Available online at www.medicinescience.org

ORIGINAL ARTICLE

Medicine Science International Medical Journal

Medicine Science 2020;9(1):140-4

# The role of education levels on patients' treatment in type 2 diabetes

**Turkan Pasali Kilit[1], Kevser Onbasi[2], Nazif Yalcin[1]**

[1]*Kutahya University of Health Sciences, Faculty of Medicine, Department of Internal Medicine, Kutahya, Turkey*
[2]*Kutahya University of Health Sciences, Faculty of Medicine, Department of Endocrinology, Kutahya, Turkey*

Received 29 July 2019; Accepted 23 September 2019
Available online 24.02.2020 with doi: 10.5455/medscience.2019.08.9154

**Abstract**
One of the main problem in the treatment of diabetes is difficulty of achieving treatment target levels. In recent years, despite the improvements in diagnosis, treatment and follow-up methods, target hemoglobin A1c levels in diabetic individuals cannot be reached to the desired extent. In this study, it was aimed to investigate the effects of the education status (levels) of patients on diabetes treatment. Four hundred and thirty-six diabetic individuals who applied to the internal medicine and endocrinology clinics between September 2017 and December 2017 were asked to fill in a questionnaire. The subjects were divided into 5 groups according to their education status. The groups were compared in terms of age, gender, cholesterol, hemogram parameters, hemoglobin A1c, and urinary microalbumin levels. The primary school graduate group consisted of the most crowded group (302 patients). Significant differences were found between education status groups in terms of age, gender distribution, body-mass index, and hematocrit values. Fasting blood glucose, hemoglobin A1c, lipid parameters, and urinary microalbumin levels were similar between groups. There was no relationship between education status and hemoglobin A1c. And also there was no relationship between education status and lipid levels. While we could not observe any relation between education level and the course of diabetes treatment we recommend to observe all diabetic patients closely.

**Keywords:** Diabetes mellitus; educational status; hemoglobin A1c protein

## Introduction

Diabetes mellitus is a chronic metabolic disease with impaired insulin secretion [1]. DM affects all aspects of life by causing many microvascular and macrovascular complications [2]. The most important problem in the treatment of DM is a failure to achieve treatment goals. Achieving a normal hemoglobin A1c (HbA1c) reduces the frequency of development of microvascular and macrovascular complications [3]. Despite recent advances in diagnosis, treatment and follow-up methods, the desired HbA1c levels in DM patients are still not observed mostly reached. Therefore, the management of diabetic patients is very important and treatment should be determined considering the sociodemographic characteristics of each patient. Recently diagnosed DM patients should undergo a comprehensive diabetes self-management training program on nutrition, physical activity, optimizing metabolic control and preventing complications. Diabetes self-management is an important cornerstone of good diabetes control [4].

***Coresponding Author:** Turkan Pasali Kilit, Kutahya University of Health Sciences, Faculty of Medicine, Department of Internal Medicine, Kutahya, Turkey E-mail: turkandr@yahoo.com

Training of patients and their relatives is very important in order to reduce the risk of acute complications and to avoid chronic complications.

Type 2 DM is characterized by impaired insulin secretion and insulin resistance and hyperglycaemia. The prevalence of DM is increasing from day to by day. With lifestyle change, a 58% reduction in the development of DM was achieved in these patients. In 2000, World Health Organization foresaw that the number of 3 million with diabetes in Turkey would reach to 6.5 million in 2030, but according to the results of studies this number was already exceeded in the year 2014 and the number of patients exceeded to 7 million. Necessary measures should be taken for the disease of our age, which has increased above expectations yet, and patients should have the necessary knowledge and skills about their diseases and treatments. In this study, it was aimed to investigate the effect of educational levels on metabolic parameters of patients with DM.

## Materials and Methods

The study was designed as a descriptive, cross-sectional survey. The study was conducted in by face-to-face interviews with 436 diabetic patients over 18 years of age, and were admitted to the

Internal Medicine and Endocrinology Clinics of Evliya Çelebi Training and Research Hospital, Kütahya Dumlupınar University Medical Faculty. Written informed consents were obtained from all participants and ethics committee approval was received from Kütahya Dumlupınar University Faculty of Medicine Clinical Research Ethics Committee. The study complies with the World Health Organization Declaration of Helsinki and the World Psychiatric Association, Good Clinical Practices and Good Laboratory Practice rules. The data of the study was collected by using the Diabetes Education Form, which was prepared by the researcher in accordance with the literature. In addition to the sociodemographic data, the drugs used for the treatment of DM, the forms of the drugs (oral, subcutaneous), frequency and duration of administration, method of administration (intermittent or continuous) were recorded. Concomitant diseases and drug use history for these diseases were questioned. The patients were divided into 5 groups according to their educational level. Group 1 was defined as illiterate, group 2 as primary school graduates, group 3 as middle school graduates, group 4 as high school graduates, and group 5 as university graduates. In the laboratory parameters, fasting blood glucose, HbA1c, total cholesterol, HDL cholesterol, LDL cholesterol, triglyceride, creatinine, C reactive protein, urinary microalbumin and hemogram parameters were recorded. The groups were compared in terms of sociodemographic data, responses to the questionnaire, and laboratory parameters.

**Statistical Analysis**

For the analysis of the study data, SPSS (Statistical Package for Social Science) version 16 program was used. The suitability of continuous variables to normal distribution was examined by Kolmogorov-Smirnov and Shapiro-Wilk tests. Data showing normal distribution were expressed as mean ± standard deviation and categorical variables were expressed as percentages. Differences between the groups were evaluated by one-way analysis of variance (ANOVA) and post-hoc multiple comparison tests. Categorical parameters were analyzed using the Chi-square test. P <0.05 was considered statistically significant for all tests.

## Results

Demographic data of 436 patients are given in Table 1. Of the patients, 293 (67.2%) were female and 143 (32.7%) were male. 216 patients (49.5%) were using insulin for treatment. The comparison of the demographic data of the 5 groups determined according to the educational level of the patients is given in Table 2. Mean age of the illiterate group was significantly higher than the other groups. The mean age of primary school graduates was higher than that of middle school graduates (p <0.05). The female gender ratio was highest in the illiterate group (84%) and lowest in the university graduates group (10.5%). As the level of education increased, the female gender ratio decreased. Body-mass index was lower in the university graduates compared to the primary school graduates (p <0.05). In addition, the body-mass index of the high school graduate group was lower than the illiterate group (p <0.05). Family history of diabetes was lowest in the illiterate group (54%) and highest in the high school graduate group (82.1%). As the education level of the patients increased, the rate of attending to regular outpatient controls increased (p = 0.010). Groups were similar in terms of diabetes duration, regular blood glucose measurement and frequency, diabetic diet administration, regular HbA1c control and diabetes complications.

**Table 1.** Demographic data of the subjects

| Parameters | n = 436 |
|---|---|
| **Age (years)** | 57.8 ± 12.2 |
| **Female gender (%)** | 293 (67.2%) |
| **Body-mass index (kg/m2)** | 30 (27-34) |
| **Level of education n, (%)** | |
| **Illiterate** | 50 (11.5%) |
| **Primary school** | 302 (69.3%) |
| **Middle School** | 37 (8.5%) |
| **High School** | 28 (6.4%) |
| **University** | 19 (4.4%) |
| **Diabetes duration (years)** | 8 (4-15) |
| **Treatment regimen n, (%)** | |
| **Oral anti-diabetic drug** | 220 (50.5%) |
| **Oral anti-diabetic drug + Insulin** | 78 (17.9%) |
| **Insulin** | 138 (31.7%) |
| **Family history of diabetes n, (%)** | 310 (71.1%) |
| **History of complications related to diabetes in the family n,(%)** | 88 (20.2%) |
| **Regular blood glucose measurement n, (%)** | 270 (61.9%) |
| **Blood glucose measurement frequency n, (%)** | |
| **Every day** | 197 (45.2%) |
| **Every other day** | 67 (15.4%) |
| **1 per week** | 57 (13.1%) |
| **Less than 1 per week** | 48 (11.0%) |
| **In the presence of symptoms** | 67 (15.4%) |
| **Blood glucose measurement time n, (%)** | |
| **Hungry** | 263 (60.3%) |
| **Full** | 40 (9.2%) |
| **Hungry and full** | 133 (30.5%) |
| **Regular hemoglobin A1c control n, (%)** | 224 (51.4%) |
| **Regular outpatient control, n (%)** | 241 (55.3%) |
| **Outpatient control in terms of diabetes complications, n (%)** | 211 (48.4%) |
| **Following diabetic diet, n (%)** | 257 (58.9%) |
| **Reaching LDL cholesterol target value, n (%)** | 146 (33.5%) |
| **Reaching rate of target hemoglobin to A1c (<6.5%), n (%)** | 101 (23.2%) |
| **Obesity (Body-mass index>30 kg/m2), n (%)** | 234 (53.7%) |
| **Albuminuria (>30 mg/day), n (%)** | 163 (37.4%) |

**Table 2.** Comparison of demographic data of the groups

| Parameters | Group 1 (Illiterate) n = 50 | Group 2 (Primary school) n = 302 | Group 3 (Middle school) n = 37 | Group 4 (High school) n = 28 | Group 5 (University) n = 19 | p |
|---|---|---|---|---|---|---|
| **Age (years)** | 66 ± 9 | 58 ± 11[a] | 51 ± 12[a, b] | 54 ± 17[c] | 50 ± 12[a] | <0.001 |
| **Female gender, n (%)** | 42 (84.0%) | 220 (72.8%) | 20 (54.1%) | 9 (32.1%) | 2 (10.5%) | <0.001 |
| **Diabetes duration (years)** | 11 ± 9 | 9 ± 7 | 8 ± 6 | 11 ± 8 | 8 ± 9 | 0.141 |
| **Body-mass index (kg / m2)** | 31 ± 5 | 32 ± 6 | 30 ± 6 | 27 ± 5[b, c] | 27 ± 3[b] | <0.001 |
| **Family history of DM, n (%)** | 27 (54.0%) | 219 (72.5%) | 28 (75.7%) | 23 (82.1%) | 13 (68.4%) | 0.049 |
| **Regular blood glucose measurement, n (%)** | 26 (52.0%) | 195 (64.6%) | 20 (54.1%) | 17(60.7%) | 12 (63.2%) | 0.408 |
| **Blood glucose measurement frequency, n (%)** | | | | | | |
| **Every day** | 23 (46.0%) | 138 (45.7%) | 15 (40.5%) | 15 (53.6%) | 6 (31.6%) | |
| **Every other day** | 7 (14.0%) | 49 (16.2%) | 3 (8.1%) | 4 (14.3%) | 4 (21.1%) | |
| **1 per week** | 7 (14.0%) | 35 (11.6%) | 7 (18.9%) | 4 (14.3%) | 4 (21.1%) | 0.950 |
| **Less than 1 per week** | 7 (14.0%) | 32 (10.6%) | 5 (13.5%) | 2 (7.1%) | 2 (10.5%) | |
| **In the presence of symptoms** | 6 (12.0%) | 48 (15.9%) | 7 (18.9%) | 3 (10.7%) | 3 (15.8%) | |
| **Regular HbA1c control, n (%)** | 22 (44.0%) | 149 (49.3%) | 21 (56.8%) | 20 (71.4%) | 12 (63.2%) | 0.108 |
| **Regular outpatient control, n (%)** | 19 (38.0%) | 165 (54.6%) | 22 (59.5%) | 21 (75.0%) | 14 (73.7%) | 0.010 |
| **Outpatient control in terms of diabetes complications, n (%)** | 21 (42.0%) | 142 (47.0%) | 20 (54.1%) | 17 (60.7%) | 11 (57.9%) | 0.418 |
| **Following diabetic diet, n (%)** | 26 (52.0%) | 176 (58.3%) | 22 (59.5%) | 20 (71.4%) | 13 (68.4%) | 0.468 |

[a]p<0.001 when compared to Group 1, [b]p<0.05 when compared to Group 2, [c]p<0.05 when compared to Group 1

**Table 3.** Comparison of the laboratory parameters of the groups

| Parameters | Group 1 (Illiterate) n = 50 | Group 2 (Primary school) n = 302 | Group 3 (Middle school) n = 37 | Group 4 (High school) n = 28 | Group 5 (University) n = 19 | p |
|---|---|---|---|---|---|---|
| **Fasting blood sugar (mg/dL)** | 158 ± 85 | 178 ± 73 | 164 ± 90 | 178 ± 78 | 210 ± 131[a, b] | 0.028 |
| **HbA1c (%)** | 8.1 ± 1.8 | 8.3 ± 2.0 | 8.1 ± 2.4 | 8.1 ± 1.8 | 8.7 ± 3.0 | 0.836 |
| **Total cholesterol (mg/dL)** | 195 ± 49 | 192 ± 49 | 180 ± 38 | 198 ± 44 | 199 ± 52 | 0.537 |
| **Triglyceride (mg/dL)** | 177 ± 82 | 183 ± 143 | 174 ± 93 | 211 ± 205 | 171 ± 79 | 0.982 |
| **HDL (mg/dL)** | 45 ± 14 | 44 ± 11 | 44 ± 12 | 43 ± 9 | 42 ± 11 | 0.774 |
| **LDL (mg/dL)** | 114 ± 39 | 116 ± 40 | 103 ± 39 | 118 ± 39 | 123 ± 42 | 0.372 |
| **Hemoglobin (g/dL)** | 13.1 ± 1.5 | 13.3 ± 3.9 | 13.9 ± 1.7 | 14.0 ± 1.9 | 14.5 ± 1.1 | 0.393 |
| **Haematocrit (%)** | 39.3 ± 3.9 | 39.3 ± 4.6 | 41.6 ± 4.9 | 41.5 ± 5.1 | 42.8 ± 2.6[a, c] | <0.001 |
| **RDW (%)** | 14.0 ± 1.4 | 14.3 ± 2.6 | 13.9 ± 2.1 | 14.1 ± 2.1 | 13.4 ± 0.8 | 0.230 |
| **WBC (x1000/µL)** | 8.10 ± 2.00 | 8.65 ± 2.99 | 8.06 ± 2.02 | 8.11 ± 1.62 | 8.34 ± 2.15 | 0.668 |
| **Platelet (x1000/µL)** | 270 ± 74 | 264 ± 76 | 254 ± 50 | 248 ± 61 | 271 ± 58 | 0.573 |
| **MPV (fL)** | 9.5 ± 1.4 | 9.6 ± 1.1 | 9.5 ± 1.2 | 9.5 ± 1.2 | 9.3 ± 1.2 | 0.578 |
| **Neutrophil (x1000/µL)** | 4.82 ± 1.89 | 5.36 ± 2.38 | 4.71 ± 1.54 | 4.89 ± 1.57 | 5.29 ± 2.02 | 0.361 |
| **Lymphocyte (x1000/µL)** | 2.54 ± 0.80 | 2.52 ± 1.41 | 2.46 ± 0.81 | 2.47 ± 0.74 | 2.31 ± 0.90 | 0.964 |
| **Monocyte (/µL)** | 520 ± 171 | 516 ± 176 | 540 ± 161 | 516 ± 184 | 516 ± 151 | 0.920 |
| **Neutrophil - Lymphocyte ratio** | 2.25 ± 1.84 | 2.78 ± 4.73 | 2.08 ± 0.83 | 2.40 ± 2.19 | 3.07 ± 3.62 | 0.548 |
| **Platelet-Lymphocyte ratio** | 114 ± 45 | 124 ± 85 | 120 ± 71 | 110 ± 45 | 139 ± 90 | 0.589 |
| **Monocyte-HDL ratio** | 14.7 ± 17.6 | 12.8 ± 6.3 | 13.3 ± 5.8 | 12.5 ± 5.5 | 13.7 ± 6.7 | 0.915 |
| **CRP (mg/L)** | 10.7 ± 20.9 | 10.5 ± 15.4 | 10.2 ± 21.5 | 10.0 ± 20.3 | 5.3 ± 4.2 | 0.434 |
| **Creatinine (mg/dL)** | 1.66 ± 4.42 | 1.08 ± 0.52 | 1.65 ± 3.69 | 1.25 ± 0.87 | 1.05 ± 0.33 | 0.080 |
| **Albuminuria (mg/day)** | 34 ± 38 | 122 ± 236 | 75 ± 196 | 123 ± 253 | 122 ± 290 | 0.965 |

RDW: Red blood cell distribution width, MPV: Mean platelet volume
[a]p<0.05 when compared to Group 1, [b]p<0.05 when compared to Group 3, [c]p<0.05 when compared to Group 2

The comparison of the groups in terms of metabolic parameters is given in Table 3. The fasting blood glucose level of the university graduates group was higher than the illiterate group and the primary school graduate group ($p < 0.05$). There was no difference between the groups in terms of other metabolic parameters.

## Discussion

DM is a chronic metabolic disease that affects the life of patients and their relatives in many ways, decreases the quality of life and can cause many complications. According to the 8th Diabetes Atlas data published by the International Diabetes Federation in 2017, it is thought that 425 million DM patients worldwide and half of these patients are not diagnosed [5]. Therefore, early diagnosis of diabetes and effective treatment of patients diagnosed with diabetes is important. Patient education is an integral part of treatment in diabetic patient management [6]. Socioeconomic and demographic factors such as age, educational level, ethnic and cultural background limit diabetes self-management [7]. For that reason, while educating the patients, the socioeconomic status of the patient should be taken into consideration and the treatment given should be tailored to the patient. Studies have shown that obesity and diabetes are more common among individuals and groups with low levels of education, and this leads that these patients receive late diagnosis and treatment [8].

In this study, the awareness levels of participants about DM follow-up and treatment were investigated. It was found that the percentage of subjects participating in the study for regular outpatient follow-up visits was 55.2%. In a study conducted by Altundağ, it was found that 82.6% of children with type 1 DM applied for control every 3 months [9]. The difference between the studies suggests that regional and sociocultural variables affect the patient's awareness of the disease. In this study, the rate of coming to regular outpatient control in the illiterate group was found to be 38% and it was thought that this low rate was due to low education level. The level of education of the patient is a factor that provides easier and earlier access to the information necessary for awareness of maintaining a healthier life [10]. Therefore, it should be remembered that the ability to apply the recommended treatment and to adhere to the correct diet and exercise program, to go to the outpatient clinic control and to comprehend their diseases may be insufficient in patients with low educational level.

Several studies and meta-analyses have shown that diet and exercise can provide significant improvements in glucose control in people with type 2 DM [11]. It has been shown that the diet can reduce HbA1c by approximately 0.12% to 0.5% for blood sugar control [12]. It was seen that 58.9% of the subjects participated in the study followed a diabetic diet and a significant proportion of them did not. In a study by Aslan et al., only 24.5% of the subjects were found adhere to the diet and 40% did not obey to the diet at all [2]. Patients with DM should be told that medical treatments alone will not be sufficient to regulate blood sugar and that only the desired result can be achieved with a diabetic diet. In the study conducted by Tavakolizadeh et al., it was determined that blood sugar levels of diabetic patients were lower after the training and that the training had a positive effect on dietary habits [13].

When the frequency of regular blood glucose measurement of DM subjects in this study was examined, it was found that the rate was 61.9%. As a result of the study, it was found that 12% of illiterate and 15.8% of university graduates measured blood sugar levels only in the presence of symptoms. In all groups, the frequency of measuring blood glucose in the presence of symptoms was 15.4% and this rate was very low. Hypoglycaemia can often lead to nonspecific symptoms such as sweating, palpitation, dizziness, visual impairment and neurological symptoms, and may lead to loss of consciousness [14]. All diabetics and their family members should be taught to measure blood glucose at home and should be trained to make appropriate treatment changes based on blood glucose measurement results [15]. In this study, the low blood glucose measurement rate in the presence of symptoms revealed the importance of training.

In a study conducted by Maneze et al., it was shown that individuals with high educational level had higher health literacy and lower diabetes self-management [16]. When the groups in this study were examined, there was no significant difference in HbA1c and cholesterol levels, although fasting blood glucose levels of university graduates were higher than individuals with low education levels. Similar results in this study indicate that high educational level of individuals is not a determining factor for DM treatment success.

## Conclusion

As a result, in planning and monitoring DM treatment, physicians should be equally sensitive to individuals with all educational levels and apply regular training programs to each patient. It is considered that individual differences of the patients should be determined and training and treatment plans should be prepared accordingly. Recognizing and increasing awareness of patients will contribute to achieving good results by providing more accurate and effective treatment.

**Competing interests**
*The authors declare that they have no competing interest.*

**Financial Disclosure**
*There are no financial supports.*

**Ethical approval**
*Ethics committee approval was received from Kutahya Dumlupinar University Faculty of Medicine Clinical Research Ethics Committee.*

*Turkan Pasali Kilit ORCID: 0000-0003-1126-7336*
*Kevser Onbasi ORCID: 0000-0003-2230-9263*
*Nazif Yalcin ORCID: 0000-0002-0110-0498*

## References

1. IDF Diabetes Atlas 7th ed. International Diabetes Federation. Brussels, Belgium; 2015.

2. Aslan Ü, Korkmaz M. Diyabetli Bireylerin İnsülin Uygulama Bilgi-Beceri Düzeyleri: Doğru ve Yanlışlar. DEUHFED. 2015;8:18-26.

3. Baxter M, Hudson R, Mahon J, et al. Estimating the impact of better management of glycaemic control in adults with Type 1 and Type 2 diabetes on the number of clinical complications and the associated financial benefit. Diabet Med. 2016;33:1575-81.

4. Powers MA, Bardsley J, Cypress M, et al. Diabetes self-management education and support in type 2 diabetes: a joint position statement of the American Diabetes Association, the American Association of Diabetes Educators, and the Academy of Nutrition and Dietetics. Diabetes Educ. 2015;41:417-30.

5. IDF Diabetes Atlas 8th ed. International Diabetes Federation. Brussels, Belgium; 2017.

6. Assal JP. A Global integrated approach to diabetes: a challenge for more efficient therapy. In: Davidson JK, ed, Clinical Diabetes Mellitus: A Problem Oriented Approach. 2nd ed. Thieme Medical Publishers, New York, 1991;703-16.

7. Onwudiwe NC, Mullins CD, Winston RA, et al. Barriers to self-management of diabetes: a qualitative study among low-income minority diabetics. Ethn Dis. 2011;21:27-32.

8. Al Shafaee MA, Al-Shukaili S, Rizvi SG, et al. Knowledge and perceptions of diabetes in a semi-urban Omani population. BMC Public Health. 2008;8:249.

9. Altundağ S. Tip 1 diyabetli çocukların hastalığa uyumunda eğitimin ve sosyal desteğin etkisi. Pamukkale Tıp Dergisi. 2018;11:137-44.

10. Usta Atmaca H, Akbaş F, Şak T, et al. Diyabetik Hastalarda Hastalık Bilinç Düzeyi ve Farkındalık. İstanbul Med J. 2015;16:101-4.

11. Thomas DE, Elliott EJ, Naughton GA. Exercise for type 2 diabetes mellitus. Cochrane Database Syst Rev. 2006;3:CD002968.

12. Ajala O, English P, Pinkney J. Systematic review and meta-analysis of different dietary approaches to the management of type 2 diabetes. Am J Clin Nutr. 2013;97:505-16.

13. Tavakolizadeh J, Moghadas M, Ashraf H. Effect of Self-regulation Training on Management of Type 2 Diabetes. Iran Red Crescent Med J. 2014;16:13506.

14. Workgroup on Hypoglycemia, American Diabetes Association. Defining and reporting hypoglycemia in diabetes: a report from the American Diabetes Association Workgroup on Hypoglycemia. Diabetes Care. 2005;28:1245-9.

15. Norris SL, Engelgau MM, Narayan KM. Effectiveness of self-management training in type 2 diabetes: a systematic review of randomized controlled trials. Diabetes Care. 2001:24:561-87.

16. Maneze D, Everett B, Astorga C, et al. The Influence of Health Literacy and Depression on Diabetes Self-Management: A Cross-Sectional Study. J Diabetes Res. 2016;2016:3458969.