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Research Article

Evaluation of Complication Development and Laboratory Data Between Diabetic Individuals Regularly Check-Ups and Diabetic Individuals Not Regularly Attending Check-ups at the Endocrinology and Metabolism Diseases Polyclinic of Necmettin Erbakan University Meram Faculty of Medicine Hospital

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Abstract

Objectives: Our intention is to assess the effects of routine control and diabetes education on diabetes-related complications, anthropometric measurements, and laboratory tests.

Methods: The research enrolled patients over 18 years of age who presented to the Endocrinology and Metabolic Diseases Outpatient Clinic, including both those undergoing regular control and those not undergoing regular control.

Results: Patients enrolled in this research were separated into two groups: those under irregular control and those under regular control. There were no remarkable discrepancies in the characteristics of the two groups. Those in the irregular monitoring group had a longer duration of diabetes (11.6±7.5 vs. 8.3±7.1, p<0.001). When evaluated in terms of diabetes-related complications and comorbidities, the irregular control group showed higher rates of diabetic foot, peripheral neuropathy, diabetic kidney disease, and coronary artery disease (p=0.002, p=0.001, p=0.001, and p=0.002, respectively).

Conclusion: The prevention of diabetes-related complications, illnesses, and deaths can be achieved through regular patient follow-up. Regular follow-up enables the early detection of alterations in HbA1c levels and allows for early intervention before glycemic control deteriorates; it also ensures that patients receive face-to-face information about diabetes and the risks of diabetes-related complications. Regular control also contributes to raising patient awareness about diabetes and improving dietary adherence.

Keywords: Diabetes-related complications, HbA1c, regular check-ups

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The number of diabetes cases worldwide is estimated at 828 million, corresponding to a global prevalence of 14%.[1] Type 2 diabetes (T2DM) accounts for 98% of all diabetes diagnoses.[2] The increase in childhood obesity raises concerns that the prevalence of diabetes will increase. Diabetes cases increased by 39% globally from 1990 to 2019.[3] Furthermore, one study showed increased rates of T2DM among young adults and adolescents.[4]

Diabetes is a chronic condition associated with decreased insulin secretion and impaired insulin activity. Chronic hyperglycemia associated with diabetes leads to dysfunction and failure in many organs over the long term. Abnormal blood glucose levels are caused by impaired insulin secretion in pancreatic islet β-cells or insulin resistance in insulin-sensitive tissues (the liver, muscles, and adipose tissue).[5] In type 2 DM, insulin resistance causes increased glucose release from the liver while reducing glucose uptake in adipose tissue and muscles. Additionally, β-cell dysfunction causes decreased insulin secretion and abnormal glucose levels.[6] Various studies have shown that both adolescents and adults lose approximately 80% of their pancreatic β-cell function before receiving a diagnosis of type 2 DM.[7,8]

Long-standing complications of diabetes can lead to organ dysfunction and limb amputation. Nephropathy causes kidney failure, while peripheral neuropathy can have serious consequences ranging from foot ulcers to amputation. Autonomic neuropathy causes sexual dysfunction and genitourinary, gastrointestinal, and cardiovascular symptoms. The incidence of atherosclerotic heart disease, peripheral artery disease, and cerebrovascular disease is increased in patients with diabetes. Hypertension and abnormalities in lipoprotein metabolism are also frequently found in individuals with diabetes.[9]

Diabetes mellitus (DM) is classified based on the pathogenic process leading to hyperglycemia. The two major classes of diabetes mellitus are called type 1 and type 2 diabetes. Both types are preceded by abnormal glucose homeostasis that worsens as the pathological processes progress.

Diabetes-related morbidity and mortality are associated with acute complications of diabetes (hypoglycemia, diabetic ketoacidosis, and hyperosmolar hyperglycemic state) and chronic microvascular (retinopathy, nephropathy, and neuropathy) and macrovascular (atherosclerosis) complications. The onset of type 2 diabetes is insidious, and diagnosis is often delayed. Consequently, diabetes-related complications may be present when a diagnosis is made.[10] The progression of these complications can be prevented by regulating glycemia, blood pressure, and fasting lipid levels. Laser treatment can be applied for advanced retinopathy, and ACE inhibitors (angiotensin-converting enzyme inhibitors) and ARBs (angiotensin receptor blockers) can be given for nephropathy. These interventions reduce the incidence of various diabetes-related complications, such as stroke, myocardial infarction (MI), end-stage renal disease, and limb amputation.[11]

The aim of this study is to examine the relationship between diabetes education, regular clinical check-ups at specific intervals, timely interventions, and the prevention of the onset and progression of diabetes-related complications in patients diagnosed with diabetes. Furthermore, laboratory tests, such as complete blood count, lipid profile, glycemic control, and renal function tests, as well as anthropometric measurements, such as body mass index (BMI), body weight, waist circumference, and hip circumference, will also contribute to this relationship.

Methods

Patient selection and study design

The study enrolled individuals aged 18 years and older who had been diagnosed with type 2 diabetes, had visited the Endocrinology and Metabolic Diseases Outpatient Clinic over a five-year period, and had sufficient recorded data, including both those attending regular follow-up and those not attending regular follow-up.

For patients with HbA1c≤7, those attending follow-up every 6 months or less frequently were included in the ordered check-ups group, whereas those attending check-ups at intervals of more than 6 months were included in the disordered check-ups group.

For patients with HbA1c>7, those attending follow-up every 3 months or less frequently were included in the ordered check-ups group, whereas those attending check-ups at intervals of more than 3 months were included in the disordered check-ups group.

It is recommended that patients with type 2 DM have their HbA1c checked every 3–6 months, their lipid profiles checked annually, and their kidney function tests (complete urinalysis and spot urine microalbumin/creatinine ratio) and liver function tests performed.

Patients whose check-up time was due and who had undergone these tests were reviewed.

The patients' age, sex, smoking status, duration of diabetes, comorbid diseases, and presence of type 2 DM complications (retinopathy, nephropathy, and neuropathy) were evaluated according to their medical histories and medications used.

BMI, body weight, waist circumference, and hip circumference were recorded as anthropometric values.

Patients with type 1 diabetes mellitus, pregnant women, and patients with insufficient data were excluded from the study.

Anthropometric and clinical measurements

BMI was calculated by dividing body weight in kilograms by the square of height in meters. Measurements were performed using methods recommended by the World Health Organization (WHO).

Blood pressure measurements were taken from the right brachial artery using a standard Erka-brand sphygmomanometer after the patient had rested in a seated position for at least 5 minutes before the examination.

Assessment of diabetes complications

The presence of diabetic retinopathy in patients was determined based on their medical histories. The presence of peripheral neuropathy was investigated. The presence of diabetic kidney disease was determined using the microalbumin/creatinine ratio in spot urine, the eGFR value [calculated using the MDRD (Modification of Diet in Renal Disease) formula], and the patients' medical histories.

Statistical Analysis

Statistical analyses were performed using the IBM SPSS Version 21.0 software package. Numerical variables are presented as the mean±standard deviation, while categorical variables are presented as counts and percentages. We checked the normality of the numerical values using the one-sample Kolmogorov–Smirnov test. To compare categorical data across groups, the chi-square test and Fisher's exact test were used. The independent-samples Student's t-test was used to compare numerical data that followed a normal distribution, while the Mann–Whitney U test was used for data that did not follow a normal distribution. A p-value of <0.05 was considered statistically significant.

Ethics Committee Approval

The study commenced after receiving approval from the Necmettin Erbakan University Faculty of Medicine Clinical Research Ethics Committee, dated January 19, 2018, and numbered 2018/1167. Written informed consents were obtained from patients who participated in this study.

Results

Clinical and demographic findings of all patients

The mean age of the 361 patients included in the study was 56.9±10.2 years (range, 32–80 years). Of the patients, 222 (61.5%) were female, and 139 (38.5%) were male. The mean body weight of the patients was 84.1±13.8 kg, and the mean BMI was 31.7±5.6 kg/m^2. Based on the mean BMI, the patients were classified as "obese." Based on BMI, 30 (8.3%) patients were classified as morbidly obese (BMI>40), 187 (51.8%) as obese (BMI, 30–40), and 114 (31.5%) as overweight (BMI, 25–30). Only 27 (7.4%) patients were found to be within the normal BMI range (BMI, 18–25). The mean BMI of female patients was 34.1±13.2 kg/m^2, and that of male patients was 29.3±4.5 kg/m^2 ($p<0.001$). The mean waist circumference of female patients was 104.3±14.1 cm, and that of male patients was 99.7±15 cm. The mean hip circumference of female patients was 117.2±13 cm, and that of male patients was 102±11.4 cm. The mean duration of diabetes was 9.5±7.4 years (range, 4 months–50 years). The patients' mean systolic blood pressure was 132.8±17.1 mmHg, and their mean diastolic blood pressure was 82.7±11.1 mmHg (Table 1).

Of the patients, 55 (15.2%) had coronary artery disease (CAD), 193 (53.5%) had hypertension (HT), 3 (0.8%) had peripheral artery disease (PAD), and 3 (0.8%) had a history of cerebrovascular events (CVA).

When the patients were evaluated for diabetes-related complications, 147 (40.7%) had diabetic kidney disease, 43 (11.9%) had diabetic retinopathy, 127 (35.2%) had diabetic neuropathy, 12 (3.3%) had diabetic foot, and 41 (11.4%) had a history of hypoglycemia. Regarding proteinuria levels, 117 (32.4%) had microalbuminuria, and 28 (7.8%) had overt proteinuria. Additionally, 39 (10.8%) patients had a history of urinary tract infection (UTI) (Table 2).

Of the patients, 107 (29.6%) were on a diet, 87 (24.1%) exercised, and 37 (10.2%) were smokers.

Regarding the diabetes medications used by the patients, 193 (53.4%) were taking oral antidiabetic drugs, 56 (15.5%) were receiving insulin, and 109 (30.1%) were receiving oral antidiabetic drugs plus insulin therapy. Three (0.8%) patients were not taking any medication.

Laboratory findings of all patients

The mean fasting plasma glucose (FPG) level of the patients was 157.8±66 mg/dL, the mean HbA1c level was 7.9±1.8%,

Table 1. Clinical and demographic findings of the patients

Parameters	Mean±SD
Age in years	56.9±10.2
Gender (F/M)	222/139
Diabetes duration (years)	9.5±7.4
Body weight (kg)	84.1±13.8
BMI (kg/m2)	31.7±5.6
Systolic blood pressure (mmHg)	132.8±17.1
Diastolic blood pressure (mmHg)	82.7±11.1

the mean total cholesterol level was 196.8±46.1 mg/dL, the mean LDL cholesterol level was 117±35.4 mg/dL, the mean HDL cholesterol level was 44.2±12.3 mg/dL, the mean creatinine level was 0.86±0.32 mg/dL, and the mean microalbumin/creatinine ratio in spot urine was 149.7±544.6 mg/g. Other laboratory findings are shown in Table 3.

Comparison of diabetes-related complications according to the diabetes medications used by the patients

Of the patients included in the study, 163 (45.2%) were receiving insulin therapy, while 198 (54.8%) were not receiving insulin therapy. When the patients were divided into two groups, those receiving insulin therapy and those not receiving insulin therapy, and diabetes-related complications were compared, the rates of diabetic neuropathy, diabetic retinopathy, diabetic kidney disease, hypoglycemia, and coronary artery disease were found to be significantly higher in the insulin-using group than in the other group (p<0.001, p<0.001, p=0.002, p=0.002, and p<0.001, respectively) (Table 4).

Table 2. Diabetes complication rates of patients

Parameters	n (%)
Retinopathy	43 (11.9)
Neuropathy	127 (35.2)
Diabetic kidney disease	147 (40.7)
Microalbuminuria	117 (32.4)
Overt proteinuria	28 (7.8)
Hypoglycemia	41 (11.4)
Diabetic foot	12 (3.3)

Table 3. Laboratory findings of the patients

Parameters	Mean±SD
APG (mg/dL)	157.8±66
HbA1C (%)	7.9±1.8
Total chol. (mg/dL)	196.8±46.1
LDL chol. (mg/dL)	117±35.4
HDL chol. (mg/dL)	44.2±12.3
Triglycerides (mg/dL)	187.3±136.3
Creatinine (mg/dL)	0.86±0.32
GFR (ml/min)	87.9±21.2
ALT (IU/mL)	24.5±17.3
Hemoglobin (g/dL)	13.6±1.6
WBC (µl)	8185±2064
Platelets (103/µl)	288±78.1
TSH (µIU/mL)	2.1±1.9
Microalbumin/creatinine in spot urine (mg/g)	149.7±544.6
Vitamin D (ng/mL)	13±9.8
Vitamin B12 (pg/ml)	408±330.4

APG: Admission plasma glucose; HbA1C: Hemoglobin A1C; LDL: Low-density lipoprotein; HDL: High-Density Lipoprotein; GFR: Glomerular filtration rate; ALT: Alanine transaminase; WBC: White blood count; TSH: Thyroid-stimulating hormone.

Comparison of the clinical and demographic findings of patients attending regular and irregular follow-ups

Patients enrolled in this research were separated into two groups: those attending regular follow-ups and those attending irregular follow-ups. A total of 222 (61.4%) patients attended regular follow-ups, while 139 (38.6%) attended irregularly. The groups were observed to be similar in terms of sex distribution, age, and diastolic and systolic blood pressure measurements. The mean duration of diabetes was longer in patients who attended irregular check-ups than in those who attended regular check-ups (11.6±7.5 vs. 8.3±7.1 years, p<0.001) (Table 5). The mean BMI of the group attending irregular health check-ups was 32.4±6.4 kg/m^2, while the mean BMI of the other group was 31.3±5 kg/m^2 (p=0.14). The mean body weight of the group attending irregular follow-up examinations was 87±16 kg, while the mean body weight of the other group was 82.2±11.9 kg (p=0.003). Waist circumference was greater in patients who attended irregular check-ups, but no difference was found between the groups in terms of hip circumference (105.4±15.7 vs. 100.7±13.7 cm, p=0.005) (Table 5).

Although there was no difference between the groups regarding exercise and smoking rates, the rate of dieting

Table 4. Comparison of diabetes complications according to the diabetes medications used by patients

Parameters	Insulin (n/%*)	Others (n/%*)	p
Diabetic retinopathy	35/%21.5	8/%4	**<0.001**
Diabetic kidney disease	80/%50	67/%34	**0.002**
Diabetic neuropathy	74/%45.4	53/%26.8	**<0.001**
Hypoglycemia	28/%17.2	13/%6.6	**0.002**
Diabetic foot	6/%3.7	6/%3	0.731
CAD	43/%26.4	12/%6.1	**<0.001**
PAH	2/%1.2	1/%0.5	0.591
STROKE	3/%1.8	0/%0	0.091
UTI	23/%14.6	16/%8.1	0.054

*: Percentage within the group. CAD: Coronary artery disease; PAH: Pulmonary arterial hypertension; STROKE: Symptoms, causes, types, and recovery; UTI: Urinary tract infection.

Table 5. Comparison of clinical and demographic findings of patients attending regular and irregular follow-up

Parameters	Regular (n=222)	Irregular (n=139)	p
Age	57.1±10.1	56.8±10.5	0.820
Gender (F/M)	142/80	80/59	0.223
Duration of diabetes (years)	8.3±7.1	11.6±7.5	**<0.001**
Body weight (kg)	82.2±11.9	87±16	**0.003**
BMI (kg/m2)	31.3±5	32.4±6.4	0.140
Waist circumference	100.7±13.7	105.4±15.7	**0.005**
Hip circumference	110.3±13.4	113.1±15.9	0.093
Systolic BP (mmHg)	132.2±16.7	133.7±17.8	0.669
Diastolic BP (mmHg)	82.4±10.9	83.3±11.4	0.579
Smoking (%)	8.6	12.9	0.181
Exercise (%)	26.1	20.9	0.255
Diet (%)	36.5	18.7	**<0.001**

BP: Blood pressure.

was higher in the group that attended regular follow-ups (36.5% vs. 18.7%, p<0.001) (Table 5).

When the groups were compared in terms of diabetes-related complications and comorbidities, diabetic kidney disease, diabetic foot, coronary artery disease, and diabetic neuropathy were more prevalent in the group with irregular attendance at follow-up visits (p=0.001, p=0.002, p=0.002, and p=0.001, respectively). There were no differences between the groups in the frequency of stroke, peripheral artery disease, hypertension, diabetic retinopathy, hypoglycemia, or a history of urinary tract infection (Table 6).

Table 6. Comparison of comorbid diseases and diabetic complications in patients who attended regular and irregular control

Parameters	Regular	Irregular	p
Diabetic retinopathy (n/%*)	21 / %9.5	22 / %15.8	0.176
Diabetic kidney disease (n/%*)	77 / %34.7	70 / %51.9	**0.001**
Diabetic neuropathy (n/%*)	63 / %28.4	64 / %46	**0.001**
Hypoglycemia	24 / %10.8	17 / %12.2	0.679
Diabetic foot	2 / %0.9	10 / %7.2	**0.002**
Hypertension	111 / %50	82 / %59	0.096
CAD	25 / %11.3	30 / %21.6	**0.002**
PAH	1 / %0.5	2 / %1.4	0.561
STROKE	0 / %0	3 / %2.2	0.056
UTI	19 / %8.6	20 / %14.9	0.065

*: Percentage within the monitoring group. CAD: Coronary artery disease; PAH: Pulmonary arterial hypertension; STROKE: Symptoms, causes, types, and recovery; UTI: Urinary tract infection.

Comparison of laboratory findings of patients attending regular and irregular follow-up

According to the comparison of laboratory parameters, the mean levels of FPG, urine microalbumin-to-creatinine ratio, HbA1c, and triglycerides were statistically significantly higher in patients attending irregular check-ups than in those attending regular check-ups (p<0.001, p=0.017, p<0.001, and p=0.023, respectively). Among individuals attending regular follow-up, the mean serum vitamin D level was higher than that in the other group (14.5±10.2 vs. 10.7±8.9, p=0.006). No remarkable disparities were found between the groups according to the other laboratory parameters evaluated (Table 7).

In the group attending regular check-ups, microalbuminuria was detected in 65 (31%) patients during spot urine evaluation, compared with 52 (39.7%) patients in the group attending irregular check-ups. Similarly, macroalbuminuria was detected in 12 (5.7%) patients in the group attending regular check-ups and 16 (12.2%) patients in the group attending irregular check-ups. The difference was significant (p=0.003) (Table 8).

Comparison of patients grouped according to follow-up duration

There was a significant difference in disease duration be-

Table 7. Comparison of laboratory findings of patients who attended check-ups regularly and irregularly

Parameters	Regular	Irregular	p
FPG (mg/dL)	132±35.2	198.7±81.3	**<0.001**
HbA1C (%)	7±1	9.5±1.9	**<0.001**
Total Chol. (mg/dL)	193.7±47.5	201.6±43.6	0.111
LDL Chol. (mg/dL)	114.8±35.3	120.4±35.4	0.149
HDL Chol. (mg/dL)	44.7±11.7	43.5±13.1	0.112
Triglycerides (mg/dL)	177±129.9	203.6±144.8	**0.023**
Creatinine (mg/dL)	0.82±0.23	0.91±0.44	0.051
GFR (ml/min)	89.1±18.6	86.1±24.7	0.214
ALT (IU/mL)	23.8±14.5	25.7±21.1	0.622
Hemoglobin (g/dL)	13.5±1.5	13.7±1.8	0.437
WBC (µl)	8043.4±1996.7	8412.9±2156.7	0.109
Platelets (103/µl)	288±79	288±76	0.999
TSH (µIU/mL)	2.1±1.7	2.2±2.3	0.873
Microalbumin/creatinine in spot urine (mg/g)	89.1±318.1	246.9±773	**0.017**
Vitamin D (ng/mL)	14.5±10.2	10.7±8.9	**0.006**
Vitamin B12 (pg/ml)	375.2±289	477.4±397.3	0.057

FPG: Fasting plasma glucose; HbA1C: Hemoglobin A1C; LDL: Low-density lipoprotein; HDL: High-Density Lipoprotein; GFR: Glomerular filtration rate; ALT: Alanine transaminase; WBC: White blood count; TSH: Thyroid-stimulating hormone.

tween the groups attending regular and irregular check-ups. To reduce the impact of this difference on the variables, patients were separated into four groups according to diabetes duration (Group 1=0–5 years, Group 2=6–10 years, Group 3=11–15 years, and Group 4=16–20 years). In each group, it was investigated whether there were differences between those attending regular and irregular follow-ups in terms of the parameters that were found to differ when all patients were evaluated. In all groups, the mean HbA1c level was significantly higher among patients attending irregular check-up visits. In the third group (11–15 years), the rates of diabetic kidney disease and neuropathy were significantly higher (p=0.029 and p=0.002, respectively), and in the fourth group (16–20 years), the frequency of diabetic neuropathy was significantly higher (p=0.021) among patients who did not attend check-up visits regularly (Tables 9–12).

Table 8. Comparison of albuminuria levels in patients who attended regular and irregular check-ups

Albuminuria level	Regular	Irregular	p
None	133 (%63.3)	63 (%48.1)	
Microalbuminuria	65 (%31)	52 (%39.7)	0.003
Macroalbuminuria	12 (%5.7)	16 (%12.2)	

Table 9. Comparison of patients with a diabetes duration of "0-5 years"

Parameters	Regular (n=101)	Irregular (n=33)	p
Diabetic retinopathy (n/%*)	3/%3	1/%3	0.968
Diabetic kidney disease (n/%*)	30/%29.7	11/%35.5	0.543
Diabetic neuropathy (n/%*)	27/%26.7	6/%18.2	0.322
Diabetic foot (n/%*)	1/%1	2/%6.1	0.150
CAD (n/%*)	8/%7.9	6/%18.2	0.096
HbA1C (%)	6.7±0.9	9.7±2.2	**<0.001**

*: Percentage within the monitoring group. CAD: Coronary artery disease; Hb1AC: Hemoglobin A1C.

Table 10. Comparison of patients with diabetes duration of "6-10 years"

Parameters	Regular (n=57)	Irregular (n=46)	p
Diabetic retinopathy (n/%*)	5/%8.8	6/%13	0.090
Diabetic kidney disease (n/%*)	22/%38.6	22/%48.9	0.297
Diabetic neuropathy (n/%*)	16/%28.1	19/%41.3	0.159
Diabetic foot (n/%*)	0/%0	3/%6.5	0.086
CAD (n/%*)	6/%10.5	7/%15.2	0.183
HbA1C (%)	7.3±0.9	9.4±1.9	**<0.001**

*: Percentage within the monitoring group.

Table 11. Comparison of patients with diabetes duration of "11-15 years"

Parameters	Regular (N=32)	Irregular (N=30)	p
Diabetic retinopathy (n/%*)	6/%18.8	6/%20	0.692
Diabetic kidney disease (n/%*)	12/%37.5	19/%65.5	**0.029**
Diabetic neuropathy (n/%*)	8/%25	19/%63.3	**0.002**
Diabetic foot (n/%*)	0/%0	3/%10	0.107
CAD (n/%*)	4/%12.5	10/%33.3	0.146
HbA1C (%)	7.2±1.2	9.3±1.5	**<0.001**

*: Percentage within the monitoring group. CAD: Coronary artery disease; Hb1AC: Hemoglobin A1C.

Table 12. Comparison of patients with diabetes duration of "16-20 years"

Parameters	Regular (N=23)	Irregular (N=18)	p
Diabetic retinopathy (n/%*)	2/%8.7	5/%27.8	0.083
Diabetic kidney disease (n/%*)	8/%34.8	11/%61.1	0.093
Diabetic neuropathy (n/%*)	7/%30.4	12/%66.7	**0.021**
Diabetic foot (n/%*)	1/%4.3	1/%5.6	1.000
CAD (n/%*)	5/%21.7	3/%16.7	0.109
HbA1C (%)	7.2±0.9	9.6±1.6	**<0.001**

* Percentage within the monitoring group. CAD: Coronary artery disease; Hb1AC: Hemoglobin A1C.

Discussion

In recent years, the significant increase in the diabetic patient population, the presence of important diabetes-related complications, and the substantial financial burden associated with diabetes have made diabetes mellitus a serious social problem. The prevention of diabetes-related complications, illnesses, and deaths can be achieved through regular patient follow-up. Regular follow-up enables the early detection of alterations in HbA1c levels and allows for early intervention before glycemic control deteriorates; it also ensures that patients receive face-to-face information about diabetes and the risks of diabetes-related complications.

Diabetes is a chronic condition. Doctors and diabetes educators have no influence over patients' daily lives or dietary control.

The American Diabetes Association (ADA) describes diabetes self-management education as the process of equipping individuals with the knowledge and skills necessary to manage their own care, handle crises, and implement lifestyle changes.[12,13] Diabetes health education is crucial for long-term success. Although only limited studies exist, it is thought that diabetes education can be cost-effective and improve outcomes.[14]

In a study involving 88 patients with diabetes, comprising a study group of 44 patients and a control group of 44 patients, diabetes education was provided to patients in the study group after the initial consultation, and they were followed up by telephone for 3 months. It was found that education and telephone follow-up reduced the values of various metabolic control variables, such as hemoglobin A1c, total cholesterol, triglycerides, low-density lipoprotein cholesterol, and systolic blood pressure.[15]

In the study conducted by Anjana et al.[16], 1,798 patients with diabetes attending irregular check-ups and 1,783 patients with diabetes attending regular check-ups were retrospectively evaluated over a nine-year follow-up period. The irregularly followed group was found to have higher HbA1c, fasting plasma glucose, postprandial plasma glucose, total and LDL cholesterol, and triglyceride levels at each control visit than the regularly followed group.

Furthermore, this study observed that the glycemic load was twice as high in the group with irregular follow-up and that the risks of retinopathy and nephropathy were also increased. This study indicated that regular follow-up was associated with a favorable cardiovascular risk profile and a lower risk of developing retinopathy and nephropathy.

Kumar et al.[17] revealed a relationship between microvascular complications and triglyceride levels. Triglyceride levels and aging have been identified as independent risk factors for neuropathy. A study by Wiggin et al.[18] also showed a similar relationship between triglyceride levels and neuropathy.[19,20]

Other studies have also observed that patients with diabetic nephropathy have higher triglyceride levels.[21,22] Therefore, it is suggested that lipid-induced kidney damage may occur through the stimulation of TGF-β (transforming growth factor-beta), thereby inducing the production of reactive oxygen species that damage the glomerulus and glomerular glycocalyx.[23]

The association between hypertension and microvascular complications observed in other populations was also observed in the Thai population.[24,25] This study also demonstrated that advanced age and duration of diabetes are associated with microvascular complications in patients with T2DM.[26,27] However, in another study, no association was observed between the duration of diabetes and microvascular complications.[24]

Furthermore, large epidemiological studies have revealed the advantages of glycemic control in preventing complications.[28,29]

Timely assessment of HbA1c allows physicians to identify trends in disease progression and initiate corrective measures for glycemic control at the most appropriate time.[30]

Furthermore, reinforcing healthy behaviors through consultations with physicians, diabetes educators, dietitians, and exercise consultants at each visit can contribute to better glycemic control and a lower glycemic load in regularly monitored patients.[31]

Conclusion

As recommended by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD), a patient-centered approach is necessary for diabetes management. Preventing microvascular and macrovascular complications and ensuring a high quality of life for patients require not only good glycemic control but also the prevention of other controllable risk factors. Furthermore, the importance of lifestyle changes should be better explained to patients, and they should be encouraged to be more willing to adopt them. Therefore, patient education or an assessment of patient awareness regarding this issue is necessary at each follow-up appointment.

Disclosures

Ethics Committee Approval: The study commenced after receiving approval from the Necmettin Erbakan University Faculty of Medicine Clinical Research Ethics Committee, dated January 19, 2018, and numbered 2018/1167.

Informed Consent: Written informed consents were obtained from patients who participated in this study.

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