ORIGINAL ARTICLE

# Association between glycemic control and the level of knowledge and disease awareness in type 2 diabetic patients

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**KEY WORDS**

diabetes, glycated hemoglobin, knowledge and awareness level

**ABSTRACT**

**INTRODUCTION** Diabetes-related complications may be prevented if good metabolic control is achieved. In addition to drug therapy, patient education may facilitate better glycemic control.

**OBJECTIVES** The aim of the study was to assess the relationship between glycemic control and effective diabetes education using the knowledge and awareness (KA) questionnaire in type 2 diabetic patients. Moreover, the effect of age, duration of diabetes, sex, body mass index (BMI), and education level on glycemic control was assessed cross-sectionally.

**PATIENTS AND METHODS** The study included 164 patients with type 2 diabetes. The KA questionnaire, adapted for Turkish population, was distributed among patients after establishing whether they received diabetes education. Associations between the questionnaire scores and glycated hemoglobin ($HbA_{1c}$), fasting blood glucose (FBG), and BMI were assessed.

**RESULTS** A significant negative correlation was observed between KA scores and $HbA_{1c}$ and FBG levels. Sixty-three patients had received diabetes education. These patients had higher KA scores compared with the remaining group (24.0 ±4.0 vs. 16.8 ±5.37, respectively; $P < 0.0001$) and lower $HbA_{1c}$ levels (6.5% vs. 8.5%, respectively; $P < 0.0001$).

**CONCLUSIONS** In type 2 diabetic patients, the higher the KA score, the more efficient glycemic control can be achieved. Patients who require diabetes education can be identified by using questionnaires that determine their KA level and by using $HbA_{1c}$ tests.

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**INTRODUCTION** According to the World Health Organization, the number of diabetic patients will increase from 135 million in 1995 to 300 million in the first quarter of the 21st century. In Turkey, 5.2% of the population in 1995 had diabetes and it is estimated that this proportion will have reached 7.2% by 2025.[1]

It is known that diabetes increases the risk of coronary artery disease, stroke, blindness, kidney failure, leg amputation, and early death.[2,3] Scientific evidence shows that diabetes-related complications may be prevented if a good metabolic control is achieved.[4,5] To achieve good metabolic control, it is important not only to measure glycated hemoglobin ($HbA_{1c}$) levels regularly, but also to educate patients on diabetes. Sufficient knowledge can be acquired in diabetes education programs,[6-8] which not only develop patients' awareness and understanding of the disease and strengthen motivation and self-care, but also reduce the economic costs of diabetes treatment by preventing complications.[8]

Despite clear evidence on the benefits of tight glycemic control in diabetics,[4,5] many patients are not able to reach an optimal glycemic target and thus fail to significantly reduce a long-term cardiovascular risk.[9,10] Moreover, it has been shown that inadequate knowledge about diabetes negatively affects behavior and self-care.[11-13] According to the available data, the majority of diabetic patients do not receive sufficient diabetes education.[6,14] So far, no study in Turkey has assessed the effect of patients' knowledge about the disease on glycemic control, although Karahan et al.[15] evaluated the effect of emotional intelligence training on anxiety and glycemic control in patients with type 2 diabetes. They found that this program might improve glycemic control by reducing anxiety and burnout.[15] Duke et al.[16] suggested a benefit of individual patient education on glycemic control when compared with usual care in a subgroup of patients with baseline $HbA_{1c}$ above 8%, although no significant difference between individual education and usual care was found. Additional studies are needed to further investigate this issue.

If there indeed was a relationship between the level of knowledge and awareness (KA) of diabetes and $HbA_{1c}$,[17] it would become important to search for ways to increase the KA level of patients and organize education programs.

**PATIENTS AND METHODS** The study included 164 patients with type 2 diabetes who were referred to internal medicine and cardiology clinics of the Gumussuyu Military Hospital, Istanbul, Turkey, from January to July, 2008. Informed consent was obtained from all participants and the study protocol was approved by the local ethics committee.

To make an accurate assessment of the effect of diabetes education, the study group involved both patients who received formal diabetes education and patients who did not. Patients who had not participated in an education program, or participated only for a short time, were considered as not having received diabetes education. Patients who were in the course of their diabetes education program, or patients with severe dementia, were excluded from the study.[17]

The data were obtained by using a questionnaire completed during face-to-face interviews.[18,19] The questionnaire consisted of 2 parts. The first part included 8 questions on education, sex, age, weight, height, social status, the ratio of treatment cost to income, diabetes duration, and diabetes education. The second part consisted of 28 questions that we assumed educated patients should be able to answer, thus allowing us to assess their KA level. These 28 questions were compiled from the Michigan Diabetes Research and Training Center's Brief Diabetes Knowledge Test[20,21] and from similar sources.[22-24] All questions were adapted to Turkish population. Similarly to Heisler et al.,[17] we asked patients whether they knew their most recent $HbA_{1c}$ test result (MRHAT); the answer was considered correct if it was within the ±0.5% range of the actual value.[17,25,26] The survey took approximately 20 to 25 minutes. One point was given for the correct answer and no points for an incorrect answer; the total KA score was calculated for each patient.

**TABLE 1** Characteristics of patients

| | |
|---|---|
| number of patients | 164 |
| age, y, mean ±SD | 50.1 ±8.6 |
| men, n (%) | 101 (62) |
| women, n (%) | 63 (38) |
| BMI, kg/m², mean ±SD | 28.9 ±3.9 |
| $HbA_{1c}$, %, mean ±SD | 7.82 ±1.76 |
| KA score, mean ±SD | 20 ±6 |
| patients receiving oral medications only, n (%) | 92 (56) |
| patients receiving insulin + oral medications, n (%) | 64 (39) |
| diet only, n (%) | 8 (5) |
| duration of diabetes, y, mean ±SD | 9.2 ±6.8 |
| nephropathy, n (%)[a] | 23 (14) |
| neuropathy, n (%)[b] | 39 (24) |
| retinopathy, n (%)[c] | 8 (5) |
| cardiovascular disease, n (%)[d] | 21 (13) |

a defined as albuminuria
b defined as pain, numbness, paraesthesia, or skin changes, especially in the foot
c defined by patient records
d defined by a history of angina or patient records and by examination in cardiology outpatient clinic

Abbreviations: BMI – body mass index, $HbA_{1c}$ – hemoglobin $A_{1c}$, KA – knowledge and awareness, SD – standard deviation

Based on the body mass index (BMI), patients were classified as normal-weight (<25 kg/m²), preobese (25–29.9 kg/m²), and obese (≥30 kg/m²).[27,28]

$HbA_{1c}$ levels of all respondents were measured using the high-performance liquid chromatography method in the Bio-Rad D-10 hemoglobin test system. The fasting blood glucose (FBG) level was measured using the hexokinase method in the Olympus AU 400 autoanalyzer. The equipment was checked with quality control samples before each measurement.

The data were analyzed using the SPSS software. For nonparametric-unpaired data with more than 2 groups, the Kruskal-Wallis test was used, and for parametric data with more than 2 groups, the one-way analysis of variance (ANOVA) was used. For nonparametric-unpaired values with a group number equal to 2, the Mann-Whitney U test was used, and for parametric-unpaired data with a group number equal to 2, the unpaired t-test was used. Correlations of nonparametric and parametric data were analyzed with the Spearman and Pearson tests, respectively.

**RESULTS** Men constituted 62% of the study group and women – 38% (mean age, 50.1 ±8.6 years; mean BMI, 28.9 ±3.9 kg/m²; mean $HbA_{1c}$, 7.82 ±1.76%; mean KA score, 20 ±6 points; mean duration of diabetes, 9.2 ± 6.8 years; oral glucose-lowering medications only, 56%; insulin + oral glucose-lowering medications, 39%; diet only, 5%).

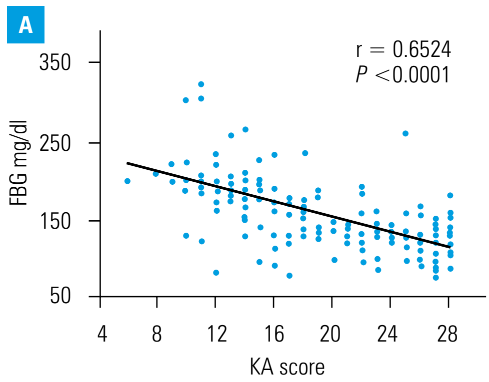


**FIGURE 1** The inverse correlation of the knowledge and awareness score with fasting blood glucose (**A**) and $HbA_{1c}$ levels (**B**)
Abbreviations: FBG – fasting blood glucose, others – see TABLE 1

Of all patients, 14% were diagnosed with nephropathy, 24% with neuropathy, 5% with retinopathy, and 13% with cardiovascular disease (TABLE 1).

There was a strong negative correlation between the KA score and $HbA_{1c}$, and between the KA score and FBG (r = –0.8101, $P$ <0.0001 and r = –0.6524, $P$ <0.0001, respectively). The correlation between the KA score and $HbA_{1c}$ was stronger than that between the KA score and FBG (FIGURE 1).

Only 63 patients had completed at least one diabetes education program before inclusion into the study (either for individuals or groups, irrespective of program duration). The study showed that $HbA_{1c}$ and FBG levels were significantly lower and the KA scores were significantly higher in patients who received diabetes education compared with those who did not (6.8% vs. 8.5%; $P$ <0.0001 and 132 vs. 170 mg/dl; $P$ <0.0001 and 25 vs. 16 points; $P$ <0.0001, respectively). Similarly, BMI values were lower in patients who received diabetes education compared with the remaining patients (27.6 ±3.51 vs. 29.4 ±3.76 kg/m$^2$; $P$ = 0.0021). The study showed that 71.4% of the patients who received diabetes education knew their MRHAT compared with 34.7% of patients who did not receive diabetes education ($P$ <0.0001) (TABLE 2).

When patients were grouped according to their education level (elementary school or lower education vs. college or higher education), the difference between the groups in terms of the mean KA score and mean $HbA_{1c}$ levels was significant ($P$ <0.01). The difference between patients with high school degree and those with college or higher education degrees was not significant ($P$ >0.05) (TABLE 3).

The patients were asked how much they contributed to treatment costs and were grouped accordingly; 92, 36, and 36 patients covered 0 to 25%, 25% to 50%, and more than 50% of treatment costs, respectively. Mean $HbA_{1c}$ levels were significantly lower and the KA score significantly higher in patients who covered 0 to 25% of treatment costs compared with the remaining groups ($P$ <0.01). On the other hand, there was no significant difference between the patients who covered 25% to 50% of their treatment costs and those who covered more than 50% ($P$ >0.05). Furthermore, all patients who covered 0 to 25% of treatment costs and 75% of patients from the 2 remaining groups had social security coverage (TABLE 4).

More than half of the patients (51.2%) did not answer the question about their MRHAT correctly.

**TABLE 2** $HbA_{1c}$ levels, the knowledge and awareness score, and awareness of the most recent $HbA_{1c}$ test result in patients with and without diabetic education

| | Patients without diabetes education | Patients with diabetes education | *P* |
|---|---|---|---|
| number of patients, n (%) | 101 (61.6) | 63 (38.4) | |
| $HbA_{1c}$, %, mean ±SD | 8.5 ±1.79 | 6.8 ±1.10 | <0.0001[a] |
| $HbA_{1c}$, %, median (min–max) | 8.1 (5.8–13.1) | 6.6 (5.3–11.3) | |
| KA score, mean ±SD | 16.8 ±5.37 | 24.0 ±4.00[c] | <0.0001[b] |
| KA score, median (min–max) | 16 (6–28) | 25 (13–28)[c] | |
| FBG, mg/dl, mean ±SD | 170 ±47 | 132 ±35 | <0.0001[a] |
| FBG, mg/dl, median (min–max) | 171 (79–323) | 131 (88–267) | |
| BMI, kg/m$^2$, mean ±SD | 29.4 ±3.76 | 27.6 ±3.51 | 0.0021[a] |
| BMI, kg/m$^2$, median (min–max) | 29.4 (20.6–45.5) | 27.8 (20.0–35.9) | |
| MRHAT knowledge +, n (%) | 35 (34.7)[c] | 45 (71.4)[c] | <0.0001[b] |
| MRHAT knowledge –, n (%) | 66 (65.3%)[c] | 18 (28.6%)[c] | |

a unpaired t-test, b Mann-Whitney test (nonparametric), c nonparametric analysis was used because the values in one of the groups were not normally distributed

Abbreviations: FBG – fasting blood glucose, MRHAT – most recent $HbA_{1c}$ test result, others – see TABLE 1

**TABLE 3** HbA$_{1c}$ levels and the knowledge and awareness score in patients according to the education level

| | Elementary school or lower (A) | High school (B) | College or higher (C)[b] |
|---|---|---|---|
| number of patients, n (%) | 42 (25.6) | 66 (40.2) | 56 (34.2) |
| HbA$_{1c}$, %, mean ±SD | 8.7 ±1.87 | 7.6 ±1.65 | 7.3 ±1.55 |
| HbA$_{1c}$, %, median (min–max) | 8.9 (6.0–13.1) | 7.1 (5.3–12.6) | 7.0 (5.5–12.6) |
| KA score, mean ±SD | 16.5 ±5.73 | 20.3 ±5.45 | 20.9 ±6.21 |
| KA score, median (min–max) | 15.5 (6.0–28.0) | 21.0 (9.0–28.0) | 22.5 (10.0–28.0) |
| correlations between the levels of HbA$_{1c}$ and education | | | |
| *P*[a] | <0.01 | <0.001 | >0.05 |
| correlations between KA score and the education level | | | |
| | A–B | A–C | B–C |
| *P*[a] | <0.01 | <0.01 | >0.05 |

**a** Kruskal-Wallis test (nonparametric ANOVA), **b** nonparametric analysis was used because the values in one of the groups were not normally distributed

Abbreviations: ANOVA – analysis of variance, others – see **TABLE 1**

**TABLE 4** HbA$_{1c}$ levels and knowledge and awareness scores in patients according to their contribution to treatment cost

| | 0–25% A | 26–50% B | >50% C |
|---|---|---|---|
| number of patients, n (%) | 92 (56) | 36 (22) | 36 (22) |
| HbA$_{1c}$, %, mean ±SD | 7.4 ±1.60 | 8.3 ±1.62 | 8.5 ±1.97 |
| HbA$_{1c}$, %, median ±SD | 7.0 (5.3–12.6) | 8.2 (6.2–12.6) | 8.3 (5.6–13.1) |
| KA score, mean ±SD | 21.2 ±5.67 | 17.4 ±5.9 | 17.4 ±5.8 |
| KA score, median (min–max) | 22 (6–28) | 16 (8–28) | 15 (9–28) |
| patients with health insurance, n (%) | 92 (100) | 30 (83.3) | 24 (66.7) |
| correlations between HbA$_{1c}$ levels and CR | | | |
| | A[c]–B | A[c]–C | B–C |
| *P*[a] | <0.01 | <0.01 | >0.05 |
| correlations between KA score and CR, % | | | |
| | (0–25) – (26–50) | (0–25) – (>50) | (26–50) – (>50) |
| *P*[b] | <0.01 | <0.01 | >0.05 |
| q | 4.74 | 4.74 | 0.00 |

**a** Kruskal-Wallis test (nonparametric ANOVA), **b** one-way ANOVA, **c** nonparametric analysis was used because the values in one of the groups were not normally distributed

Abbreviations: CR – contribution rate, others see – **TABLE 1**

**TABLE 5** HbA$_{1c}$ levels and the knowledge and awareness score in patients according to their awareness of the most recent HbA$_{1c}$ test result

| | MRHAT (–) | MRHAT (+)[b] | *P* |
|---|---|---|---|
| number of patients, n (%) | 84 (51.2) | 80 (48.8) | |
| patients with diabetes education, n (%) | 18 (21.4) | 45 (56.25) | |
| patients without diabetes education, n (%) | 66 (78.6) | 35 (43.75) | |
| KA score, mean ±SD | 16.6 ±4.94 | 22.6 ±5.50[b] | <0.0001[a] |
| KA score, median (min–max) | 16 (6–27) | 25 (9–28)[b] | |
| HbA$_{1c}$, %, mean ±SD | 8.6 ±1.82 | 7.0 ±1.28[b] | <0.0001[a] |
| HbA$_{1c}$, %, median (min–max) | 8.2 (5.9–13.1) | 6.7 (5.3–11.6)[b] | |

**a** Mann-Whitney test (nonparametric), **b** nonparametric analysis was used because the values in one of the groups were not normally distributed

Abbreviations: see **TABLES 1** and **2**

**TABLE 6** $HbA_{1c}$ levels and the knowledge and awareness score in patients according to the body mass index

| | Normal-weight (A) | | Preobese (B) | | Obese (C) | |
|---|---|---|---|---|---|---|
| n (%) | 21 (12.8) | | 84 (51.2) | | 59 (36) | |
| | $HbA_{1c}$, % | KA score | $HbA_{1c}$, % | KA score | $HbA_{1c}$, % | KA score |
| mean | 6.98 | 22.6 | 7.46 | 20.5 | 8.63 | 17.1 |
| SD | 0.89 | 4.44 | 1.44 | 5.35 | 2.08 | 6.60 |
| median | 7.0 | 23 | 7.1 | 21 | 8.60 | 15 |
| min–max | 5.6–9.1 | 12–28 | 5.3–12.2 | 10–28 | 5.5–13.1 | 6–28 |
| correlations between $HbA_{1c}$ levels and BMI | | | | | | |
| | A–B | | A–C | | B–C | |
| *P*[a] | >0.05 | | <0.001 | | <0.001 | |
| q | 1.69 | | 5.58 | | 5.92 | |
| correlations between KA scores and BMI | | | | | | |
| | A–B | | A–C | | B–C | |
| *P*[a] | >0.05 | | <0.001 | | <0.01 | |
| q | 2.17 | | 5.34 | | 4.88 | |

a one-way ANOVA

Abbreviations: see TABLE 1

Most of these patients (78.6%) did not participate in a diabetes education program. Mean $HbA_{1c}$ levels were lower and the mean KA score was significantly higher in patients who knew their MRHAT compared with those who did not (7.0 ±1.28% vs. 8.6 ±1.82%; $P < 0.0001$ and 22.6 ±5.49 points vs. 16.6 ±4.94 points; $P < 0.0001$, respectively) (TABLE 5). We also found a moderate correlation between $HbA_{1c}$ levels and the fact of knowing one's MRHAT ($r = –0.4911$ $P < 0.0001$).$HbA_{1c}$ levels and KA scores of men and women were similar ($P > 0.05$).

Our study showed that 36% of patients with type 2 diabetes were obese, 51.2% were preobese, and 12.8% were normal-weight based on the BMI. When the groups were compared, we found that the mean KA score in obese patients was lower than in preobese and normal-weight patients (17.1 ±6.60 vs. 20.5 ±5.35 [preobese]; $P < 0.01$ and 17.1 ±6.60 vs. 22.6 ±4.44 [normal-weight]; $P < 0.001$, respectively). In contrast, the mean $HbA_{1c}$ level was higher in obese subjects than preobese (8.63% vs. 7.46%; $P < 0.01$) and in normal-weight (8.63% vs. 6.98%; $P < 0.001$) patients. The difference between the KA scores and $HbA_{1c}$ values of normal-weight and preobese patients was not significant ($P > 0.05$) (TABLE 6). Moreover, we found a weak positive but significant correlation between BMI and $HbA_{1c}$ ($r = 0.35$, $P < 0.0001$).

Our findings showed a weak negative correlation between duration of diabetes and $HbA_{1c}$, and a weak positive correlation between KA score and duration of diabetes ($r = –0.28$, $P = 0.0002$ and $r = 0.26$, $P = 0.0009$; respectively) (FIGURE 2). We did not observe any significant correlations between patient age and the KA score and $HbA_{1c}$ levels ($r = –0.17$, $P = 0.03$ and $r = 0.16$, $P = 0.04$; respectively).

**DISCUSSION** Diabetes is a chronic disease associated with high morbidity and mortality rate because of its acute and chronic complications.[29] Apart from pharmacologic agents for glycemic regulation, treatment compliance, education about the disease, and modifications in lifestyle are also crucial to avoid complications. Our study showed that better glycemic control is achieved when the level of patients' knowledge about diabetes is high. Thus, it is important to educate patients about diabetes, its complications, treatment, and self-care.[30,31]

The result that showed a stronger correlation between the KA score and $HbA_{1c}$ levels than between the KA score and FBG in type 2 diabetes may be attributed to the fact that $HbA_{1c}$ has been considered to better reflect the average glycemic control during the past several months than FBG.[32,33] Of note, a close correlation between the results of KA test and $HbA_{1c}$ levels emphasizes the importance of the KA test-oriented survey. For all these reasons, $HbA_{1c}$ was preferred over FBG in the data comparison.

We found that patients with lower education level (elementary school) had a significantly lower KA score compared with those with higher education (high school, university). This is in line with literature data showing that patients' knowledge and beliefs about diabetes and awareness of MRHAT are affected by education level.[14,17] Heisler et al.[17] asked patients if they knew their MRHAT instead of conducting a survey on the level of patients' knowledge and interest in their disease. They showed that patients who knew their MRHAT had better knowledge about diabetes and achieved a better glycemic control.

Although statistically not significant, an increase in the KA score and a decrease in $HbA_{1c}$ levels was observed among patients with high school and university degrees. This finding highlights

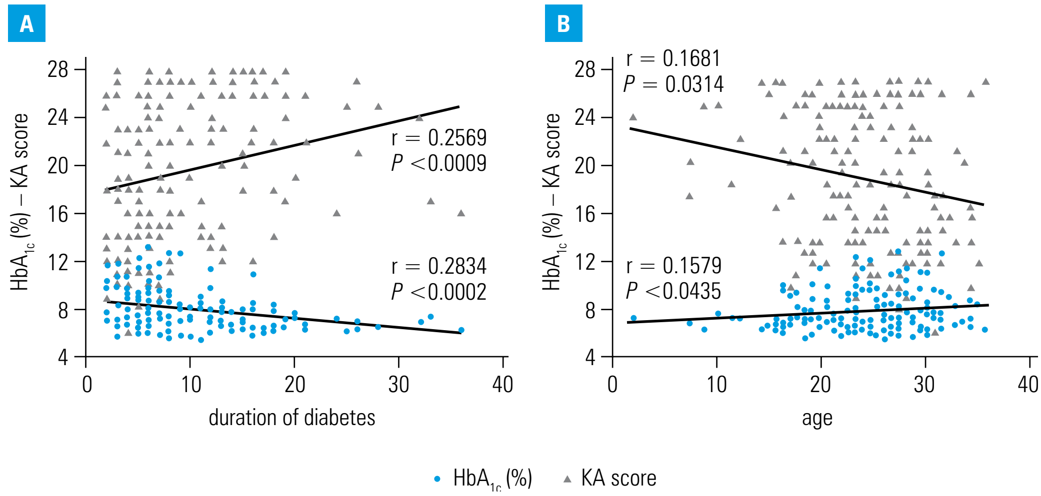


**FIGURE 2** Correlation of $HbA_{1c}$ and the knowledge and awareness score with age and duration of diabetes
**A** duration of diabetes is well correlated with knowledge and awareness scores and inversly correlated with $HbA_{1c}$ levels
**B** correlations between age and the knowledge and awareness score and $HbA_{1c}$ levels are not statistically significant
Abbreviations: see TABLE 1

the importance of education in adapting oneself to life with diabetes and raising awareness of the disease. The major differences between the results of patients with lower education and those of patients with higher education led to the conclusion that 12 years of education is the minimum threshold for patients to be able to understand their illness, communicate well with health care personnel, receive education about diabetes, and, more importantly, live with it.

Significant differences in $HbA_{1c}$ levels between obese patients and preobese or normal-weight patients are in line with the previous studies.[34,35] Although no significant difference was observed between normal-weight and preobese patients in terms of mean $HbA_{1c}$ levels, $HbA_{1c}$ tended to increase and the KA score to decrease with increasing BMI. A significant difference between the KA score was found between obese patients and the 2 remaining groups. This finding is related to the result that $HbA_{1c}$ levels are lower in patients with higher KA scores, because they are more successful in controlling diabetes and following their diet. The positive correlation between the BMI and $HbA_{1c}$ levels and negative between the BMI and KA score further support our findings.

No correlation between age and $HbA_{1c}$ levels was observed, which is in line with a similar study suggesting no direct relationship between the 2 parameters.[36] The inverse correlation between duration of diabetes and $HbA_{1c}$ levels in our study is also in agreement with the results of other investigators.[37] $HbA_{1c}$ levels are reduced with time as diabetic patients gain knowledge and personal experience in managing the disease. A significant positive correlation was detected between duration of diabetes and the KA score, which is particularly interesting because no such correlation was found between age and the KA score or between age and $HbA_{1c}$ levels. This is in line with the previous studies that evaluated the level of patients' knowledge about their condition and their awareness of the $HbA_{1c}$ test results.[14,37]

We observed that the more patients contribute to treatment costs (26%–50% and >50%), the higher the $HbA_{1c}$ level. Patients may not be able to afford treatment and follow-up costs. Therefore, social security coverage and economic status are very important in chronic illnesses.

Only 38.4% of the patients had attended and completed a diabetes education program, which shows that the majority of diabetic patients in Turkey are not properly educated about self-care in diabetes.[6,14] In line with other studies, we showed that patients who attended a diabetes education program had a higher KA score and awareness of their MRHAT compared with patients who did not receive diabetes education.[38,39] As expected from the KA score, $HbA_{1c}$, FBG and BMI values of patients who received diabetes education were lower. This suggests that patients better adapt to treatment and changes in lifestyle if they receive proper education.[38-40]

In summary, the more patients know about their condition, the better glycemic control can be achieved. The knowledge level can be raised through individual diabetes education, which contributes to better glycemic control in addition to pharmacological agents. Optimal glycemic control that is achieved in this way is very important because it may help reduce the side effects of drugs as well as treatment costs. Furthermore, questionnaires that measure the KA level in type 2 diabetic patients are as important as $HbA_{1c}$ and FBG analysis in understanding and following patients; they may also prove useful in designing diabetes education programs.

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**ARTYKUŁ ORYGINALNY**

# Związek pomiędzy kontrolą glikemii a poziomem wiedzy i świadomości choroby u chorych z cukrzycą typu 2

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**SŁOWA KLUCZOWE**

cukrzyca, hemoglobina glikowana, poziom wiedzy i świadomości

**STRESZCZENIE**

**WPROWADZENIE** Osiągnięcie prawidłowej kontroli metabolicznej pozwala zapobiegać powikłaniom związanym z cukrzycą. Edukacja chorych w połączeniu z farmakoterapią może ułatwić kontrolę glikemii.

**CEL** Celem badania była ocena związku między kontrolą glikemii a edukacją diabetologiczną, przy użyciu kwestionariusza oceniającego wiedzę i świadomość (*knowledge and awareness* – KA) u chorych z cukrzycą typu 2. Ponadto w analizie przekrojowej oceniono wpływ wieku, czasu trwania cukrzycy, płci, wskaźnika masy ciała (*body mass index* – BMI) oraz poziomu edukacji na kontrolę glikemii.

**PACJENCI I METODY** Badaniem objęto 164 chorych z cukrzycą typu 2. Ustalono, czy pacjenci zostali poddani edukacji diabetologicznej i poproszono ich o wypełnienie kwestionariusza KA przystosowanego do populacji tureckiej. Następnie oceniono związki między wynikiem kwestionariusza a hemoglobiną glikowaną ($HbA_{1c}$), stężeniem glukozy na czczo (*fasting blood glucose* – FBG) i BMI.

**WYNIKI** Zaobserwowano prawidłową negatywną korelację pomiędzy wynikiem KA a poziomem $HbA_{1c}$ i FBG. Edukację diabetologiczną przeprowadzono u 63 chorych. U tych pacjentów stwierdzono wyższy wynik KA w porównaniu z pozostałymi chorymi (odpowiednio 24,0 ±4,0 *vs* 16,8 ±5,37; $P < 0{,}0001$) oraz niższy poziom $HbA_{1c}$ (6,5% *vs* 8,5%; $P < 0{,}0001$).

**WNIOSKI** U chorych z cukrzycą typu 2 wyższy wynik KA jest związany z osiąganiem lepszej kontroli glikemii. Dzięki wykorzystaniu kwestionariusza oceniającego poziom KA i oznaczeniu $HbA_{1c}$ można zidentyfikować pacjentów, którzy wymagają edukacji diabetologicznej.

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