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Original Article

Comparison of group-based and individually training in patients with diabetes mellitus: 2-year follow-up study

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Abstract

Objective: This study examines whether any difference in hemoglobin A1c (HbA1c) levels exists among diabetic patients who had group-based training in a diabetes school and patients who were individually trained in outpatient clinics.

Methods: This study was conducted in Karabuk University Education and Research Hospital, Turkey, between March/2016 and March/2018. The HbA1c levels of 96 patients who were trained in a diabetes school and 99 patients who were individually trained in the outpatient clinic were measured. The treatments of the patients trained in the outpatient clinic had also recently been changed, either by the addition of a new medication (oral anti-diabetic drugs or insulin) and/or by increasing the dosages of their current medications.

Results: The mean HbA1c level was 9.29±1.90 for the diabetes school patients and 9.73±1.22 for the individually trained group patients (p>0.05). It was found that HbA1c regressed to 8.25±1.84 three months after the training in a school, while the regression was 8.34±1.66 in the outpatient trained group (p>0.05). No difference was detected between groups in terms of lowering HbA1C. Group-based training provided a more efficient HbA1c decrease in male patients, who had a body mass index (BMI) of ≥30, and in those who received intensive insulin therapy. However, at the first year follow up, HbA1c showed a tendency to increase again in the diabetes school group.

Conclusion: Group-based training is a cost-effective method that may also decrease anti-diabetic requirement and provides more patient satisfaction, along with higher patient compliance. However, for long-term success, the training should be continuous and should be held at least once a year to provide up-to-date information.

Keywords: Diabetes mellitus; group-based training; individual training; Hemoglobin A1c.

INTRODUCTION

Type 2 diabetes mellitus (T2DM), which particularly affects economically wealthy countries, continues to show an unceasing increase in prevalence all around the world (1). Increasing urbanization, an aging population, obesity, and limited physical activity levels contribute to the worldwide rise of T2DM. According to related scientific research, Saudi Arabia has the highest prevalence of T2DM in the world, and more than 10% of adults in the United States, Switzerland, and Austria were found to have T2DM (2). The role of obesity and body fat is significant in this metabolic disorder, as the main reason for the pandemic nature of T2DM is the increased prevalence of obesity in Europe and the United States. To date, not only are all the major scientific associations, such as the World Health Organization (WHO), but also nonscientific organizations, are emphasizing the role of diet in the prevention of noncommunicable diseases, including T2DM (2,3).

Diabetes training programs are essential tools allowing the people with diabetes to understand the details of the disease and its effect on their lives. This is because individual training attempts in an outpatient setting may not be enough to provide the knowledge and skills a patient needs to properly manage diabetes over the course of a lifetime. For the successful treatment of diabetes, cooperation between the patient, the patient's family, and the health team is necessary (4-6). For this purpose, in addition to individual training, a diabetes school was initiated by the authors of this study in 2016 in a hospital, in alignment with the recommendations of the Turkish Ministry of Health. We examined whether a difference exists in the hemoglobin A1c (HbA1c) levels of

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diabetic patients trained in diabetes school and in diabetic patients who were individually trained in a diabetes training outpatient clinic.

MATERIAL and METHODS

Design and Patients

This study was conducted in Karabuk University Education and Research Hospital between March/2016 and March/2018. The study protocol fulfilled the ethical guidelines of the Declaration of Helsinki (http://www.wma.net/e/policy/b3.htm) and was approved by the institutional review board (Karabuk University Education and Research Hospital approved, date:16/11/2015, issue:1384).

In the diabetes school, which was initiated as a part of the Diabetes Prevention and Control Program of the Turkish Ministry of Health, training sessions were scheduled for eight different groups, each consisting of 15 to 20 individuals, on two different days, for a total of 4 hrs. Training was provided by an internal medicine and endocrinology specialist, a diabetes training nurse, and a nutritionist. Two hundred forty-four patients who were referred from the internal medicine, family medicine, and endocrinology outpatient clinics, and patients who were participants in the diabetes school, were invited via phone call for the training. One hundred twenty-five patients participated in the school training, out of which only the 96 patients who completed the courses participated in the trial. The patients' treatment remained unchanged, so only the effects of training on HbA1c levels were examined. Pre-tests and post-tests consisting of 25 questions were given to the patients, aiming to test their knowledge before and after the training, and each question was worth 4 points. HbA1c was measured before the training and in the third month, first year, and second year after the training was given.

Another study group was also formed, consisting of patients who were referred to the diabetes training outpatient clinic for individual training and were unable to obtain blood glucose regulation. In this group, diabetic patients whose treatments were changed by the addition of a new anti-diabetic agent (oral anti-diabetic [OAD] or insulin) and/or by increasing the doses of their current medications, received individual training in outpatient clinic. No difference was between groups in terms of educational levels. The HbA1c levels before and in the third month after the individual training were measured. Then, HbA1c levels of the patients educated in diabetes school were also measured before and after in the third month of training. The decrease of HbA1c levels between these two groups were compared.

Statistical Analysis

Continuous variables were expressed as mean ± standard deviation and categorical data as number and percentage. For the inter-group analysis of the continuous variables, normality analyses were performed using the Kolmogorov–Smirnov goodness-of-fit index. When the data was abnormally distributed, the Mann–Whitney U test was applied for the comparison of the two groups. For the intra-group analysis of the repeated assessments, Friedman's test was used for the comparison of the levels measured at three different times or more (as the data were found to be abnormally distributed). Wilcoxon's signed ranks test was used as a further analysis method to detect which subgroup caused significance. Pearson's correlation test was used for the correlation analysis, while the Chi-Square test was used for the comparison of categorical data. All analyses were performed using IBM SPSS Package Software version 24.0 (IBM Corporation, Armonk, NY, USA). The statistical significance level was set as $p<0.05$.

RESULTS

The mean age of the patients was 53.11±10.37 years in the diabetes school group and 54.18 ±12.63 years in the individual training group ($p>0.05$). While there was no statistically significant difference between the two groups regarding gender or rate of diabetes type (T1DM or T2DM) ($p>0.05$), when the patients were evaluated based on their treatments modalities, insulin therapy was found to be more prevalent in the individual training group ($p<0.001$) (Table 1).

Diabetes School Data Review

Of the participants, 8.3% had a normal body mass index (BMI <25), 31.3% of them were overweight (BMI 25–29.99), and 47.9% were obese (BMI ≥30). Of the patients, 47.9% received intensive insulin therapy, 19.8% received

Table 1. Some socio-demographic and clinical characteristics of the groups

Variables	Diabetes School Training Group (n=96)	Individual Training Group in Policlinic (n=99)	p
Age	53.11±10.37	54.18±12.63	0.276*
Gender (F/M)	57/39	60/39	0.861**
Type of DM (Type 1/Type 2)	6/89	9/89	0.457**
Treatment			
Intensive treatment	46	46	
Mixed insulin treatment	11	40	<0.001
Basal insulin + OAD therapy	19	11	
Only OAD treatment	17	1	

* Mann Whitney U Test ** Chi-square Test OAD: Oral antidiabetic

basal insulin and OAD therapy, 18.3% received OAD only, and 11.8% received pre-mixed insulin (Table 1). The mean scores of the pre-tests and post-tests were 69.70±15.55 and 93.74±8.19, respectively (p<0.001) (Figure 1). The mean HbA1c percentage levels before the training was 9.29±1.90, and this decreased to 8.25±1.84 in the third month after training, to 8.30±1.73 at year one, and to 8.58±1.60 at year two (p=0.001).

Review of the Data According to Gender

In the female patients, there was a statistically significant decrease in HbA1c levels before and in the third month after training. However, the levels showed a statistically significant increase in HbA1c levels in the first and second year compared to the levels at the third month. In the male patients, when the pre-training HbA1c levels were compared to the levels at month three and year one, a statistically significant decrease was found; however, the decrease in the levels at year two was not statistically significant (Table 2).

Review of Data According to BMI

While there was no statistically significant difference in the HbA1c levels before and after training in individuals with a BMI <25, a statistically significant decrease was observed between HbA1c levels before training and at three months after training in individuals with a BMI ranging between 25 and 29.99. In individuals with a BMI ≥30, a statistically significant decrease in the HbA1c levels was observed at month three and year one after training, as compared to

Table 2. Comparison of HbA1c by gender

Gender		HbA1c (2016) (PET)	HbA1c (2016) (POT 3th month)	HbA1c (2017) (POT 1th year)	HbA1c (2018) (POT 2th year)	p
Female	N	55	55	41	21	
	Mean±SD	**9.17±1.85****	**8.21±1.72****	**8.34±1.67****	**8.49±1.83****	**0.006***
	Median	9.40	7.90	7.90	8.30	
	Minimum	5.10	5.10	5.00	5.50	
	Maximum	14.00	13.30	12.00	13.10	
Male	N	37	36	26	14	
	Mean±SD	**9.48±1.98****	**8.32±2.04****	**8.25±1.84****	**8.72±1.23****	0.079*
	Median	9.20	7.90	7.60	8.75	
	Minimum	6.20	5.60	5.20	7.20	
	Maximum	16.00	13.20	12.50	11.20	

* Friedman Test, ** Wilcoxon Signed Ranks Test
In Females [PET – POT 3th month, p=0.001] [POT 3th month – POT 1th year, p=0.023] [POT 3th month – POT 2th year, p=0.025]
In Males [PET – POT 3th month, p=0.001] [PET – POT 1th year, p=0.004]
PET: Pre-training, POT: Post-training

Table 3. Comparison of HbA1c by BMI

BMI		HbA1c (2016) (PET)	HbA1c (2016) (POT 3th month)	HbA1c (2017) (POT 1th year)	HbA1c (2018) (POT 2th year)	p
0-24.99	N	8	8	3	2	
	Mean±SD	**10.97±2.15**	**9,02±2,18**	**8,43±1,85**	**9,05±0,49**	-
	Median	10.25	9.50	9.40	9.05	
	Minimum	9.00	5.60	6.30	8.70	
	Maximum	16.00	11.60	9.60	9.40	
25-29.99	N	28	27	16	11	
	Mean±SD	**9.07±1.67****	**8.02±1.57****	**8.69±1.81**	**9.08±1.20**	0.187
	Median	9.20	7.70	7.90	8.80	
	Minimum	6.20	6.00	6.60	7.40	
	Maximum	13.00	13.20	12.50	11.20	
30 and above	N	44	44	36	19	
	Mean±SD	**9.01±1.94****	**8.18±1.98****	**7.98±1.74****	**8.37±1.90**	**0.024**
	Median	9.05	7.70	7.55	8.10	
	Minimum	5.10	5.10	5.00	5.50	
	Maximum	14.00	13.30	12.00	13.10	

* Friedman Test, ** Wilcoxon Signed Ranks Test
BMI 25-29.99 [PET – POT 3th month, p=0,002]
BMI 30 and above [PET – POT 3th month, p=0,002] [PET – POT 1th year, p=0,008]
PET: Pre-training, POT: Post-training

the pre-training levels; however, the decrease in the levels at year two was not statistically significant (Table 3).

Review of Data According to Treatment

A statistically significant decrease in the HbA1c levels at the third month and first year after training was observed, when compared to the pre-training levels, in patients receiving intensive insulin; in contrast, a statistically significant decrease in the HbA1c levels at the third month was seen, when compared to the pre-training levels, in patients receiving mixed insulin therapy. A statistically significant decrease was present in the HbA1c levels at the third month and first and second years, when compared to pre-training levels, in patients receiving basal insulin and OAD therapy. However, no statistically significant difference was observed between the pre- and post-training HbA1c levels in patients receiving OAD therapy alone (Table 4).

No statistically significant correlation was detected between BMI and pre-training (r=−0.177, p=0.117) and post-training HbA1c levels (post-training month three [r=0.110, p=0.924]; post-training first year one [r=−0.037, p=0.788]; post-training scond year 2 [r=0.119, p=0.517]).

Comparison of HbA1c Levels of Diabetes School and Individually Trained Patients

The HbA1c levels of the patients trained in the diabetes school were also compared to those of the patients trained individually in the outpatient clinic. It was determined that HbA1c levels before education and treatment were higher in patients who were individually trained (9.73±1.22) than in those trained at the diabetes school (9.29±1.90); however, the difference was not found to be statistically significant (p>0.05). When the HbA1c levels at the third month after diabetes school and individual training were compared, no significant difference was found between the two groups (p>0.05). When both the groups were

Table 4. Comparison of HbA1c by treatment

Type of Treatment		HbA1c (2016) (PET)	HbA1c (2016) (POT 3th month)	HbA1c (2017) (POT 1th year)	HbA1c (2018) (POT 2th year)	p
Intensive treatment	N	46	45	34	16	
	Mean±SD	**9.68±1.58****	**8.61±2.04****	**8.32±1.82****	**8.73±1.55**	0.117
	Median	9.60	8.10	7.55	8.70	
	Minimum	6.20	5.60	6.10	6.80	
	Maximum	14.00	13.30	12.50	13.10	
Mixed insulin treatment	N	11	11	9	7	
	Mean±SD	**10.55±2.73***	**8.70±1.56***	**9.15±1.35**	**9.48±1.57**	0.334
	Median	10.74	8.80	9.40	9.20	
	Minimum	6.50	6.20	7.10	7.20	
	Maximum	16.00	11.50	11.11	11.60	
Basal insulin + OAD therapy	N	18	18	11	6	
	Mean±SD	**9.36±1.39****	**8.25±1.58****	**8.04±1.49****	**8.30±1.40****	**0.020**
	Median	9.30	8.00	7.80	7.65	
	Minimum	6.70	6.30	5.20	7.20	
	Maximum	12.20	12.30	10.20	10.70	
Only OAD treatment	N	17	17	13	6	
	Mean±SD	**7.37±1.19**	**7.00±1.16**	**7.90±1.85**	**7.40±1.51**	0.535
	Median	7.20	7.00	7.30	7.60	
	Minimum	5.10	5.10	5.00	5.50	
	Maximum	10.00	10.30	11.70	9.40	

* Friedman Test, ** Wilcoxon Signed Ranks Test
Intensive treatment [PET – POT 3th month, p<0,001] [PET – POT 1th year, p=0,004]
Mixed insulin treatment [PET – POT 3th month, p=0,02]
Basal insulin + OAD therapy [PET – POT 3th month, p=0,024] [POT 3th month – POT 1th year, p=0,033] [POT 3th month – POT 1th year, p=0,027]
PET: Pre-training, POT: Post-training, OAD: Oral Antidiabetic

Table 5. Comparison of HbA1c Levels of Groups Before and After Training

Groups		HbA1c (PET)	HbA1c (POT 3th month)	p
Diabetes School Training Group	N	92	91	
	Mean±SD	**9.29±1.90**	**8.25±1.84**	**<0.001***
	Median (min-max)	9.35 (5.10-16.00)	7.90 (5.10-13.30)	
Individual Training Group in Policlinic	N	99	99	
	Mean±SD	**9.73±1.22**	**8.34±1.66**	**<0.001***
	Median (min-max)	9.69 (7.00-13.07)	8.00 (4.80-15.18)	
	p	0.055**	0.464**	

*** Wilcoxon Signed Ranks Test**
**** Mann Whitney U Test**
PET: Pre-training, POT: Post-training

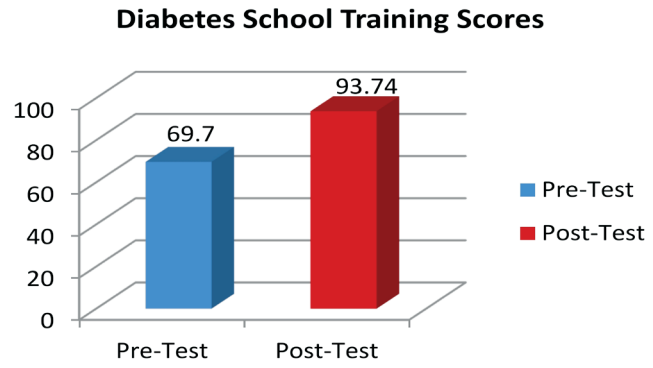

Figure 1. Comparison of pre-test and post-test training scores

compared among themselves, a statistically significant decrease was detected between the pre- and post-training HbA1c levels (Table 5).

DISCUSSION

This study divided diabetic patients into two groups: those trained group-based in a diabetes school and those trained individually in an outpatient clinic. It then investigated the difference in HbA1c levels between the two groups. Although the treatments of patients who were trained in the diabetes school remained unchanged, the treatments of the patients who were individually trained in the outpatient clinic did change, either by the addition of new medications (i.e., OAD or insulin) and/or by increasing the dosages of their current medications. No statistically significant difference was detected between the HbA1c levels of the patients at month three after the training. However, it was observed that providing training in a diabetes school resulted in a similar HbA1c decrease when compared to providing individual training and simultaneously changing the anti-diabetic medication and/or dosages being administered.

Diabetes requires lifelong monitoring and treatment. In diabetes school training, the authors aimed to ensure that the diabetic patients participated interactively and were informed about the disease. The training courses provided information about the problems that diabetic patients encounter in their daily lives; the prevention of damage and other adverse effects caused by diabetes to various organs; what diabetic patients should be careful about in their diets; and the importance of diet, insulin administration, and at-home blood glucose monitoring.

Completing training is one of the therapeutic components of diabetes management. Therefore, it is recommended that all diabetic patients should be trained (7-9). The literature presents varying results concerning the effectiveness of training: some studies report that training results in a 0.6% to 2.5% decrease in HbA1c levels in patients with T2DM, while other report a decrease of approximately 1% (10-12). Factors determining the success level of training include the content and duration of the diabetes training course, the treatment modality used for diabetes management, and the pre-training HbA1c levels. In the present study, a 1.04% HbA1c decrease was observed in the group who were trained in the diabetes school, without any change in their anti-diabetic treatments. Group training is a cost-effective method and may result in greater patient satisfaction and a higher patient compliance rate when compared to individual training given in outpatient settings (8).

Different outcomes have also been reported in previous studies comparing the effect of group training and individual training on glycemic control, with some demonstrating that group training is superior and others demonstrating that the efficiency of group training is comparable to that of individual training (13-16). In a meta-analysis of nine different studies involving 1359 participants, it was observed that individual training does not improve glycemic control considerably and provides only a 0.1% decrease in HbA1c levels. While individual training was found to be more effective in patients with HbA1c levels of >8%, no significant difference was found between the effects of individual training and group training regarding HbA1c level, BMI, or systolic or diastolic blood pressure after 12 to 18 months of follow-up (10).

In another meta-analysis, reviewing 11 different studies involving 1532 participants, positive effects were seen after group-based training among patients with T2DM

in terms of fasting blood glucose levels, HbA1c levels, systolic blood pressure, body weight, and anti-diabetic medication requirements, and these positive effects continued up to one year after the training (11). Similarly, in the present study, a statistically significant decrease was observed in the HbA1c levels within the first three months after diabetes school training, and this decrease continued in the follow-ups for up to one year. However, it was observed that HbA1c levels had a tendency to increase again during the second year.

After training in the diabetes school, patients' HbA1c levels tended to increase again, starting from year one in female patients and from year two in male patients. It was observed that diabetes school training was more effective for patients with a BMI ≥30 and receiving insulin therapy, while there was no statistically significant difference between the pre-and post-training HbA1c levels of patients with a BMI <25 and receiving only OAD.

CONCLUSIONS

Patients with diabet, and their relatives, should be united and motivated in seeking to understand and live with diabetes. In coming together to be taught and trained in managing the disease, both the patients and their relatives or caregivers will be able to express their problems in a safe and interactive setting that fosters mutual communication. Training in such a diabetes school may increase the success rate of diabetes treatment. Group training is a cost-effective method that may also decrease the anti-diabetic requirement and provide greater patient satisfaction and higher patient compliance. However, for long-term success, we recommend that the training should be continuous, being held at least once a year, and that the information being taught should frequently be updated.

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