the passage of waste through the intestines (55).

Soluble fiber delays gastric emptying and reduces the desire to eat due to its gel-forming feature increases the viscosity in the small intestine and slows down the digestion and absorption of simple carbohydrates, preventing a rapid rise in blood sugar levels (1, 49).

A low-fiber diet has been shown to be related to diseases such as Type 2 Diabetes, obesity, and gastrointestinal disorders. It has been shown that increasing the quantity of fiber can decrease the risk of these illnesses and even be curative in some cases (49). When consuming an ample quantity of fiber-rich foods, the digestive system operates more efficiently, maintaining optimal cholesterol levels, regulating blood sugar levels, and preventing weight gain (1).

2.12. Dietary Fiber Recommended Amount

It is advised to consume 25 g of dietary fiber per day, aligning with the recommended amounts required for maintaining healthy bowel function by EFSA and WHO/ Food and Agriculture Organization (FAO) (51).

The consumption amounts of the specific dietary fiber requirements for various age groups and specific conditions have yet to be established. But, 25-30 g/day or 14 g fiber intake per 1000 kcal/day in the diet is recommended for individuals in good health and aged 20 years or older. In general, adults should aim for a daily fiber intake of 25-35 g to meet recommended dietary requirements (55).

2.13. Relationship between Type 2 Diabetes, Depression and Quality of Life and Dietary Fiber

It has been shown that patients with type 2 diabetes often have problems with fecal microbiota dysbiosis, and psychiatric comorbidities (such as depression and anxiety) often accompany this picture (58).

Evidence suggests that gut microbiota plays an important role in innate and acquired immune functions (59). The brain-gut microbiome (BGM) pathway acts as a communication system, facilitating the integration of hunger, gut motility, inflammatory responses, and mood-related signals between the brain and the enteric nervous system of the gastrointestinal tract. The enteric nervous system, often referred to as the "second brain," is a complex network of approximately 100 million neurons distributed throughout the gastrointestinal tract lining. It maintains bidirectional communication with the central nervous system through motor and sensory fibers, primarily via the vagus nerve. It is theorized that various factors, such as genetic predisposition, an unhealthy dietary pattern, the administration of antibiotics, as well as psychological and physical stress, may disturb the gut microbiome and contribute to dysbiosis. The gut microbiota has been associated with depression in humans. In addition, there is evidence of a connection between the gut microbiota and various chronic conditions, including obesity, metabolic syndrome, and type 2 diabetes (48).

The intestinal microbiota is altered in patients with depression (22). Likewise, intestinal dysbiosis and a decrease in butyrate-producing bacteria have been found in diabetes (23). Literature supports that Bacteroidetes density is decreased and Firmicutes density is high in type 2 diabetics (48). It is concluded that the antioxidant position of dietary fiber, reducing inflammation and protecting intestinal health, and repairing the impaired microbiota will positively affect the course of these two diseases (22).

The fermentation process of dietary fiber by the microbiota generates byproducts, with the most notable being the SCFAs acetate, propionate, and butyrate. SCFAs are the main food source for cells in the colon (24). These metabolites protect the intestinal barrier through tight junction proteins (25), GLP-1 and PYY, etc. They regulate glucose homeostasis and emotional-cognitive behavior and improve beta cell function by stimulating the production of glucose. At this point, the benefit of dietary fiber for both mental health and the control of type 2 diabetes is confirmed (12).

Both experimental and observational research indicates that consuming whole grains and/or dietary fiber is effective in decreasing circulating levels of inflammatory markers, including IL-6, TNF-alpha, and CRP. The effectiveness of dietary fiber in improving the inflammatory response is very important (28).

A high-fiber dietary pattern usually encompasses a wide array of plant-derived foods that boast antioxidants, phytochemicals, and other beneficial nutrients, all of which exert anti-inflammatory or mood-elevating effects. This has been demonstrated by the seen associations relationship between a high-quality diet and the reduction of depressive symptoms and mental health (24).

Bidirectional communication between the intestine and the brain can be affected by dietary interventions. It has been proven that SCFAs formed as a result of the fermentation of dietary fiber can attenuate the stress-related response as well as gut leakiness, and can also affect brain-immune balance, energy regulation, and physiological condition. In addition, consumption of dietary fiber is strongly associated with a decrease in autoreactive T cell populations in lymphoid tissues and a reduction in inflammatory cytokine levels in the bloodstream. Consumption of functional foods and dietary fiber may increase the anti-inflammatory properties, cholesterol-lowering properties, and insulin receptivity of type 2 diabetics (58).

Alteration of microbiota composition through prebiotics; enhances intestinal barrier function, mitigates metabolic endotoxemia, suppresses inflammation, and ameliorates glucose intolerance (23). A nutritional high diet in dietary fiber can supply sufficient carbohydrates for the fermentation of gut microbiota, and microbial metabolites can serve as an energy source and modulate the immune response of the host. It has the potential to impact the advancement and activity of the nervous system, which is associated with anxiety, depression, and other mental disorders (58).

The cornerstones of type 2 diabetes management can be classified as a nutritious eating plan, elevated physical exercise, and the maintenance of an ideal body weight (5). An essential part of diabetes management is lifestyle change. One of the primary approaches for this is referred to as "medical nutrition therapy." The goals of medical nutrition therapy involve boosting the control of blood sugar levels, and blood pressure, lipid profiles to lower the risk of cardiovascular disease in type 2 diabetics. Medical nutrition therapy has demonstrated a 1% to 2% decrease in glycosylated hemoglobin (HbA1c) levels among individuals diagnosed with type 2 diabetes. Additionally, it has

been demonstrated to lead to advancements in low-density lipoprotein cholesterol, a significant marker in managing cardiovascular disease risk (4).

The American Diabetes Association (ADA) suggests a high-fiber diet as part of medical nutrition therapy for type 2 diabetics (4). The daily fiber intake recommended by the American Diabetes Association has been determined as 14 g/1000 kcal/day for diabetics. High amounts of fiber are needed to improve glucose control (27). It is mentioned in the literature that high-fiber foods have a positive effect on diabetes and blood sugar regulation since their glycemic index is low (4).

In type 2 diabetics, an increase in the intake of predominantly soluble dietary fiber has been found to enhance glycemic control and decrease hyperinsulinemia, in addition to the expected decrease in plasma lipid concentrations (60). According to the findings of a meta-analysis, there was a significant statistical enhancement observed in fasting blood glucose and HbA1c levels when patients with type 2 diabetes increased their intake of dietary fiber as an intervention (4). In a study, it was found that a high intake of dietary fiber was associated with enhanced glycemic control in individuals with type 2 diabetes who were fed two diets with the same isoenergetic and macronutrient composition, except for soluble fiber (27).

In a randomized controlled trial of 192 people, a fiber-enriched nutritional formula that targeted the microbiome has improved the quality of life and measures of metabolic health in type 2 diabetics. Given the HbA1c reduction resulting from the improvement in postprandial glucose and the moderate decrease in body weight (<2%), other contributing elements alongside weight loss are likely to play a role in improving glycemic control (61). Based on the findings of a meta-analysis, regular physical activity, strict blood sugar monitoring, correct management of complications, and the Mediterranean Diet, a high-fiber diet, protect against depression and increase the quality of life in this patient group (62).

Raising dietary fiber levels in the diets of people with type 2 diabetes is good and recommended to be promoted as a technique for disease control (4). While an unbalanced diet also increases the risk of depression, a healthy diet protects against depression (12).

In addition, high fiber intake has shown associations with lifestyle factors such as increased engagement in recreational physical activity, reduced smoking habits, and decreased alcohol consumption. These conditions affect the quality of life positively (24).

Literature has shown a meaningful fiber deficit, with a mere 5% of the population meeting the recommended fiber intake, and there is a correlation between insufficient fiber intake and the incidence of metabolic diseases (61).



3. MATERIALS AND METHODS

Ethics committee approval for the “Non-Invasive Observational Study” was derived from Yeditepe University Clinical Research Ethics Committee on October 5, 2022. The necessary permission from the Ministry of Health was obtained on 16.02.2023 to carry out the study in Kartal Family Health Center No. 3, which is the institution to reach the population compatible with the sample.

The aim of this study is to analyze the relationship between dietary fiber intake, depression condition, and quality of life of elderly patients diagnosed with Type 2 Diabetics. This research was conducted as a face-to-face application of the data collection form and scales. The questionnaire application took an average of 30 minutes for each individual, although it differs from individual to individual. It is nutritional research that does not involve any risk.

The research was conducted between March 2023 and May 2023 at the Family Health Center No. 3 in the Kartal District of Istanbul. 120 adult volunteers with Type 2 Diabetes, aged 18 years or older diagnosis registered in Kartal Family Health Center No. 3 were included in the study.

3.1. Inclusion and Exclusion Criteria

- Sample Inclusion Criteria: Volunteers aged 18 and over, having a diagnosis of Type 2 diabetes, who applied to Kartal Family Health Center No. 3 and signed the Informed Consent Form, will be
- Sampling Exclusion Criteria: Participants who are under the age of 18 and do not have a diagnosis of Type 2 diabetes, individuals diagnosed with depression or other psychiatric diseases, pregnant or lactating women, and individuals who cannot fill in the retrospective food consumption record will not be included in the study.

3.2. Data Collection Tools

Demographic information (gender, age, educational status, etc.) was obtained from the volunteers participating in the research with the data collection form.

The anthropometric measurements of the participants were taken after the questionnaire application when they came to the interview. The participants' weights were recorded with a digital scale suitable for medical use. Before the measurement, the participants were asked to remove their thick clothes and shoes. The participants'

heights were measured using a height meter with an accuracy of 0.1 cm, while the feet were side by side, and the head was in the Frankfurt plane (eye triangle and auricle are at the same level, parallel to the ground). Before the measurement, the participants were asked to remove their shoes.

A three days retrospective food consumption record was collected from the participants when they came to the interview.

"Beck Depression, Inventory for Primary Care" was used to determine the depression condition of the participants, and "The SF-36 Quality of Life Scale" was used for quality of life.

3.2.1. Beck Depression Inventory for Primary Care

The Beck Depression Screening Inventory for Primary Care (BDI-PC), a screening measure known as the Beck Depression Inventory for Primary Care, effectively lowers the rate of false positive results in identifying depression. The scale assesses depression across seven categories, using symptoms of sadness, pessimism, past failures, self-dislike, self-blame, loss of interest, and suicidal ideation or desire. The titles he used were taken from the Beck Depression Scale, which reflects major depressive disorder according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). Each title contains a four-digit rating from 0 to 3. The "Primary Level Beck Depression Scale" score is obtained by adding the highest scores in each item. A maximum of 21 points can be obtained in total. Although there is no reported cut-off point., the probability of depressive disorder is over 90% in scores above 4. In order to meet the maximum requirements of the DSM-IV criteria, individuals are asked about their emotional state "in the last 2 weeks, including today". The Turkish validity and reliability of the scale was made by Zekeriya AKTÜRK, Metin DAĞDEVİREN, Mevlüt TÜRE, and Cengiz TUĞLU (63). Scale results were evaluated in SPSS 21.0 program.

3.2.2. SF-36 Quality of Life Scale

SF-36 Quality of Life Scale: It was created by Ware in 1987. It is designed for use in clinical practice and research, healthcare policy assessment, and general population research (64). The SF-36 quality of life scale is widely used to measure quality of life.

This scale consists of 8 sub-dimensions and 36 questions: physical function, physical role difficulty, emotional role difficulty, social function, pain, mental health, energy-vivacity-vitality, pain, and general health (65).

The highest score is 100, the lowest score is 0. The SF-36 was scored such that the higher the score for each health domain, the higher the well-being and quality of life-related to health. For example, A high score on the pain scale will indicate reduced pain status. The scale's Turkish version underwent validation and reliability testing conducted by Rukiye PINAR BÖLÜKBAŞ to ensure its accuracy and consistency (64). The scale does not give a single total score; it provides different total scores for each sub-dimension (65).

The meanings of the sub-dimensions of the sf-36 scale are shown in Table 3.1.

Table 3.1. The Meanings of the Sub-dimensions of the SF-36 Scale

Sub Dimensions	Low Score	High Score
Physical Function	Limitation in performing all physical activities	The ability to perform all physical activities without any restrictions
Physical Role Difficulty	Problems in daily activities due to physical problems	No problems at work or other daily activities
Social Functionality	Ordinary physical and emotional problems excessive and frequent interruptions in social activities	Their usual social activities without interruption executive
Pain	Extremely severe and limiting pain	Absence of pain or limitation due to pain absence
Mental Health	Persistent feelings of irritability, anxiety, or depression	Feeling calm, happy, and comfortable all the time
Emotional Role Difficulty	The result of emotional problems at work or other daily problems at events	No problem
Energy/Vivacity/Vitality	Feeling constantly tired and exhausted	Feeling constantly alive and energetic
General Health	That his health is bad and that he is getting worse don't believe	Do not believe that your health is perfect

Ataoğlu S, Ankaralı H, Ankaralı S. Fibromiyalji Hastalarının Yaşam Kalitesini Değerlendirmede Kullanılan Ölçeklerin Karşılaştırılması. *Anadolu Klin.* 2017; 2(22).

3.2.3. Data Collection Form

With the data collection form, anthropometric measurements were taken, as well as demographic information such as age, gender, marital status, and educational status of the participants. At the same time, in the medical anamnesis section, information on diseases other than diabetes, medications-supplements used, physical activity status, smoking, and alcohol use were obtained.

When the physical activity status was questioned, the inactive category was used for the group that did no physical activity, the moderately active category was used for the group that performed physical activity occasionally but not frequently or regularly, and the active category was used for the group that performed physical activity regularly. Information about the physical activity status of the participants was obtained by asking them. Information on how many days a week they exercised was also obtained from individuals who stated that they exercised regularly.

After the scales applied to the participants' 3-day food consumption records were retrospectively obtained for weekdays, data was collected for 2 days, while on weekends, it was collected for 1 day. Dietary fiber amounts in daily consumptions were investigated using "Computer Aided Nutrition Program, Nutrition Information Systems Package Program (BEBIS)." As a result of the analysis, the amounts of total dietary fiber, water-soluble dietary fiber, and water-insoluble dietary fiber were calculated.

As a result of the analysis, energy, water, carbohydrate, protein, fat, total dietary fiber, water-soluble dietary fiber, water-insoluble dietary fiber, cholesterol, vitamin A, vitamin E, carotene, thiamine, riboflavin, pyridoxine, folic acid, vitamin C, sodium, potassium, calcium, magnesium, phosphorus, iron and zinc consumption amounts were calculated.

3.3. Analysis of data

Data analysis was done with SPSS 21.0 and studied at a 95% confidence level. Since the sample size obtained for the variables is $n > 30$, it is assumed that the data are normally distributed according to the central limit theorem. For this reason, parametric test techniques were used in our analyses.

In our analyses, t-test, ANOVA test, Tukey test, Pearson correlation, and regression test were utilized. Accordingly, the analysis of the measurements in terms of variables with 2 groups was analyzed with the t-test, and the analysis in terms of

variables with 3 or more groups was analyzed with the ANOVA test. In case of difference in the ANOVA test, multiple comparisons were analyzed with the Tukey test. The relationship between the measurements was analyzed with the Pearson correlation test, and the effect was analyzed with the regression test.



4. RESULTS

According to these data, the age distribution of the patients is as follows: 26.7% are 50 years old and under, 54.2% are 51-65 years old, and 19.2% are over 65 years old.

The mean age was 56.47 years, and the standard deviation was 10.44. Regarding sex distribution, 68.3% of the patients were women, and 31.7% were men. In marital status, 85.0% of the patients are married, and 15.0% are single. In case of education, 10.0% of the population is literate, 49.2% of the population, which constitutes almost half of the participants, is a primary school graduate, 13.3% belongs to secondary school graduates, 18% It can be said that .3% of them are high school graduates and 9.2% are collage graduates. The age, sex, marital status, and educational status of the patients are shown in Table 4.1.

Table 4.1. Demographic Variables

		n	%
Age	50 years and under	32	26.7
	51-65 years	65	54.2
	over 65 years old	23	19.2
Mean±S.D.		56.47±10.44	
Sex	Women	82	68.3
	Men	38	31.7
Marital status	Married	102	85.0
	Single	18	15.0
Education status	Literate	12	10.0
	Primary school	59	49.2
	Middle school	16	13.3
	High school	22	18.3
	University	11	9.2

The mean height of the patients was 161.73 cm, and the standard deviation was 7.99 cm. The patients' mean weight was 82.03 kg, and the standard deviation was 17.37 kg.

The classification of the participants based on BMI (kg/m^2) level is as follows: Normal weight (11.7%), overweight (38.3%), obese (40.8%), and morbidly obese (9.2%). The mean BMI (kg/m^2) level is 31.33, and the standard deviation is 6.51. It is seen that most of the participants are in the obese class, and a significant share of the remaining percentage is in the overweight category. The patients' mean weight, height, and BMI (kg/m^2) values are shown in Table 4.2.

Table 4.2. Anthropometric Measurements

Value	Mean±SD	
Height (cm)	161.73±7.99	
Weight (kg)	82.03±17.37	
BMI (kg/m ²)	31.33±6.51	
BMI Classification	(n)	%
Normal weight	14	11.7
Overweight	46	38.3
Obese	49	40.8
Morbidly obese	11	9.2

While the rate of patients with hypertension is 52.5%, the rate of patients with cancer is 1.7%, the rate of patients with chronic obstructive pulmonary disease (COPD) is 3.3%, and the rate of patients with heart failure is 19.2%. The rate of patients with chronic renal failure is 1.7%. The rate of patients with other diseases is 55.0%. The distribution of chronic diseases present in patients is shown in Table 4.3.

Table 4.3. Chronic Diseases

		n	%
Hypertension	No	57	47.5
	Yes	63	52.5
Cancer	No	118	98.3
	Yes	2	1.7
COPD	No	116	96.7
	Yes	4	3.3
Cardiac insufficiency	No	97	80.8
	Yes	23	19.2
Chronic renal failure	No	118	98.3
	Yes	2	1.7
Other	No	54	45.0
	Yes	66	55.0

When the physical activity status of the patients is examined, 6.7% of them do regular physical activity, 79.2% have an active lifestyle and are moderately active, and 14.2% of them are sedentary and inactive. Considering how many days a week they do physical activity, 37.5% of them do physical activity for 2-3 days, 50.0% for 3-4 days, and 12.5% for 4 days.

In cases of smoking, it was determined that 17.5% of the patients were smokers, and 82.5% were non-smokers. In cases of alcohol use, it was determined that 5.0% of the patients used alcohol, and 95.0% did not use alcohol. The physical activity status of the patients and the percentages of alcohol and cigarette use are shown in Table 4.4.

Table 4.4. Physical Activity Status and Smoking, Alcohol Consumption

		n	%
Physical activity status	Active	8	6.7
	Moderately Active	95	79.2
	Inactive	17	14.2
Frequency of physical activity	Number of day per week	n	%
	2	3	37.5
	3	4	50.0
	4	1	12.5
Smoking	Yes	21	17.5
	No	99	82.5
Alcohol use	Yes	6	5.0
	No	114	95.0

Scores on the depression scale varied between 0 and 18, while the patients's mean score was 3.79. The standard deviation is 3.39.

While the physical function scores covered a spectrum of 0 to 100, the patients's mean score amounted to 67.29. The standard deviation is 27.83.

The physical role difficulty scores covered a spectrum of 0 to 100, while the patients's mean score was 52.92. The standard deviation is 46.31.

The emotional role difficulty scores covered a spectrum of 0 to 100, while the patients's mean score was 56.39. The standard deviation is 48.27.

The Energy/Vivacity/Vitality scores covered a spectrum of 5 to 95, while the average score of the patients was 45.04. The standard deviation is 20.21.

Mental health scores covered a spectrum of 0 to 92, while the average score of the patients was 57.57. The standard deviation is 19.47.

Social functionality scores covered a spectrum of 12.5 to 100, while the patients' mean score was 62.31. The standard deviation is 20.97.

While the pain scores covered a spectrum of 0 to 100, the mean score of the patients was 73.75. The standard deviation is 30.38.

While the general health scores covered a spectrum of 0 to 95, the average score of the patients was 49.96. The standard deviation is 22.89.

The daily fiber intake covered a spectrum of 5.71 to 54.94, while the average of the patients was 17.27. The standard deviation is 6.56.

The depression scale and quality of life scale scores of the patients and their dietary fiber consumption averages are shown in Table 4.5.

Table 4.5. Descriptive Statistics of Depression, Quality of Life, and Daily Fiber Intake

	n	Min_max.	Mean±SD
Depression Scale	120	0_18	3.79±3.39
Physical Function	120	0_100	67.29±27.83
Physical Role Difficulty	120	0_100	52.92±46.31
Emotional Role Difficulty	120	0_100	56.39±48.27
Energy/Vivacity/Vitality	120	5_95	45.04±20.21
Mental Health	120	0_92	57.57±19.47
Social Functionality	120	12.5_100	62.31±20.97
Pain	120	0_100	73.75±30.38
General Health	120	0_95	49.96±22.89
Daily fiber intake	120	5.71_54.94	17.27±6.56

There was no significant relationship between daily fiber intake and Quality of Life and depression ($p>0.05$).

With Depression, Physical Function ($r = -0.46$, $p<0.05$), Physical Role Difficulty ($r = -0.418$, $p<0.05$), Emotional Role Difficulty ($r = -0.358$, $p<0.05$), Energy/Vivacity/Vitality ($r = -0.508$, $p<0.05$), Mental Health ($r = -0.595$, $p<0.05$), and Pain ($r = -0.566$, $p<0.05$) were moderately negative relationship exists. There was a very weak and statistically meaningful relationship between Social Functioning and Depression ($r = -0.236$, $p<0.05$). There is a strong and negative relationship between General Health and Depression ($r = -0.627$, $p<0.05$).

The values of the relationship between the daily fiber intake of the patients and quality of life and depression are shown in Table 4.6.

Table 4.6. Daily Fiber Intake, Analysis of the Relationship between Quality of Life and Depression

	Depression Scale	Daily fiber intake
Depression Scale	r	-0.021
	p	0.816
Physical Function	r	-0.436
	p	0.000**
Physical Role Difficulty	r	-0.418
	p	0.000**
Emotional Role Difficulty	r	-0.358
	p	0.000**
Energy/Vivacity/Vitality	r	-0.508
	p	0.000**
Mental Health	r	-0.595
	p	0.000**
Social Functionality	r	-0.236
	p	0.009**
Pain	r	-0.566
	p	0.000**
General Health	r	-0.627
	p	0.000**
Daily fiber intake	r	-0.021
	p	0.816

Pearson correlation test

There is a statistically meaningful difference in Physical Function scores between age groups ($F=5.439$, $p=0.006$). Group 1 in the multiple comparison columns includes participants aged 50 and under, group 2 contains participants aged 51-65, and group 3 includes participants aged 65 and over (elderly), in other words, the elderly group. According to multiple comparison tests, it was seen that the 1st age group (50 years and under) had considerably higher physical function scores than the 2nd age group (51-65 years) and the 3rd age group (over 65 years). The values of the daily fiber intake, quality of life, and depression status of the patients according to the age parameter are shown in Table 4.7.

Table 4.7. Analysis of Depression, Quality of Life, and Daily Fiber in Terms of Age

	Age			F	p	Multiple comparisons
	50 years and under	51-65 years	Elder			
	Mean±SD	Mean±SD	Mean±SD			
Depression Scale	3.66±3.29	3.83±3.45	3.87±3.47	0.035	0.965	
Physical Function	73.91±22.89	69.77±25.41	51.09±34.87	5.439	0.006*	1>3, 2>3
Physical Role Difficulty	54.69±45.1	57.69±46.34	36.96±46.39	1.757	0.177	
Emotional Role Difficulty	62.5±46.18	52.82±49.26	57.97±49.46	0.442	0.644	
Energy/Vivacity/Vitality	46.72±22.17	44.46±20.86	44.35±15.69	0.148	0.862	
Mental Health	59.75±19.88	56.98±20	56.17±17.91	0.286	0.752	
Social Functionality	57.64±19.78	64.32±21.21	63.13±21.76	1.113	0.332	
Pain	78.13±27.5	71.15±30.37	75±34.54	0.585	0.559	
General Health	52.19±25.27	49.92±23.59	46.96±17.24	0.346	0.708	
Daily fiber intake	17.46±6.4	17.57±7.37	26.98±3.94	0.393	0.676	

ANOVA test

p<0.05

When investigating sex-based distinctions, Physical Function scores ($t=-2.892$, $p=0.005$), Physical Role Difficulty scores ($t=-3.018$, $p=0.003$), Emotional Role Difficulty scores ($t=-2.519$, $p=0.014$), Energy/Vivacity/Vitality scores ($t=-2.204$, $p=0.029$), Pain scores ($t=-4.355$, $p<0.001$), General Health scores ($t=-2.089$, $p=0.040$) and a statistically significant difference was found between the sex. In all these scores, it is seen that men have higher scores than women.

The daily fiber intake shows a statistically significant difference between the sex ($t=-2.872$, $p=0.006$). Men appear to have a higher daily fiber intake compared to women. The values of the daily fiber intake, quality of life, and depression status of the patients according to sex are shown in Table 4.8.

Table 4.8. Investigation of Depression, Quality of Life, and Daily Fiber Intake in Terms of Sex

	Sex		t	p
	Women	Men		
	Mean±SD	Mean±SD		
Depression Scale	3.96±3.5	3.42±3.14	0.815	0.417
Physical Function	62.44±28.05	77.76±24.57	-2.892	0.005*
Physical Role Difficulty	44.51±45.65	71.05±42.92	-3.018	0.003*
Emotional Role Difficulty	49.19±48.35	71.93±44.87	-2.519	0.014*
Energy/Vivacity/Vitality	42.32±19.68	50.92±20.36	-2.204	0.029*
Mental Health	57.46±19.23	57.79±20.24	-0.085	0.932
Social Functionality	62.82±21.54	61.21±19.92	0.391	0.697
Pain	66.77±30.95	88.82±23.03	-4.355	0.000*
General Health	47.26±24.06	55.79±19.12	-2.089	0.040*
Daily fiber intake	15.87±4.49	20.29±8.98	-2.872	0.006*

t-test

p<0.05

Depression, Quality of Life, and daily fiber intake do not differ significantly according to marital status ($p>0.05$). The values of the daily fiber intake, quality of life, and depression status of the patients according to the marital status parameter are shown in Table 4.9.

Table 4.9. An Investigation of Depression, Quality of Life, and Daily Fiber Intake of Fiber in Terms of Marital Status

	Marital status		t	p
	Married	Single		
	Mean±SD	Mean±SD		
Depression Scale	3.69±3.34	4.39±3.65	-0.811	0.419
Physical Function	68.14±26.41	62.5±35.32	0.646	0.525
Physical Role Difficulty	52.94±45.91	52.78±49.92	0.014	0.989
Emotional Role Difficulty	57.84±48.28	48.15±48.81	0.784	0.434
Energy/Vivacity/Vitality	44.56±20.14	47.78±21.02	-0.621	0.536
Mental Health	57.61±19.83	57.33±17.84	0.055	0.956
Social Functionality	63.49±20.66	55.67±22.05	1.466	0.145
Pain	74.02±30.65	72.22±29.57	0.231	0.818
General Health	50.78±22.47	45.28±25.29	0.941	0.349
Daily fiber intake	17.45±6.63	16.26±6.26	0.712	0.478

t-test

p>0.05

Group 1 in the multiple comparison columns includes literates; group 2 includes primary school graduates, group 3 includes middle school graduates, group 4 includes high school graduates, and group 5 includes university graduates.

Depression Scale scores show a statistically meaningful difference between education levels ($F=5.133$, $p=0.001$). It is seen that literate individuals have higher depression scale scores compared to primary school graduates, high school graduates, and university graduates.

Physical Function scores show a statistically meaningful difference between education levels ($F=3.685$, $p=0.007$). It is seen that university graduates have higher physical function scores compared to literate individuals.

Physical Role Difficulty scores show a statistically meaningful difference between education levels ($F=2.492$, $p=0.047$). It is seen that university graduates have higher physical role difficulty scores compared to secondary school graduates.

Energy/Vivacity/Vitality scores show a statistically meaningful difference between education levels ($F=2.637$, $p=0.038$). It is seen that university graduates have higher energy /Vivacity / vitality scores compared to high school graduates.

Mental Health scores show a statistically meaningful difference between education levels ($F=6.875$, $p<0.001$). It is seen that university graduates have higher mental health scores compared to literate, primary school graduates, secondary school graduates, and high school graduates.

General Health scores show a statistically meaningful difference between education levels ($F=2.773$, $p=0.030$). It is seen that university graduates have higher general health scores compared to literate individuals. The values of the daily fiber intake, quality of life, and depression status of the patients according to the education level parameter are shown in Table 4.10.

Table 4.10. Examination of Depression, Quality of Life, and Daily Fiber Intake in Terms of Educational Status

	Education status					F	p	Multiple comparison	
	Literate	Primary school	Middle school	High school	University				
	Mean	Mean	Mean	Mean	Mean				
	±SD	±SD	±SD	±SD	±SD				
Depression Scale	6.92±5.23	3.46±2.65	5.13±4.3	2.95±2.65	1.91±1.58	5.133	0.001	1>2, 1>5,	1>4,
Physical Function	50±35.55	63.98±27.65	66.56±22.64	75.91±26.31	87.73±11.04	3.685	0.007	1<5	
Physical Role Difficulty	50±52.22	45.76±46.92	42.19±45.39	64.77±44.09	86.36±23.35	2.492	0.047	2<5	
Emotional Role Difficulty	66.67±49.24	53.67±48.75	29.17±45.34	66.67±47.14	78.79±37.34	2.404	0.054		
Energy/Vivacity/Vitality	40±20.78	42.63±15.07	38.75±22.91	53.86±23.4	55±26.93	2.637	0.038	3<5	
Mental Health	47±21.78	56.34±13.8	49.25±25.07	61.09±20.85	80.73±12.63	6.875	0.000	1<5, 3<5, 4<5	2<5,
Social Functionality	54.63±17.36	65.1±22.06	59.91±18.64	56.59±18.46	70.68±23.79	1.596	0.180		
Pain	60.42±43.25	71.19±28.55	67.19±29.89	85.23±27.45	88.64±20.5	2.426	0.052		
General Health	38.33±25.52	48.47±20.79	44.06±23.47	58.86±21.87	61.36±25.11	2.773	0.030	1<5	
Daily fiber intake	17.43±4.61	17.06±7.55	18.35±5.28	18.25±6.25	14.74±4.83	0.651	0.627		
ANOVA test									
p<0.05									

Depression, quality of life, and daily fiber intake do not differ significantly according to BMI (kg/m^2) level ($p>0.05$). The values of the patients' daily fiber intake, quality of life, and depression status in terms of BMI (kg/m^2) level are shown in Table 4.11.

Table 4.11. Investigation of Depression, Quality of Life and Daily Fiber Intake in terms of BMI Level

	BMI Level				F	p
	Normal weight	Overweight	Obese	Morbidly obese		
	Mean±SD	Mean±SD	Mean±SD	Mean±SD		
Depression Scale	2.71±1.64	3.41±2.9	4.61±3.93	3.09±3.86	1.818	0.148
Physical Function	80.36±9.9	71.3±23.63	59.69±32.04	67.73±32.43	2.675	0.051
Physical Role Difficulty	78.57±33.77	54.35±45.43	45.92±48.77	45.45±45.85	1.961	0.124
Emotional Role Difficulty	61.9±46.88	63.04±46.73	46.94±49.5	63.64±50.45	1.063	0.368
Energy/Vivacity/Vitality	46.43±19.56	44.46±21.99	44.39±18.7	48.64±22.15	0.164	0.920
Mental Health	61.14±19.24	58.87±18.72	55.59±21.31	56.36±15.12	0.402	0.752
Social Functionality	65.11±20.51	64±20.43	60.8±20.34	58.45±27.76	0.386	0.764
Pain	87.5±23.51	75±30.28	69.39±31.15	70.45±33.2	1.375	0.254
General Health	58.93±18.62	51.3±25.13	45.82±20.88	51.36±25.31	1.330	0.268
Daily fiber intake	16.85±6.36	16.83±6.11	17.69±7.58	17.79±3.68	0.173	0.915

ANOVA test

p>0.05

Group 1 in the table consists of inactive individuals who never do physical activity; group 2 consists of moderately active individuals who do physical activity occasionally, although not frequently or regularly; and group 3 consists of individuals who do physical activity regularly.

Depression Scale scores show a statistically meaningful difference between physical activity status (F=3.331, p=0.039). It is seen that individuals who do regular physical activity have lower depression scale scores compared to sedentary individuals.

Physical Function scores show a statistically meaningful difference between physical activity states (F=7.167, p=0.001). It is seen that individuals who do regular physical activity have higher physical function scores compared to sedentary individuals. At the same time, it was determined that moderately active individuals had higher physical function scores compared to sedentary individuals.

Energy/Vivacity/Vitality scores show a statistically meaningful difference between physical activity states (F=3.859, p=0.024). It is seen that individuals who do regular physical activity have higher energy/vigor/vitality scores compared to sedentary individuals. The values of the patients' daily fiber intake, quality of life, and physical activity level of depression are shown in Table 4.12.

Table 4.12. Investigation of Depression, Quality of Life, and Daily Fiber Intake in terms of Physical Activity Status

	Physical Activity Status			F	p	Multiple comparisons
	Active	Moderately Active	Inactive			
	Mean±SD	Mean±SD	Mean±SD			
Depression Scale	2.25±1.91	3.61±3.18	5.53±4.42	3.331	0.039	1<3
Physical Function	83.75±15.29	69.63±25.84	46.47±33.25	7.167	0.001	1>3, 2>3
Physical Role Difficulty	68.75±45.81	55.79±45.76	29.41±44.4	2.932	0.057	
Emotional Role Difficulty	87.5±35.36	54.74±48.6	50.98±48.76	1.850	0.162	
Energy/Vivacity/Vitality	57.5±27.12	45.79±19.11	35±19.61	3.859	0.024	1>3
Mental Health	70.5±15.7	56.67±18.98	56.47±22.53	1.920	0.151	
Social Functionality	64.38±24.43	62.87±19.03	58.24±29.31	0.389	0.678	
Pain	81.25±22.16	75.79±30.17	58.82±31.8	2.577	0.080	
General Health	55.63±32.23	51.53±22.49	38.53±17.3	2.660	0.074	
Daily fiber intake	15.88±3.55	17.43±6.57	17.03±7.74	0.218	0.805	

ANOVA test

p<0.05

Physical Function scores show a statistically significant difference in relation to smoking (t=2.300, p=0.025). It is seen that smokers have higher physical function scores compared to non-smokers. The values of the daily fiber intake, quality of life, and depression status of the patients in terms of smoking are shown in Table 4.13.

Table 4.13. Investigation of Depression, Quality of Life, and Daily Fiber Intake in Terms of Smoking

	Smoking		t	p
	Yes	No		
	Mean±SD	Mean±SD		
Depression Scale	4.43±2.99	3.66±3.46	0.949	0.345
Physical Function	75.71±15.11	65.51±29.58	2.300	0.025
Physical Role Difficulty	50±42.57	53.54±47.25	-0.339	0.737
Emotional Role Difficulty	49.21±47.86	57.91±48.47	-0.749	0.455
Energy/Vivacity/Vitality	40.71±21.64	45.96±19.89	-1.081	0.282
Mental Health	57.52±23.82	57.58±18.57	-0.011	0.991
Social Functionality	66.33±24.37	61.46±20.21	0.967	0.335
Pain	76.19±33.98	73.23±29.72	0.404	0.687
General Health	47.86±23.69	50.4±22.81	-0.462	0.645
Daily fiber intake	16.23±6.4	17.5±6.61	-0.804	0.423

t-test

p<0.05

Energy/Vivacity/Vitality scores show a statistically significant difference between alcohol use status (t=2.537, p=0.012). It is seen that individuals who drink alcohol have higher energy/vigor/vitality scores compared to those who do not drink alcohol. The values of the daily fiber intake, quality of life, and depression status of the patients in terms of alcohol use are shown in Table 4.14.

Table 4.14. Investigation of Depression, Quality of Life, and Daily Fiber Intake in Terms of Alcohol Use

	Alcohol use		t	p
	Yes	No		
	Mean±SD	Mean±SD		
Depression Scale	3.33±3.67	3.82±3.39	-0.339	0.735
Physical Function	84.17±21.31	66.4±27.92	1.533	0.128
Physical Role Difficulty	58.33±49.16	52.63±46.37	0.293	0.770
Emotional Role Difficulty	50±54.77	56.73±48.16	-0.331	0.741
Energy/Vivacity/Vitality	65±27.39	43.99±19.36	2.537	0.012
Mental Health	69.33±25.76	56.95±19.03	1.527	0.129
Social Functionality	57.75±25.24	62.55±20.82	-0.545	0.587
Pain	87.5±30.62	73.03±30.33	1.139	0.257
General Health	61.67±32.81	49.34±22.28	1.289	0.200
Daily fiber intake	18.09±7.8	17.23±6.53	0.312	0.756

t-test, p<0.05

5. DISCUSSION

The study was conducted with 120 adult patients with type 2 diabetes registered in Family Health Center in Istanbul. The relationship between dietary fiber intake and depression and quality of life was examined. Dietary or medical nutrition therapy is of great importance in patients with type 2 diabetes because it provides reasonable glycemic control and prevents several negative consequences expressed as micro and macrovascular complications (67). Nutritional therapy is recognized as an integral part of preventing the development of diabetes, managing diabetes that has already occurred, and patient self-management education (68). The Mediterranean diet stands out as a model recommended by the American Diabetes Association (ADA) for the medical nutrition therapy of Type 2 diabetes due to its positive effects on glycemic control and beneficial impact on cardiovascular risk factors (69).

In people with type 2 diabetes, dietary fiber, carbohydrate quality, and the amount consumed have been found to reduce the risk of all-cause mortality and cardiovascular disease-related mortality in these patients (70). Dietary fiber intake is recommended to be 25-30 g or 14 g/1000 kcal (71). In our study, the daily fiber intake of our patients ranged from a minimum of 5.71 to a maximum of 54.94, with a mean of 17.27, which was below the recommended amount.

In an Italian study conducted with 540 type 2 diabetes patients, similar to our study, three-day (2 days on weekdays and 1 day on weekends) food consumption records were obtained from the patients and analyzed by the physicians and dietitians in the team. The dietary fiber intake of the patients remained below the recommended amounts and was between 15-20 g, close to the daily fiber intake of 17.27 g in our study. In the said study, only 6% of the patients were able to approach the ideal intake. In the study by Rivellese et al. (2008), the mean age was 61 ± 5 years, similar to the mean age of 56 ± 10 years found in our study. While BMI was found to be 29 ± 5 kg/m² in the same study, a mean BMI of 31 ± 6 kg/m² was found in our study (67).

In another cross-sectional study in which two different samples with type 2 diabetes were evaluated together, dietary intake was calculated using the 24-hour reminder method. Dietary intakes were assessed according to ADA recommendations. Dietary fiber intakes were 15.1 and 16.9 g/day in the two samples included in the study, similar to the mean dietary fiber intake of 17.27 g in our study, but below the target recommendation of 20-35 g/day. In this cross-sectional study by Sigal et al. (2008), the

mean BMI of participants who did not meet the ADA recommendations was 32 ± 0.2 kg/m², while the BMI of those who met the recommendations was 29.3 ± 0.8 , kg/m² suggesting that patients with inadequate fiber intake were more obese (72). In parallel with this study, in our study, participants did not have sufficient fiber intake and only 11% of our study group was found to be normal weight, and 49% of our study group was found to be obese and morbidly obese.

In another study conducted with 1523 type 2 diabetic patients, a questionnaire was applied to the participants to determine their eating habits and physical activity status. According to the study's results, dietary fiber intake, especially the amount from fruits and vegetables, was quite inadequate in obese type 2 diabetic patients compared to those with normal weight (73). Based on this, considering that almost half of our study group was obese and morbidly obese, inadequate fiber intake may be due to insufficient fruit and vegetable consumption. In the study by Laissaoui et al. (2016), similar to our study, the number of women participants was found to be high (988 women, 535 males). In the same study, the mean age of the patients was 58 ± 9.9 years, almost the same as the mean age in our study. 64% of the patients were in the obese category, and this value was close to the 49% value in our study (73).

In a study aiming to examine the association of dietary carbohydrate, sugar, and dietary fiber intake with the presence and prevalence of depressive symptoms in older adults, data collected from participants over 55 and over 60 were analyzed. A scale for determining depression and, as in our study, the SF-36 quality of life scale was used. A depression rate of 24% was observed in 1918 people analyzed. According to the information included in the results, there was no relationship between dietary fiber intake and depressive symptoms. The only food group that showed a significant relationship was fruit consumption. Vegetable, bread, and cereal consumption was not found to be associated with depressive symptoms (74). Although our study did not approach dietary fiber intake on a nutritional basis, it determined that the daily fiber intake was not associated with depression and reached a similar conclusion to the aforementioned study. Considering the food consumption records, it can be concluded that the consumption of cereals, bread, and vegetables, which are fiber sources that can be regarded as relatively affordable in parallel with the economic level of our study group, is high and that the relationship between fiber intakes and depressive symptoms is not found for this reason. However, the fact that the study in question was not

conducted with patients with type 2 diabetes should not be ignored, which would create an inadequacy at the point of comparison.

In a meta-analysis of 17 prospective cohort studies of dietary fiber intake and risk of type 2 diabetes involving 19033 cases and 488293 participants, when total dietary fiber, cereal fiber, fruit fiber, or insoluble fiber intake and the highest and lowest categories were compared, the inverse association between dietary fiber intake and risk of type 2 diabetes was supported, but the results could not be conclusive (75). Total fiber and cereal fiber intake were associated with type 2 diabetes risk. In addition, in contrast to the study by Gopinath et al. (2017), no dose-response relationship was found for fruit fiber intake with type 2 diabetes risk (74, 75). In a prospective cohort study of 35988 middle-aged women without diabetes at baseline, 1141 cases of diabetes were identified during 6 years of follow-up. Total grain, whole grain, cereal fiber, and diabetes incidence showed strong associations. Total carbohydrate intake, refined grains, fruits and vegetables, and soluble fiber were not associated with diabetes risk (76). According to these results, total fiber intake generally gave more consistent results regarding the association, while different results were obtained for food group-based examinations. Since it is not known from which food group the 3-day total fiber intake of our participants predominantly came from, the source of inadequate fiber intake cannot be clearly determined.

In the study by Gopinath et al. (2017), a decrease in the risk of type 2 diabetes was found when total dietary fiber intake was 25 g or more per day. The risk of type 2 diabetes was found to decrease by 6% for a 10 g/day increase in total dietary fiber intake and by 6% for a 2 g/day increase in cereal fiber intake, while the relationship between fruit fiber intake and type 2 diabetes was not statistically significant (75). When our study is examined, it can be said that our study group had low levels of benefiting from dietary fiber's protective or therapeutic effects, both because we studied patients diagnosed with type 2 diabetes and because our group's daily fiber intake was 17 g.

In a case-control study in which 98 individuals with type 1 and type 2 diabetes were examined to determine diet quality and adherence to dietary recommendations, fiber intake for the whole group was found to be 19.4 g/day, a value below ideal. Fiber and fruit, and vegetable intake were not in amounts to meet the recommendations (77). Although not all of the group had type 2 diabetes, since the majority of the group had

type 2 diabetes, it would be appropriate to compare the similarity with the fiber intake in our study.

One in every four people with type 2 diabetes has symptoms of depression. Depression makes it difficult to control diabetes and increases the risk of macro-micro complications caused by diabetes (13). Patients with type 2 diabetes have to cope with both depression and diabetes stress as mental health problems (78). This stress increases the likelihood of depression symptoms after the diagnosis of diabetes (13). The presence of depression in patients with type 2 diabetes leads to poor quality of life, and treating depression results in improved quality of life (78, 79)

Diet is an important lifestyle factor in managing type 2 diabetes and is also significantly associated with depression risk. A meta-analysis designed to observe the effect of a healthy dietary pattern on depression in patients with type 2 diabetes found that a healthy diet significantly reduced the likelihood of depression in patients with type 2 diabetes compared to those without diabetes. At the same time, the study added that depressive symptoms regressed in dietary patterns in which adequate and balanced amounts of all nutrients could be obtained. The researchers considered fiber consumption, which is included in these balanced dietary elements, as precious (80). In our study, when we look at our total population, although no significant relationship was found between daily fiber intake and depression, there is a critical situation here. Although the Beck Depression Screening Inventory for Primary Care (BDI-PC), which we used to test depression, does not have a cut-off score, the scale reveals a 90% probability of depression at a rate of 4 points and above. The depression score we obtained in our study was 3.79 ± 3.39 for the whole group. The closeness to the estimated cut-off score suggests our hypothesis is still verifiable. However, there is still a discrepancy between our study and the study of Dipnall et al. (2015) (80).

In a study involving 17866 people aged 20 years and older, dietary intakes were taken with a 24-hour reminder method, in which fiber intake and depression status of two groups with and without type 2 diabetes were compared. According to the study results, age, gender, fiber consumption, and depression were found to be associated. The most important study result is the following: Increasing dietary fiber intake reduced the incidence of depression in the group without type 2 diabetes but not in the group with type 2 diabetes (81). Similarly, in our study, no relationship was found between dietary fiber intake and depression in our population with type 2 diabetes. The important aspect of this study, which we compared with our study, is that it examined the effect of fiber

intake on the depression parameter for the group with and without type 2 diabetes. It is important to see this distinction and to reach a similar conclusion with our study.

In the study by Mao et al. (2022), BMI (kg/m^2) was associated with depression. However, no relationship between depression and BMI (kg/m^2) was found in our study. This may be due to the fact that the study of Mao et al. (2022) was conducted with both people with and without type 2 diabetes (81).

In a study conducted with 3609 type 2 diabetics, a relationship was found between depression, which is among mental health problems, and quality of life. Depression was associated with lower quality of life (82). Similarly, in our study, the presence of depression was found to be related to many sub-layers of the quality of life scale, and the result of the study mentioned above supports the result of our study. A different point stands out in this study: Diabetes is a disease state in which patients have less freedom to eat what they want. In the study, it was also found that in an environment where the person's disease is already known, there is environmental pressure on the foods that the person eats. It was concluded that this loss of dietary flexibility led to poor quality of life in patients. The current state of psychological stress can be a trigger for depression and anxiety in patients. The significant relationship we found between depression and quality of life in our study may have occurred due to a social environment and loss of dietary flexibility, similar to the study by Donald et al. (2013) (82).

In a meta-analysis of 18 studies involving a total of 57109 type 2 diabetes patients, Jing et al. (2018) found no significant association of dietary control with quality of life in type 2 diabetes patients. The study only found that a daily diet plan that included more red meat had a negative effect on quality of life (62). In our study, we also found that there was no significant association between dietary fiber intake and quality of life. At this point, since dietary fiber, which we specifically focused on, is among the elements of dietary control other than red meat, the result of the study of Jing et al. (2018) and our study is in line with the result of our study (62).

In a cross-sectional study of patients over 18 years of age with type 2 diabetes, 1394 patients were examined. The SF-36 Quality of Life Scale was included in this study, just as we used in our study. In this study, the quality of life of patients with type 2 diabetes was generally found to be inadequate. Depression stands out as the factor that has the highest impact on quality of life (31). In our study, weak, moderate and strong negative relationships were found between depression and many sub-layers of the

quality of life scale. This relationship, in which it is concluded that as the symptoms of depression increase, the quality of life decreases, is consistent with the results of the aforementioned study.

In the study by Cruz et al. (2018), it was observed that women had lower quality of life scores (31). One of the important results of our study was that men had higher quality of life scores than women, that is, their quality of life was higher. When the quality of life is analyzed in terms of gender, our study and the aforementioned study support each other.

In the study of Gopinath et al. (2017), which examined the effect of soluble fiber on metabolic syndrome and cardiometabolic risk factors in patients with type 2 diabetes, women patients were found to have a higher prevalence of depression symptoms (74). In our study, although no relationship was found between male gender and depression in our male participants, it was found that depression was negatively associated with quality of life. At the same time, since the quality of life scores of our male population were found to be high in our study, it can be interpreted that depressive symptoms are less in this gender group. Therefore, it can be said that high quality of life and low depressive symptoms were found in the male gender, confirming the study of Gopinath et al. (2017) (74).

In a cross-sectional study conducted to determine the factors associated with health-related quality of life in type 2 diabetics, the SF-36 scale was used to determine quality of life. The results showed that women had lower scores in the lower layers of the SF-36 scale compared to men (83). In our study, the same quality of life scale was used and the same results were obtained in the same direction. It is seen that the two studies confirm each other. In this study conducted with 283 patients with type 2 diabetes, the mean age of the participants was 56.4 ± 13.2 years (83). The mean age of the study was very similar to the mean age of our study, which was 56.4 ± 10.4 .

In a cross-sectional study involving 4923 patients with type 2 diabetes, the relationship between gender differences and cardiovascular risk factors, lifestyle, and psychological factors was examined. The dietary fiber intake of the study group was $< 20\text{g/day}$. In terms of gender, the dietary fiber intake of women participating in the study was found to be lower than men. Accordingly, their depression scores were found to be higher (84). Similarly, in our study, the daily fiber intakes of men were found to be higher in men than in women, and in our study, our fiber intake remained below 20

g/day. However, in contrast to the aforementioned cross-sectional study, no significant relationship was found between dietary fiber intake and depression in our study.

In a study examining the effect of wheat bran on glycemic control and cardiovascular disease risk factors in type 2 diabetes, 23 patients with type 2 diabetes were studied for 3 months. The fact that there was no change in fasting blood glucose and hba1c values during the treatment revealed that it did not affect glycemic control. It also did not improve risk factors for cardiovascular disease (85). In our study, the relationship between dietary fiber and quality of life was examined, and no relationship was found with dietary fiber intake. It is a known fact that quality of life is largely affected by macro and micro complications of diabetes. Therefore, according to the results of the aforementioned study, the lack of effect of dietary fiber intake on the complications of diabetes and glycemic control will lead to low quality of life for patients with diabetes in the study group. Based on this, it can be said that similar results were indirectly reached with our study.

In the study by Cruz et al. (2018), hypertensive patients constituted 74% of the general population (31). Similarly, hypertension was the leading complication in our study. In the study of Laissaoui et al. (2016), 60% of the patients in the study group were hypertensive, while this value was close to the mentioned study with 52% in our study (73).

In the study by Mao et al. (2022), the sample consisted of individuals with and without type 2 diabetes. In the study population, hypertensive individuals, less educated individuals, and individuals with low physical activity had a higher prevalence of type 2 diabetes (81). Our study group consisted entirely of individuals with type 2 diabetes, and, similar to the aforementioned study, more than half of our study group consisted of hypertensive individuals. At the same time, similar to the study of Mao et al. (2022), when we look at the results of our study; it is seen that physical activity levels are low, and 59% of our patients are primary school graduates and literate in terms of educational level (81).

In a study examining the effect of soluble fiber on metabolic syndrome and cardiometabolic risk factors in patients with type 2 diabetes, 44 patients with type 2 diabetes were given soluble fiber supplements for 4-6 weeks. The study results showed that soluble fiber had beneficial effects on the associated parameters. This study found positive effects of dietary fiber on complications and, thus, quality of life (74). In our study, dietary fiber was found to have no impact on these parameters. However, the

same study makes two different important points. The first of these The first is that the result may be related to the fact that type 2 diabetics in the study group were a group with strong glucose control at the beginning of the study (74). The physician-nurse observation of our study group was that their medication compliance and compliance with dietary recommendations were poor. Accordingly, the fact that we could not obtain similar positives with the study in question may be due to the poor cooperation of our study group in treatment. Another important point of the study was that the frequency of doctor and dietitian visits affected the change in the participants. According to the researchers, in this intervention study, which observed a change that lasted for 4-6 weeks, the group's frequent meetings with the doctor and dietitian may have played an important role in the positive trend of the results (74). In this regard, the fact that we had a single interview with the participants in our study group and that our study was a cross-sectional study may have caused the difference between the results.

The presence of complications and hypertensive status were associated with poor quality of life in the study by Jing et al. (2018) (62). Hypertension, which was present in more than half of our study group, may have a significant quality of life decreasing effect on our participants, considering the study of Jing et al. (2018) (62).

Inadequate physical activity is among the risk factors in the development and management of diabetes. Exercise has an important role in the treatment of type 2 diabetes and the management of complications (86). Adding physical activity or exercise to the routine as a lifestyle change has an effect on improving quality of life (62).

In the study by Laissaoui et al. (2016), the physical activity practice of the patients participating in the study was poor. Similar to our study, the majority of the patients in this study were middle-aged women with no active working life. Considering their daily routines, this study attributed the inadequacy in physical activity to sociocultural reasons (73). In our study, the percentage of our group who engaged in regular physical activity was 6.7%. The remaining part stated that they were active in their daily activities. Considering that we conducted our study with a population similar to the study of Laissaoui et al. (2016), it would be appropriate to attribute this result to sociocultural reasons (73).

In a study of 300 physically inactive sedentary type 2 diabetics, the effect of physical activity on cardiovascular risk factors was observed. It was found that the time spent sedentary decreased with the increase in exercise, and a 1% decrease was

observed in HbA1c levels, which is an important indicator in the management of type 2 diabetes; waist circumference, body weight, and fasting blood glucose improved. Significant improvements in cardiometabolic risk factors occurred in patients who applied the most significant difference in exercise to their lives (87). Considering that 6.7% of the patients in our study practiced regular physical activity and 52% of our patients were hypertensive, it can be considered that lack of exercise leads to hypertension by threatening cardiovascular health in patients.

In Ohkuma et al. study, women were more likely to have unhealthy factors in general and therefore had a lower quality of life than men. Women had lower rates of exercise, and depression symptoms were higher than men (84). Similarly, in our study, it was observed that men had higher quality of life scores than women, and since depression and quality of life were related, they were at a better point in terms of quality of life. At the same time, our study determined that the depression scores of those who engaged in regular physical activity regardless of gender were lower, and their quality of life was higher. We have reached a similar result obtained by Ohkuma et al.(2023) (84).

In a meta-analysis of 18 studies, including a total of 57109 type 2 diabetes patients, it was found that an increase in physical activity was associated with a better quality of life. Physical activity was found to improve quality of life in most dimensions of the SF-36 quality of life scale, which is the quality of life scale we used in our study. The presence of depression was also found to be a negative condition in terms of quality of life in the study by Jing et al. (2018) (62). Similarly, in our study, a better mental health status or a better quality of life with lower depressive symptoms was observed in patients with adequate physical activity. The fact that we used the same quality of life scale as Jing et al. (2018) also increases the accuracy of the comparison (62).

In a study investigating the effects of physical activity on depression in adults with diabetes, when the study group was analyzed according to educational status, primary school graduates and below constituted the highest rate (48.3%) (88). Similarly, in our study, it is observed that a very high proportion of our participants, 59%, had an educational status of primary school graduates and below.

In this study conducted with 418 people diagnosed with diabetes aged 19 and over, it was found that gender and income status affected depression. The study states that woman gender is more depressed than male gender (88). Similarly, our study

confirms that gender affects depression, and when the depression scores of our participants are analyzed, it is confirmed that men are less depressed than women.

In Kim's study (2018), 70% of the participants were classified as married in terms of marital status. The study did not find a relationship between marital status and depression (88). Our study population consisted of married individuals, with a rate of 85%. Similar to Kim's study (2018), no relationship was found between marital status and depression in our study. In the study conducted by Cruz et al. (2018), 82% of the participants were married, and 18% were single (31). These percentages are very close to the aforementioned study, with 85% and 15% in our study.

In Al Hayek et al. (2014) study, economic status is a determinant point. It was found that the quality of life of the low-income population was low. It was found that low socioeconomic status and high school or lower education strongly affected patients' quality of life (83). Since it is known that our study group is also economically inadequate in terms of its structure and the high school graduates and below have a share of 91% in parallel with the study above, it can be said that the low quality of life is due to economic reasons and low education level.

In a prospective study with 1604 healthy subjects over 30 years of age, in which the relationship between dietary fiber intake and diabetes incidence was examined, the level of education was significantly lower in participants who developed type 2 diabetes (89). Both the study mentioned above and our study support that the level of education is of great importance in the occurrence of diabetes, its management, and food choices. In our study, our dietary fiber intake were below ideal, and the educational level of our population was predominantly literate and primary school graduates.

In a cross-sectional study conducted with 604 type 2 diabetic patients aged 45 years and older, it was found that marital status affected quality of life. The study concluded that the quality of life scores of those who were married and had a low level of education were higher than those who were divorced and university graduates. It is explained that this result in the said study was due to the limitation of the socialization time of highly educated patients by their professional commitment (90). In this study, a different result emerged from the results of our study and Kim's study (2018) regarding the relationship between marital status and quality of life. This may be related to the social structure of the populations studied. At the same time, it is seen that a contrasting result was reached with our study in terms of educational status.

In the study by Donald et al. (2013), it was found that diabetes-specific quality of life was better at older age, and this was thought to be due to the stabilization in professional life and the cumulative financial situation with age. Since expectations from life decreased with age, it was thought that these patients were satisfied with their lives even if the disease condition was present (82). Unlike this study, we observed that our study group's quality of life scores decreased with age and that there was a lower quality of life for our group at older ages. According to the comments of this study, it can be concluded that this incompatible result is due to the low socioeconomic level of the population we studied and that although they lowered their life expectations since they had financial difficulties, their continued concerns about their livelihood were also effective in this regard.

The study by Cruz et al. (2018) found that patients with inadequate quality of life were at advanced ages (31). Similarly, our study concluded that patients under 50 years had an advantage in some of the sub-layers of the quality of life scale compared to patients aged 51-65 and over 65 years. The study conducted by Al Hayek et al. (2014) observed that patients aged 50 years and below were at a better point in terms of quality of life compared to patients aged 50 years and above (83). This study is in parallel with our results and confirms our results.

A meta-analysis of 16383 type 2 diabetics from 19 prospective cohort studies found that smokers had a 38% increased risk of type 2 diabetes compared to non-smokers. For every 10 cigarettes smoked, there was a 16% increase in diabetes risk (91). Smoking, among the modifiable risk factors of diabetes, increases the incidence of type 2 diabetes and makes it difficult to manage diabetes. Smoking has been found to decrease insulin sensitivity and increase inflammation and oxidative stress leading to insulin resistance (92). In our study, a smoking rate of 17% was found. Although all these results emphasize that smoking leads to increased diabetes risk and poor diabetes control, a surprising result emerged in our study. Physical function score, one of the sub-parameters of the quality of life scale, was higher in smokers. Based on this result, it would not be correct to conclude that smoking patients have a good quality of life. Because the quality of life scale used has many sub-parameters.

A total of 706716 people from 26 studies involving 31621 cases found that low and moderate alcohol consumption was associated with a lower risk of type 2 diabetes. The study also found that excessive alcohol consumption did not affect the incidence of type 2 diabetes. The researchers added that excessive alcohol consumption may pose a

threat to cirrhosis of the liver and may indirectly lead to type 2 diabetes. Although the study also stated that the mechanism underlying the reduction in type 2 diabetes risk due to alcohol consumption is still not clearly explained, it was interpreted that low to moderate alcohol consumption may be associated with increased insulin sensitivity and low fasting insulin resistance (93). Our study found a significant relationship between alcohol consumption and one of the sub-parameters of the quality of life scale. Quality of life scores were higher in our participants who consumed alcohol. The results of this study suggest that moderate alcohol consumption may be beneficial in facilitating the management of existing diabetes due to its positive effects. This may also have positive effects on quality of life. In our study, the positive relationship between alcohol consumption and quality of life may be due to moderate alcohol consumption.

In a cross-sectional study examining alcohol consumption in adult patients with diabetes, it was found that the addiction levels of the patients examined were low, and most of them were distant from alcohol consumption (94). Similarly, in our study, it was observed that 5% of the participants consumed alcohol, and 95% did not consume alcohol.

In a study evaluating the relationship between alcohol intake and cardiovascular complications in individuals with type 2 diabetes, there is evidence that individuals with type 2 diabetes who reported moderate alcohol intake had a lower risk of cardiovascular events, microvascular complications, and all-cause mortality within 5 years compared to those who reported no alcohol intake. This effect was particularly pronounced in wine drinkers (95). Cardiovascular complications are health problems that seriously affect the quality of life. In our study, a relationship was found between high scores in quality of life parameters and alcohol intake. According to the results of the aforementioned study, since moderate alcohol consumption had a positive effect on cardiovascular complications and considering the complication-quality of life relationship, it can be concluded that our study group consumed moderate amounts of alcohol. A daily intake of less than 20 g of alcohol is defined as 'light drinking,' 20-70 g of alcohol is defined as 'moderate drinking,' and more than 70 g of alcohol is defined as 'heavy drinking' (96).

6. CONCLUSION

A total of 120 individuals, 82 women (68.3%) and 38 men (31.7%), who applied to Family Health Center No. 3 in Kartal District of Istanbul province between March 2023 and May 2023, were included in this study. The relationship between the dietary fiber intake of the participants and their depression and quality of life was examined.

Our study found no association between dietary fiber intake and quality of life and depression in patients with type 2 diabetes, but this result does not mean that dietary fiber is unimportant for patients with type 2 diabetes. Dietary fiber intake, especially soluble fiber intake, is vital in the proper management of type 2 diabetes, blood glucose regulation, and the prevention of macro- and microvascular complications. Although no significant association was found between dietary fiber intake and depression, dietary fiber has been found to regulate gut microbiota with the help of SCFA and improve mental health through the brain-gut axis. Our study did not detect a significant relationship between dietary fiber and quality of life, but the results of well-controlled type 2 diabetes and reduction in depressive symptoms, which are the conditions mentioned above, confirm an indirect effect on quality of life. In our study, quality of life and depression were associated. Accordingly, good quality of life in this patient group will lead to lower depressive symptoms. Our study also found that physical activity was associated with depression. A non-sedentary life is very beneficial for mental health.

Our study has some limitations. The first is that the Ministry of Health applies strict permission protocols for external researchers. Therefore, a study requiring blood analysis could not be planned. At the same time, the diabetes age of the patients in our study could not be taken due to the limited access to the date of the first diabetes diagnosis. Another limitation, our population's low education level, caused data collection difficulties. Considering the average age of our participants, the situation of forgetting and not remembering has developed in retrospective data collection. The decrease in the transparency of the answers can be counted as another limitation when it is learned that the person who administered the questionnaire is a dietitian.

The study was conducted in The Family Health Center No. 3, a primary health care institution. The results can be generalized to the entire first step but not the 2nd and 3rd steps. Further studies are needed to understand these associations and their mechanisms better.

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ANNEXES

Annex-1

BİLGİLENDİRİLMİŞ GÖNÜLLÜ OLUR FORMU

- **Araştırmanın Adı**

İstanbul İli Kartal İlçesi Birinci Basamak Sağlık Kuruluşuna Başvuran Tip 2 Diyabetli Yetişkin Hastalarda Diyet Lifi İle Depresyon ve Yaşam Kalitesi İlişkisi

- **Çalışmanın Niteliği**

Araştırma, yüksek lisans tezi amacıyla yürütülecek olan kesitsel bir araştırmadır.

- **Araştırmanın Amacı**

Diyetle alınan lif miktarının depresif belirtileri azalttığı, tip 2 diyabetin yönetimini kolaylaştırdığı tespit edilmiştir. Yapılacak olan araştırmada amaç: Tip 2 diyabetli yetişkin hastaların diyetle aldıkları toplam lif miktarını hesaplayarak, depresif durumlarını ve yaşam kalitelerini bu miktarla ilişkilendirmek ve bu yolla bu ilişkiyi saptamaktır.

- **Gönüllünün Araştırmaya Devam Etmesi İçin Öngörülen Süre**

Yapılması planlanan araştırma, aile hekimine muayeneye gelindiği esnada alınacak besin tüketim kaydı ve gerekli ölçekleri uygulama şeklinde kısa bir bilgi toplama süresi gerektirmektedir. Bu sürenin ortalama 30 dk olacağı öngörülmekte ve çalışmaya katılmaya karar veren gönüllü ile tek sefer görüşme yapılması gerekli bilgiyi toplamak için yeterli olacaktır.

- **Araştırmada Uygulanacak Yöntemler**

Boy ve kilo ölçümü yapılacak, 3 günlük besin tüketim kaydı alınacak, ‘Birinci Basamak İçin Beck Depresyon Tarama Ölçeği’ ve ‘SF-36’ Yaşam Kalitesi Ölçeği uygulanacaktır.

- **Gönüllünün maruz kalacağı öngörülen riskler veya rahatsızlıklar**

Gönüllü veri toplama sürecinde herhangi bir riske maruz kalmayacaktır.

- **Çalışmanın Maddi Boyutu**

Gönüllü çalışmaya katılmakla herhangi bir parasal yük altına girmeyecektir ve gönüllüye herhangi bir ödeme yapılmayacaktır.

- **Gönüllülerin Sorumlulukları**

Gönüllüden beklenen sorumluluk: Veriler konusunda şeffaf olunması, soruların boşluk bırakmadan cevaplanması ve cevapları doğru bir şekilde verilmesidir.

- **Gönüllülerin Çalışmaya Katılma ve Ayrılma Durumlarındaki Özgürlüğü**

Gönüllülerin çalışmaya katılımı isteğe bağlıdır ve gönüllü istediği zaman herhangi bir yaptırıma ya da cezaya maruz kalmaksızın, hiçbir hakkını kaybetmeksizin araştırmaya katılmayı reddedebilir veya araştırmadan çekilebilir. Araştırmadan çıkması veya çıkarılması halinde, hastalığı ile ilgili tedavisinde bir aksama olmayacağı konusunda güvence verilmektedir.

- **Kişisel Bilgilerin Kullanımı**

Gönüllünün kimliğini ortaya çıkaracak kayıtlar gizli tutulacaktır. Araştırma sonuçlarının yayımlanması halinde dahi gönüllünün kimliği gizli kalacaktır. İzleyiciler, yoklama yapan kişiler, etik kurul, kurum ve diğer ilgili sağlık otoritelerinin gönüllünün orijinal tıbbi kayıtlarına doğrudan erişimleri bulunmaktadır, ancak bu bilgiler gizli tutulacaktır, yazılı bilgilendirilmiş gönüllü olur formunun imzalanmasıyla gönüllü veya kanuni temsilcisinin söz konusu erişime izin vermiş olacağı bilinmelidir.

- Araştırma konusuyla ilgili ve gönüllünün araştırmaya katılmaya devam etme isteğini etkileyebilecek yeni bilgiler elde edildiğinde gönüllü veya kanuni temsilcisi zamanında bilgilendirilecektir.

- **Daha Fazla Bilgi İçin İletişim Bilgileri**

Gönüllünün; araştırma, kendi hakları veya araştırmayla ilgili herhangi bir advers olay hakkında daha fazla bilgi temin edebilmesi için temasa geçebileceği kişi ile bu kişiye ait günün 24 saatinde erişebileceği telefon numarası aşağıda yer almaktadır:

Diyetisyen Aybüke Merve DEMİRCİ İletişim numarası : +xxxxxxxxxxxxx

- **Gönüllünün/Hastanın Beyanı**

Bilgilendirilmiş gönüllü olur formundaki tüm açıklamaları okudum. Bana yukarıda konusu ve amacı belirtilen araştırma ile ilgili yazılı ve sözlü açıklama aşağıda adı belirtilen araştırmacı tarafından yapıldı. Araştırmaya gönüllü olarak katıldığımı, istediğim zaman gerekçeli veya gerekçesiz olarak araştırmadan ayrılabileceğimi biliyorum.

Söz konusu araştırmaya, hiçbir baskı ve zorlama olmaksızın kendi rızamla katılmayı kabul ediyorum.

Bu çalışma sonuçlarının kullanılmasını kısıtlamamayı, yayın, rapor ve benzeri bilimsel dokümanlarda kullanılmasını kabul ediyorum.

İster doğrudan, ister dolaylı olsun araştırma uygulamasından kaynaklanan nedenlerle meydana gelebilecek herhangi bir sağlık sorununun ortaya çıkması halinde, her türlü tıbbi müdahalenin sağlanacağı konusunda gerekli güvence verildi.

Katılımcı

Adı, soyadı:

Adres:

Tel:

İmza:

Tarih:

Görüşme tanığı

Adı, soyadı:

Adres:

Tel:

İmza:

Tarih:

Araştırmacı

Adı soyadı, unvanı:

Adres:

Tel:

İmza:

Tarih:

Annex-2



T.C.

YEDİTEPE ÜNİVERSİTESİ REKTÖRLÜĞÜ
Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu

Sayı : E.83321821-805.02.03-59
Konu : Etik Kurul Karar Yazısı

Sayın Dr. Öğr. Üyesi Gözde Dumlu Bilgin

Yeditepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kuruluna etik onay için başvuru yapılmış olan araştırma önerisinin başlığı, araştırmacılar, başvuru numarası, sunulan belgeler ve toplantı bilgileri aşağıda yer almaktadır. İlgili araştırma önerisi, etik kurulumuz üyeleri tarafından değerlendirilmiş olup, etik ve bilimsel açıdan **UYGUN** olduğuna karar verilmiştir.

Araştırma Başlığı:	İstanbul İli Kartal İlçesi Birinci Basamak Sağlık Kuruluşuna Başvuran Tip 2 Diyabetli Yetişkin Hastalarda Diyet Lifi ile Depresyon ve Yaşam Kalitesi İlişkisi
Araştırmacılar:	Aybüke Merve Demirci, Dr. Öğr. Üyesi Gözde Dumlu Bilgin
Başvuru Numarası:	202203Y0219

TOPLANTI BİLGİLERİ

Toplantı Tarihi:	08.04.2022	Toplantı Yeri:	Çevirim içi (Google Meet)
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SUNULAN BELGELER

Islak imzalı başvuru dosyası, CD veya USB belleğe kaydedilmiş başvuru dosyası ve elektronik başvuru
Araştırma başlığı ve araştırmacıların isimleri
Başvuru dilekçesi
Başvuru formu
Araştırmanın;
• Niteliği
• Önemi ve özgün değeri
• Amaç ve hedefleri
• Yöntemi
• Yönetimi
• Yaygın etkisi
• Araştırma bütçesi (Mevcutsa)
• Süresi ve uygunluğu (Zaman cetveli)
• Kaynakları
Bilgilendirilmiş Gönüllü Olur Formu (yapılan araştırmaya özel olarak hazırlanmış)

Bu belge, güvenli elektronik imza ile imzalanmıştır.

Annex-3



T.C.
İSTANBUL VALİLİĞİ
İl Sağlık Müdürlüğü

Sayı : E-15916306-604.01.01-210719040
Konu : Aybuke Merve DEMİRCİ'nin Tez
Araştırma İzni Hk.

YEDİTEPE ÜNİVERSİTESİ REKTÖRLÜĞÜNE
(Yazı İşleri Müdürlüğü)

İlgi : 02.02.2023 tarihli ve E.21568116-302.14.01-1477 sayılı yazınız.

İlgi sayılı yazınızda konu olan Üniversiteniz Sağlık Bilimleri Enstitüsü Beslenme ve Diyetetik Anabilim Dalı Yüksek Lisans Programı 20203036020 no'lu öğrencisi Aybuke Merve DEMİRCİ'nin, Dr. Öğr. Üyesi Gözde DUMLU BİLGİN'in danışmanlığında yürüteceği "**İstanbul İli Kartal İlçesi Birinci Basamak Sağlık Kuruluşuna Başvuran Tıp 2 Diyabetli Yetişkin Hastalarda Diyet Lifi ile Depresyon ve Yaşam Kalitesi İlişkisi**" konulu tez araştırmasını, Müdürlüğümüze bağlı Kartal 3 No'lu Aile Sağlığı Merkezinde yapma talebi Birimimize iletilmiştir.

Söz konusu araştırma, Müdürlüğümüz Sağlık Hizmetleri Başkanlığı Araştırma, Basılı Yayın, Duyuru İçeriği Değerlendirme Komisyonu **16.02.2023 tarih ve 2023 / 02** sayılı kararınca; 24.03.2016 tarih ve 6698 sayılı Kişisel Verilerin Korunması Kanununda belirtilen maddelere riayet edilmesi, Aile Hekimleri mevzuatına uygun olarak Aile Sağlığı Merkezinin işleyişine ve güvenirliliğine zarar vermeden, ilgili kurumun uygun gördüğü zaman diliminde ve başvuru dosyasındaki aralık gözetilerek Koordinasyonun ilgili Aile Sağlığı Merkezi Sorumlu Hekimince sağlanması sartı ile oy birliği ile uygun görülmüştür.

Çalışmanın ilgili Aile Sağlığı Merkezinin uygun gördüğü zaman diliminde (Başvuru dosyasında belirtilen aralık gözetilerek) sürecin koordinasyonunun ilgili Merkezce sağlanması ve araştırmanın bitiminde bir nüshasının elektronik ortamda (CD halinde) Müdürlüğümüze teslim edilmesi gerektiğinin başvuru sahibine tebliği hususunda;

Gereğini bilgilerinize arz ederim.

Uzm. Dr. Hasan Basri VELİOĞLU
Müdür a.
Başkan

Bu belge, güvenli elektronik imza ile imzalanmıştır.

Belge doğrulama kodu: C74A1872-49F5-4C08-837A-D81073F4637D

Belge doğrulama adresi: <https://www.turkiye.gov.tr/saglik-bakanligi-ebys>

Binbirdirek mah. Peykhane sok. No: 8 Fatih/İSTANBUL 34122
Telefon No: 02126383000
e-Posta: ist.sagligingel@saglik.gov.tr İnternet Adresi:
<https://istanbulism.saglik.gov.tr/>
Kep Adresi: ism.34@hs01.kep.tr

Bilgi için: Arzu SARMUSAK
Sürekli İşçi

Telefon No: 02126383399 - 3126



Annex 4

YEDİTEPE ÜNİVERSİTESİ
BESLENME VE DİYETETİK BÖLÜMÜ YÜKSEK LİSANS TEZİ
VERİ TOPLAMA FORMU

DEMOGRAFİK BİLGİLER	
Ad-Soyad:	
Yaş:	
Cinsiyet:	() Kadın () Erkek
Medeni Hali:	() Evli () Bekar
Eğitim Durumu:	

ANTROPOMETRİK ÖLÇÜMLER	
Boy:	
Kilo:	
BKI:	

TIBBİ ANAMNEZ	
Diyabet Harici Konik Hastalıklar:	() Hipertansiyon ()Kanser ()KOA () Kalp Yetmezliği ()Kronik Böbrek Yetmezliği () Diğer
Kullanılan İlaçlar/ Takviyeler:	
Fiziksel Aktivite Durumu:	() Düzenli haftada kaç gün?..... () Hareketli () Hareketsiz
Sigara Kullanımı:	() Evet () Hayır
Alkol Kullanımı:	() Evet () Hayır

1. gün (hafta içi)

Öğün adı	Besinler	Porsiyon	İçindekiler	Ölçü	Tüketilen miktar
Kahvaltı					
Ara					
Öğle					
Ara					
Akşam					
Ara					

2. gün (hafta içi)

Öğün adı	Besinler	Porsiyon	İçindekiler	Ölçü	Tüketilen miktar
Kahvaltı					
Ara					
Öğle					
Ara					
Akşam					
Ara					

3. gün (hafta sonu)

Öğün adı	Besinler	Porsiyon	İçindekiler	Ölçü	Tüketilen miktar
Kahvaltı					
Ara					
Öğle					
Ara					
Akşam					
Ara					

Annex-5

SF-36 QUALITY OF LIFE SCALE

SF-36 Yaşam Kalitesi Ölçeği

Aşağıda son 4 hafta içinde sağlığınız hakkında görüşlerinizi belirlemek için sorular bulunmaktadır. Lütfen her bir soruyu dikkatle okuyarak altında bulunan cevap seçeneklerinden sizin için en uygun cevabı işaretleyiniz.

1. Genel olarak sağlığınız

1. Mükemmel 2. Çok iyi 3. İyi 4. Orta 5. Kötü

SAĞLIĞINIZ VE GÜNLÜK AKTİVİTELER

2. Bir yıl öncesi ile karşılaştırdığınızda, şimdiki sağlığınızı genel olarak nasıl buluyorsunuz?

Bir yıl öncesinden çok daha iyi 1

Bir yıl öncesinden biraz daha iyi 2

Hemen hemen aynı 3

Bir yıl öncesinden biraz daha kötü 4

Bir yıl öncesinden çok daha kötü 5

3. Aşağıdaki sorular normal bir gün boyunca yapabileceğiniz aktiviteler hakkındadır. Sağlığınız aşağıdaki aktiviteleri yapmanızı engelliyor mu? Eğer engelliyorsa, ne kadar engelliyor? (Her satırda uygun rakamı işaretleyiniz)

AKTİVİTELERİNİZ	Evet çok engelliyor	Hayır biraz engelliyor	Hayır pek engellemiyor
a. Koşu, ağırlık kaldırma ve ağır sporlar gibi büyük çaba gerektiren aktivitelerde	1	2	3
b. Masayı, elektrik süpürGESİNİ İTMEK GİBİ Orta / hafif aktivitelerde	1	2	3
c. Paket veya çanta taşırken	1	2	3
d. Birkaç kat merdiven çıkarken	1	2	3
e. Bir kat merdiven çıkarken	1	2	3
f. Eğilirken, çömelirken	1	2	3
g. Bir kilometreden fazla yürürken	1	2	3
h. Birkaç yüz metre yürürken	1	2	3
i. Yüz metrelik bir mesafeyi yürürken	1	2	3
j. Giyinirken veya yıkanırken	1	2	3

4. Geçen 4 hafta boyunca, işinizde veya diğer rutin işlerinizde fiziksel sağlığınıza bağlı olarak, aşağıdaki problemlerin herhangi birinden şikayetçi oldunuz mu? (Evet ya da hayır sütunundaki rakamları yuvarlak içine alarak işaretleyiniz)

	<u>Evet</u>	<u>Hayır</u>
a. İşinizde ve diğer aktivitelerinizde sağlık sorunları yüzünden çalışma zamanınızı azalttınız mı?	1	2
b. İşlerinizde amaçladığınızdan daha az mı verimli oldunuz?	1	2
c. İş ve aktivitelerinizi zahmetsiz (kolay) olanlarla sınırladınız mı?	1	2
d. İş ve aktivitelerinizi gerçekleştirirken zorluk çektiniz mi? (örneğin ekstra çaba harcadınız mı?)	1	2

5. Geçen 4 hafta boyunca, işinizde veya diğer rutin işlerinizde ruhsal durumunuzun sonucu olarak (örneğin sinirli veya stresli), aşağıdaki problemlerden herhangi biriyle karşılaştınız mı? (Evet ya da hayır sütunundaki rakamları yuvarlak içine alarak işaretleyiniz)

	<u>Evet</u>	<u>Hayır</u>
a. İşinizde veya diğer aktivitelerinizde sağlık sorunları yüzünden çalışma zamanınızı azalttınız mı?	1	2
b. İşlerinizde amaçladığınızdan daha az mı verimli oldunuz?	1	2
c. İşlerinizi ve diğer aktivitelerinizi her zamankinden daha az dikkatli mi yaptınız?	1	2

6. Geçen 4 hafta boyunca, fiziksel ve ruhsal sağlığınız ailenizle, arkadaşlarınızla, komşularınızla ilişkilerinizi ne dereceye kadar etkiledi? (Sadece bir rakamı işaretleyiniz)

Pek etkilemedi	1
Çok az	2
Orta	3
Oldukça	4
Aşırı	5

AĞRI

7. Geçen 4 hafta boyunca, vücudunuzda ne kadar ağrı oldu? (Sadece bir rakamı işaretleyiniz)

Hiç	1
Çok hafif	2
Hafif	3
Orta	4
Fazla	5
Çok fazla	6

8. Geçen 4 hafta boyunca ne kadar ağır normal işlerinizi yapmanıza olumsuz etki gösterdi?
(Evdeki vedışarıdaki işleriniz dahil olmak üzere) (Sadece bir rakamı işaretleyiniz)

Çok değil	1
Az	2
Orta	3
Oldukça fazla	4
Aşırı	5

DUYGULARINIZ

9. Bu sorular geçen ay boyunca, kendinizi nasıl hissettiğiniz ve işlerinizin nasıl gittiği hakkındadır. Hersoru için, size en uygun gelen seçeneği yuvarlak içine alarak cevaplandırınız.

GEÇEN AY BOYUNCA	NE KADAR SÜRE					
	Her zaman	Çoğunlukla	Biraz fazla	Bazen	Çok az	Hiç
a. Tam enerjik (zinde) hissettiniz	1	2	3	4	5	6
b. Çok sinirli biriydiniz	1	2	3	4	5	6
c. Hiçbir şeyin sizi neşelendiremeyeceği kadar canınız sıkındı	1	2	3	4	5	6
d. Sakin ve huzurluydunuz	1	2	3	4	5	6
e. Fazla enerjiniz vardı	1	2	3	4	5	6
f. Moralsiz ve kederli hissettiniz	1	2	3	4	5	6
g. Çok yorgun (bitkin) hissettiniz	1	2	3	4	5	6
h. Hiç mutlu oldunuz mu?	1	2	3	4	5	6
i. Yorgun hissettiniz	1	2	3	4	5	6
j. Sağlığınız akraba ve ya arkadaş ziyaretleri gibi sosyal aktivitelerinizi sınırladı mı?	1	2	3	4	5	6

GENEL OLARAK SAĞLIĞINIZ

10. Aşağıdaki ifadeler sizi ne kadar doğru veya yanlış olarak tanımlamaktadır?

	Kesinlikle doğru	Çoğunlukla doğru	Emin değilim	Çoğunlukla yanlış	Kesinlikle Yanlış
a. Diğer insanlardan daha sık hasta oluyor gibiyim	1	2	3	4	5
b. Tanıdığım herhangi biri kadar sağlıklıyım	1	2	3	4	5
c. Sağlığımın daha kötüye gideceğini sanıyorum	1	2	3	4	5
d. Sağlığım mükemmel	1	2	3	4	5

Annex-6

BECK DEPRESSION INVENTORY FOR PRIMARY CARE

Birinci Basamak İçin Beck Depresyon Ölçeği

Hastanın yaşı: ____

Cinsiyeti: ____

Öğrenim durumu: ____

Açıklama

Bu ankette yedi grup ifade bulunmaktadır. Her gruptaki ifadeleri dikkatle okuduktan sonra bugün dahil olmak üzere son iki haftadaki duygu durumunuzu en iyi açıklayan ifadeyi seçiniz. Seçtiğiniz ifadenin yanındaki sayıyı daire içerisine alınız. Eğer bir grupta birden fazla ifade sizin durumunuza uyuyorsa en yüksek puanı alan ifadeyi seçiniz.

1. Üzüntü

- 0 Üzgün değilim.
- 1 Zaman zaman üzgünüm.
- 2 Her zaman üzgünüm.
- 3 Dayanamayacak kadar üzgün ve mutsuzum.

2. Kötümserlik

- 0 Gelecekte umutsuz değilim.
- 1 Geleceğim hakkında eskisinden daha umutsuzum.
- 2 Gelecekte çok umutsuzum.
- 3 Gelecekte beklediğim hiçbir şey yok.

3. Geçmişteki başarısızlıklar

- 0 Kendimi başarısız görmüyorum.
- 1 Yapabileceğim kadar başarılı olamadım.
- 2 Geriye baktığımda pek çok başarısızlık görüyorum.
- 3 Kendimi bir insan olarak tamamen başarısız görüyorum.

4. Kendini beğenmeme

- 0 Kendi hakkımda her zamanki gibi hissediyorum.
- 1 Kendime olan güvenim azaldı.
- 2 Kendimle ilgili hayal kırıklığı yaşıyorum.
- 3 Kendimden nefret ediyorum.

5. Kendini suçlama

- 0 Kendimi her zamankinden fazla eleştirmiyor ve suçlamıyorum.
- 1 Kendimi her zamankinden fazla suçluyorum.
- 2 Kendimi bütün hatalarım için suçluyorum.
- 3 Her kötü olayda kendimi suçluyorum.

6. İlgili kaybı

- 0 İnsanlara ve olaylara olan ilgimi kaybetmedim.
- 1 İnsanlar ve olaylara olan ilgim azaldı.
- 2 İnsanlar ve olaylara olan ilgimin çoğunu kaybettim.
- 3 Artık hiçbir şeye ilgi duymuyorum.

7. İntihar düşüncesi veya isteği

- 0 Kendimi öldürme gibi düşüncelerim yok.
- 1 Kendimi öldürme düşüncem var ama bunu yapmam.
- 2 Kendimi öldürmek istedim.
- 3 Fırsatını bulsam kendimi öldürürüm.

Toplam puan

Annex-7
RESUME

