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# Is group diabetes education effective on hemoglobin A1c level?

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## ABSTRACT

***Objectives.*** Diabetes education decreases hemoglobin A1c (HbA1c) level by 1% in patients with diabetes mellitus. In addition, education delays development or progression of complications by improving psychosocial, clinical, and behavioural aspects of diabetes mellitus, improves quality of life, modifies life style behaviours including healthy eating and regular exercise. In this study, we aimed to evaluate efficacy of diabetes group education programme called diabetes school on glycemic control by comparing HbA1c levels of patients with diabetes mellitus measured before and after education. ***Methods***. Electronic medical records of patients with DM who were registered to diabetes school executed by endocrine units of two hospitals between 2015 and 2017 were retrospectively evaluated. Diabetes school programme was composed of 90 minutes sessions a week for 4 consecutive weeks. Education sessions were executed in a didactic and interactive pattern. ***Results***. The attendees (n = 65) had signicantly lower HbA1c levels after the education programme (before 9.09 ± 2.46%, after 7.88 ± 1.90%; $p = 0.001$) than the non-attendees (n = 41) (before 8.96 ± 2.35%, after 8.35 ± 2.00%; $p = 0.091$). Insulin users had significantly higher baseline HbA1c values and benefited more than non-insulin users ($p < 0.0001$). ***Conclusions***: The diabetes school education programme has positive impact on glycemic control in patients with diabetes mellitus. A large team may lessen the burden of education sessions on health specialists. The school executed by a team consisting of specialists may reach a larger number of patients while the patients get the opportunity to repeat the sessions anytime they need.

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***Key Words:*** diabetes education, hemoglobin A1c, diabetes school, group education

## Introduction

Diabetes mellitus (DM) is a chronic disease which may be associated with serious comorbidities and the prevalence is progressively increasing worldwide [1]. In Turkey, the prevalence of DM increased dramatically from 7.2% to 13.7% according to the Turkish diabetes epidemiology (TURDEP) studies in 1998 and 2010 [2, 3]. Diabetes treatment is governed by glycosylated hemoglobin A1c (HbA1c) level, as the most important indicator of glycemic control. Target level is determined by age, associated comorbidities, and life expectancy [4]. Despite novel oral and injectable agents, increased awareness of

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insulinisation, and diabetes education, 50-70% of the patients still do not achieve target levels worldwide as well as in Turkey [3, 5]. Annual cost of DM, related comorbidities, and complications reached 10 billion Turkish liras according to the official insurance agency, Sosyal Güvenlik Kurumu [6].

Education influence health outcomes and the use of health services in patients with DM. Everyday the patients have to make decisions on nutrition, physical activity, and medications [7]. Furthermore, they have to manage DM related comorbidities such as hypertension and dyslipidemia and complications and make necessary arrangements [1]. There are insufficient data favouring either individual or group education regarding outcomes of DM [7]. The main issue is to find out the most effective method of education, that behavioural change, self management, and psychosocial outcomes benefit most [7].

The patients should receive diabetes education at the time of initial diagnosis, according to personal needs, and as diabetes therapy becomes more complicated [1]. In Turkey about 500 certified nurses provide diabetes education (Turkish Diabetes Nurse Association data). Growing population, increased DM prevalence, heavy outpatient burden, and short duration of outpatient visits lead to insufficient education. Transfer of intense information during short visits cause difficulties in comprehension and memorization. Health facilities provide different methods of education including individual and group education and diabetes school, a type of structured group education steered by Health Ministry.

In order to standardize diabetes education and guide health professionals in charge, Turkish Public Health Agency published Guide for Educators of Patients with Diabetes in colloboration with experts, organizations, and associations [8]. Education method and content advised in the guide is based on International Diabetes Education Standards published by International Diabetes Federation (IDF) [9].

In this study, we aimed to evaluate the effect of diabetes school education on glycemic control by comparing HbA1c levels measured before and within 6 months after completion of education.

## Methods

Electronic medical records of 236 subjects, who attended diabetes school education programme executed by endocrinology units of Eskişehir Yunus Emre and Eskişehir State Hospitals between 2015 and 2017, were evaluated retrospectively. Although the main target population of education was patients with a diagnosis of DM, any other people including those with prediabetes and care-givers and relatives of patients with DM were also allowed for participation. Therefore only subjects over age 18 with a diagnosis of either type 1 or type DM for at least one year were selected. The school programme consisted of weekly executed 90 minute sessions for 4 consecutive weeks. The participants who attended at least 3 sessions were given certificates. One hundred six patients, who had HbA1c measurement within 3 months before and after the programme, were included to the study. They were categorized into 2 groups as attendees (n = 65) who completed the programme and as non-attendees (n = 41) who failed to do so.

The first session began with information given by an endocrinologist about definition of DM, subtypes of DM, signs and symptoms, and pathophysiological mechanisms. A certified dietitian informed about nutrition in DM. In the second session an endocrinologist described antidiabetic drugs and management of hypoglycemia. The session continued with information given by a neurologist regarding neurological complications. Third session began with information given by a specialist in sport medicine about the importance of regular exercise and exercise types. Information about insulin therapy, injection technique, and foot care was given by certified diabetes nurses. In the last session, a nephrologist described the role of kidney in diabetes, effect of diabetes on kidney function, and diabetic kidney disease. An ophthalmologist gave information about eye diseases frequently encountered in DM with special attention to retinopathy, prevention, and management of these disorders. The school programme completed after information regarding self monitoring of blood glucose and tips for life with diabetes was given by diabetes nurses. In all sessions, information was transferred in a didactic fashion along with visual supportive materials. The attendants were allowed to express themselves freely and ask questions during and after sessions.

HbA1c levels measured by HPLC within 3 months before and 6 months after diabetes school were compared along with age, gender, diabetes duration, treatment modality, and diabetic complications in patients with DM who completed at least 3 sessions of education.

### Statistical Analysis

**Table 1.** The sociodemographic and clinical features and laboratory data according to attendance to the school

| | Attendees (n = 65) | Non-attendees (n = 41) | *p* |
|---|---|---|---|
| Gender (F/M) | 37/28 | 27/14 | 0.418 |
| DM type (1/2) | 4/61 | NA | |
| Age | 56.56 ± 10.63 (25-80) | 56.17 ± 13.57 (21-76) | 0.878 |
| DM duration (years) | 11.7 (1-36) | NA | |
| Treatment (n) | | | |
| OAD | 25 | | |
| OAD+insulin | 31 | NA | |
| OAD+exenatide | 1 | | |
| Insulin only | 8 | | |
| Hypertension | 29 | NA | |
| HbA1c (%), before education | 9.09 ± 2.46 | 8.96 ± 2.35 | 0.795 |
| HbA1c (%), after education | 7.88 ± 1.90 | 8.35 ± 2.00 | 0.228 |

Data are shown mean ± standard deviation ( or range) or number. F = female, M = male, DM = diabetes mellitus, NA not available, OAD = oral antidiabetic drug, HbA1c = hemoglobin A1c

Normally distributed data (HbA1c and age) are shown as mean ± SD. Non-normally distributed data (duration of DM) is expressed as mean. Student t test was used for HbA1c and age in group analysis. For comparison of HbA1c measurements before and after the school programme, Wilcoxon signed ranks test was used for group analysis. General linear model for repeated measures was used for subgroup analysis (gender, insulin use). A p value less than 0.05 was assumed as statistically significant.

## Results

The electonic database of 65 patients out 236 subjects, who completed at least 3 sessions after registration, was evaluated. The mean number of subjects who attended each session was 33. The sociodemographic and clinical features and laboratory data are shown in Table 1.

Data regarding retinopathy was present in 44%, diabetic kidney disease in 41%, and neuropathy in 40% of the attendees. Therefore the rates of retinopathy (n = 11, 16%), diabetic kidney disease (n = 8, %12), and neuropathy (n = 12, %18) low.

When HbA1c levels before and after the education programme were compared, the attendees had signicantly lower values ($p$ = 0.001) than the non-attendees ($p$ = 0.091). The attendees who had baseline HbA1c level over 8% (n = 38) showed greater reduction (before 10.75 ± 1.79%, after 8.71 ± 2.04%) than those with lower values (n = 27; before 6.75 ± 0.77, after 6.70 ± 0.71%) ($p$ < 0.0001) although they had similar age and duration of DM.

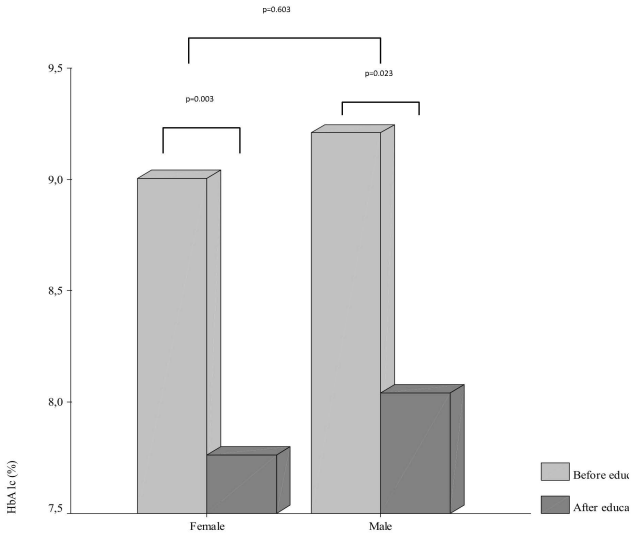


**Figure 1.** HbA1c levels before and after education according to gender

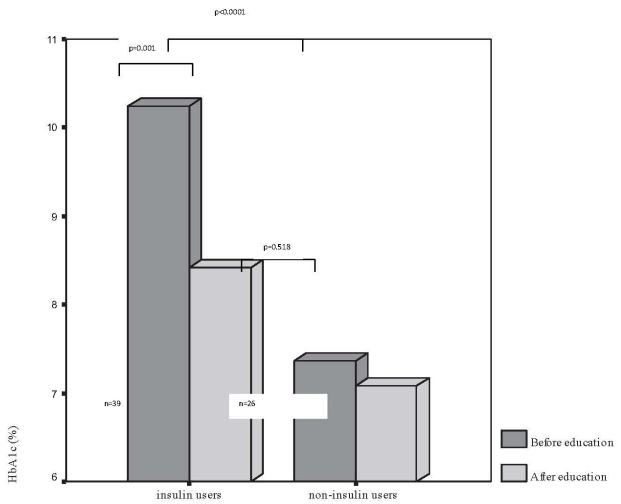


**Figure 2.** HbA1c levels before and after education according to insulin use

Both gender had significantly lower HbA1c values after completion of education, although female patients benefited nonsignificantly more than male counterparts (Figure 1). Insulin users had significantly higher baseline HbA1c values and benefited more than non-insulin users (Figure 2). Gender distribution and age were similar in both groups.

## Discussion

Diabetes education is an indispensable component of management of DM as emphasized in various guidelines [9, 10-12]. Diabetes education can decrease HbA1c level by 1% in patients with type 2 DM [10]. In the literature decrease in HbA1c varies between 0.6 to 2.5% [7, 13, 14]. Beyond absolute values, statistical analysis showed variable results, for example while in one study 0.6% decrease in HbA1c was statistically significant, in another study 1.49% decrease in HbA1c was nonsignificant [15, 16]. One possible explanation might be the heterogenity of the studies regarding education content, duration of education and diabetes, modality of treatment, and HbA1c value before education. HbA1c close to the target level before education and progressive nature of the disease further complicates the evaluation of efficacy [17]. In this study we showed a statistically significant decrement of 1.21% in HbA1c which supports positive impact of diabetes school as a group education model on short term glycemic control.

Studies comparing the effect of group versus individual education on glycemic control yielded various results, some showed superior and some showed similar efficacy [11, 12, 15-18]. A meta-analysis showed significant decrease in HbA1c at 4-6 month and 1 year after education (mean: 1.4% and 0.8%, respectively) [13]. If education continued on annual basis, benefit on glycemic control sustained at 2 years of education (HbA1c 1% lower than baseline value) [13]. Significantly lower HbA1c was observed even at the end of 5th year in Trento group education model [20]. In another meta-analysis based on Cochrane database, HbA1c was reduced by 0.1% after individual education and 0.03% after group education over a span of 12-18 months [7]. Subgroup analysis yielded significant decrease in patients with baseline HbA1c higher than 8%. We also found that the patients with HbA1c value over 8% benefited diabetes school programme significantly more than those with 8% ≥. This finding may be due to higher motivation of patients to find a solution to uncontolled DM. However it is well known that efficacy of antidiabetic therapy is greater with higher HbA1c. Also patients with poor glycemic control frequently use insulin therapy and insulin is the most efficient mode of therapy in terms if HbA1c decrease. Therefore medical therapy not only before education programme but also after the programme should be taken into consideration in order to reach a definite conclusion about the role of education in HbA1c levels above 8%.

There are a few studies dealing with diabetes education in Turkey. In a study of 291 patients, HbA1c within 3 months before and after individual or group education was compared. HbA1c level did not decrease significantly (before 8.91 ± 2.34%, after 9.00 ± 4.44%) [21]. This study was executed in 5 centers from one city. The number of educators was 161 and most of them were not certified educators. When the educators were interrogated about the content of their education, it was found that only 29-70% of main topics of necessary information was given. Questionable sufficiency of the educators, non standardized education, and absence of HbA1c sampling time after education preclude us to reach a clear conclusion. Another study involving 25 patients, 40 minute sessions of individual education was conducted for 3 consecutive weeks. HbA1c decreased by 2.0% 8 weeks after completion of programme [22]. In another study consisting of two groups consisting 25 patients each, the attendees received weekly education sessions from one expert educator for 10 consecutive weeks. At 6 month following programme, HbA1c decreased by 1.2% while 0.4% decrease was observed in control group [23]. Our study share similar features with the two latter studies. We suggest that consistency in the structure and content of education programme may contribute to the success. We believe that standardization of diabetes school education programme nationwide along with improved techniques are the determinant of success.

In another study, education was given to 53 patients on insulin therapy individually at initial and in group at 1st and 3rd months [24]. Each group consisted 5 person and interactive modality was applied. At the end of 6th month, 16% decrease in HbA1c was observed in the intervention group and 2% increase was detected in the control group who did not complete education programme. In our study we obtained similar results and insulin users benefited education programme more than non insulin users (-1.82%, 14.7% decrease vs -0.29%, 1.83% decrease). These results suggest repetitive education and office visits contribute to the success of insulin therapy as an

effective treatment modality.

The main aim of diabetes education either in individual or group pattern is to achieve behavioural outcome after learning process [10, 15]. It is hard to accomplish and maintain behavioural change and the patients frequently cannot retrieve information learned earlier [11, 18, 25]. In our study we retrospectively evaluated only short term (6 months duration after education) effect of education on glycemic control. Since we did not take surveys of diabetes attitude, diabetes care profile, empowerment, and knowledge about DM, we cannot comment on psychosocial, clinical, and behavioural outcomes of diabetes school.

The advantages of group diabetes education are avoiding the overwhelming effect of continuously repetitive nature of individual education on health professionals and providing education for more people at one time [25]. Interactivitycontributes to positive dynamics [25].

A number of education models, which have similar content but vary in learning technique, duration, and frequency, have been developed. Active contribution of patients and patient-centered approach should be favoured rather than didactic teaching model [9]. Therefore we combined both didactic teaching method and interactive approach by question and answer method.

Education delays development and progression of complications, improves quality of life, modifies life style behaviours including healthy eating and regular exercise, decreases diabetes associated stress and depression, enhances self- and empowerment skills, management and aids in healthy coping with problems by influencing psychosocial, clinical, and behavioural aspects of DM in positive manner [26]. Education is a cost-effective way of reducing hospitalizations and complications [26]. The short term nature of our study preclude us to make a comment on hospitalization and complication rates.

*The Limitations of the Study*

There are some obstacles in group education. Non homogenous composition in terms of sociodemographic features (age, education, numeracy and medical literacy, language skills, cultural behaviours) and attitude (unwillingness to contribute, interrupting people's speaking, struggle to participate etc.) may preclude a patient to share his/her own experience with others. [11, 27]. We did not assign the patients according to their sociodemographic features before admission. Therefore our groups are heterogenous. Data regarding education, numeracy, and medical literacy were unavailable.

## Conclusions

The positive impact of diabetes school education programme executed by Health Ministry and Public Health Agency on glycemic control is compatible with the results of individual and group education programmes with different concepts and design. In other studies, education team consisted of at least 1 up to 3 health professional including dietitian, diabetes nurse, and physician. Our team consisted of 6 physician specialists, 1 dietitian, and 2 certified nurses. A large team may lessen the burden of education sessions on health specialists.

However mid-term and long-term studies are needed to evaluate the effects of diabetes school programme on the targets of regarding quality of health, frequency and severity of complications, weight, dyslipidemia, and blood pressure control, cessation of smoking, and knowledge of diabetes.

We suggest that the school model executed by a team consisting of specialists may reach a larger number of patients while the patients get the opportunity to repeat the sessions anytime they need.

*Authorship declaration*

All authors listed meet the authorship criteria according to the latest guidelines of the International Committee of Medical Journal Editors, and all authors are in agreement with the manuscript.

*Conflict of interest*

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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