

## ORIGINAL ARTICLE

# The Effects of Nutrition Education and Insulin Injection Training on Glycemic Control in Iranian Patients with Type 1 Diabetes

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### ABSTRACT

*The present study aimed to determine the effects of educational programs based on measurement of biochemical parameters among the patients with insulin dependent diabetes mellitus in Shiraz, Fars Province, Iran. This study was conducted on 200 patients with insulin dependent diabetes mellitus (Type 1). The participants were randomly divided into three experimental groups; i.e., nutrition education, insulin injection training, and both nutrition education and insulin injection training, and one non-trained control group. At two stages (before the study and after 12 weeks), blood samples were taken from the participants and investigated for Fasting Blood Sugar (FBS) and glycosylated hemoglobin (HbA1C). HbA1C and FBS levels improved significantly among the experimental groups compared to the control group. Using educational programs is an effective method for reducing FBS and HbA1C levels and preventing the complication of diabetes in diabetic patients.*

**Keywords:** Educational program, Fasting blood sugar, Glycemic control, Glycosylated hemoglobin, Type 1 diabetes

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### INTRODUCTION

Type 1 Diabetes Mellitus (T1DM) is one of the most important chronic diseases with high prevalence worldwide. The prevalence of T1DM has increased intensely over the past two decades. The most recent survey has indicated that 230 million people around the world suffer from diabetes, and the value is expected to rise to 370 million by 2025 [1]. In Iran, the prevalence of this disease was reported to vary from 1.2% to 14.5 % [2]. The most common complication of diabetes is heart disease, kidney failure, nerve damage, defects in male sexual imagination, infection, and psycho-emotional problems [3].

Glycosylated hemoglobin (HbA1C) reflects the average blood sugar level over 100 to 120 days before testing. When red blood cells are exposed to a greater amount of glucose, the percentage of HbA1C increased. HbA1C is expressed as a percentage and is beneficial for assessment of long-term glycemic control. The optimal rate of HbA1C is less than 7% [4]. Higher HbA1C levels in type 1 diabetes are associated with complications, such as retinopathy and nephropathy [5, 6]. Fasting Blood Sugar (FBS) greater than 126 mg/l is a quantitative index for diagnosis of diabetes [7]. Increase of blood sugar brings its complications little by little without making any signs [8]. Thus, diabetic patients should control their blood sugar not to be afflicted with the complications of diabetes. This calls for the patients' awareness and appropriate self-care operation [9].

Dietary alteration is the basic strategy for management of diabetes in the world [10]. Therefore, following a healthy dietary pattern may help achieve desirable outcomes. In this respect, improvement of self-management through training is the chief and essential treatment plan [11].

Several studies have shown that improving patients' knowledge increased the goals of diabetes management [12-16]. However, further studies are needed to investigate the effect of various management and training programs on diabetes indexes. The present study aims to determine whether knowledge of the targets of diabetes care after receiving diabetes self-management training affected the HbA1C and FBS levels at the 12th week.

## MATERIALS AND METHODS

The present study was conducted on 200 patients whose age ranged from 20 to 45 years. They suffered from T1DM and had referred to Hospital affiliated to Shiraz University of Medical Sciences since August 2012 to December 2013. The participants were selected through convenience sampling and were randomly divided into four 50-subject groups (one control group and three training groups) using block randomization. Among the three training groups, one was trained properly regarding insulin injections, another received nutrition education, and the last one received both trainings. The inclusion criteria of the study were:

1. Diagnosis of insulin dependent diabetes by an endocrinologist
2. Having the ability to read and write
3. Not being pregnant
4. Not having a history of any particular diseases or kidney failure and not having used drugs affecting the metabolic system three months before the study.

The patients who did not follow the nutritional recommendations for 2 weeks were excluded from the study. This study aimed to investigate the effectiveness of educational programs about healthy nutrition and accurate injection method in the patients with T1DM. Then, the individuals signed written informed consents to participate in the study and completed the demographic questionnaires. All the participants were contacted once a month and were asked about the observance of the trainings. At two stages (before the study and after 12 weeks), 10 ml blood samples were taken from the participants. The blood samples were investigated for FBS (by FBS test) and HBA1C (by High Performance Liquid Chromatography (HPLC)).

### Statistical analysis

The statistical analyses were performed using the SPSS statistical software (version 16). Kolmogorov-Smirnov test was used to determine normal distribution of the variables. Then independent T-test and Mann-Whitney test were used to compare the differences between the two groups (for the variables with normal or abnormal distribution as appropriated). Chi-square test was also used to compare the means of categorical variables between the two groups. Moreover, Wilcoxon test was employed to compare the changes before and after the intervention.  $P < 0.05$  was considered as statistically significant.

## RESULTS

According to the results, FBS and HbA1C values followed normal distribution and Kolmogorov-Smirnov test was used to compare the data among the four study groups. The means of biochemical parameters before and after the intervention were compared using paired t-test and Wilcoxon test. The results showed that the biochemical parameters (FBS and HbA1C) decreased significantly in the training groups after the intervention (Tables 1 and 2). Furthermore, the biochemical parameters presented lower values in the three training groups compared to the control group after the intervention. However, no significant differences were observed among the training groups regarding the changes in biochemical parameters (Tables 3 and 4).

	Before the intervention	After the intervention	P-value
Nutrition education	218.3±155.7*	182.2±75.5	<0.05
Insulin injection training	215.3±153.3	171.7±93.4	<0.05
Nutrition education and insulin injection training	213.8±154.6	190.2±98.5	<0.05
Control	207.1±95.3	223.3±124.4	>0.05

\*mean ±SD (mg/dl)

	Before the intervention	After the intervention	P-value
Nutrition education	7.9±2.2*	6.3±1.1	<0.05
Insulin injection training	7.8±2.2	6.1± 1	<0.05
Nutrition education and insulin injection training	7.9±2.2	6.1±1.1	<0.05
Control	9.4±1.7	9.3±1.7	>0.05

\*mean ±SD (%)

## DISCUSSION

Evidence has that diabetic patients had a low knowledge level regarding self-care management [17-19]. Yet, the findings of the studies conducted on the issue have confirmed that various self-care educational programs could increase such patients' awareness and improve prevention and control of the disease [20, 21]. Different studies on the relationship between training and quantitative indexes of diabetes management have used indexes, such as HbA1C, lipids, KAP, and SE [22]. Dalewitz *et al.* showed that 1% decrease in HbA1c led to about 27% decrease in micro vascular and 21% decrease in macro vascular diabetic complications [23].

	Insulin injection training	Nutrition education and insulin injection training	Control
Nutrition education(P-value)	0.19 (0.38)	0.17 (0.44)	-2.59 (0.01)
Insulin injection training(P-value)	*	-0.02 (0.9)	-2.796 (0.01)
Nutrition education and insulin injection training(P-value)	*	*	-2.770(0.01)

	Insulin injection training	Nutrition education and insulin injection training	Control
Nutrition education (P-value)	9.837(0.6)	-9.069 (0.6)	-43.595 (0.05)
Insulin injection training (P-value)	*	-18.905(0.3)	-53.432 (0.01)
Nutrition education and insulin injection training (P-value)	*	*	-34.527(0.07)

The results of the present study indicated that the patients' mean of HbA1C decreased 12 weeks following the educational intervention. However, no significant difference was found among the three training groups regarding the mean of HbA1C before and after the intervention. The significant improvement in the training groups indicated the effectiveness of the educational intervention. Nevertheless, none of educational methods is preferred over others. Our findings regarding the effect of educational programs on decreasing the HbA1C levels are consistent with those of several clinical trials [20]. Rothman *et al.* [24] and Padmalatha *et al.* [25] reported that diabetes management program significantly improved target HbA1C rates compared to the control subjects in the low baseline knowledge group, but not those in the high baseline knowledge group. Although we did not divide the patients on the basis of baseline knowledge in the present study, it appears that high baseline knowledge can improve diabetes management program.

In the present research, the patients' mean of FBS levels decreased 3 months after the educational intervention. However, no significant difference was observed among the three experimental groups regarding the mean of FBS before and after the intervention. Similar findings were also obtained in other

researches performed on the effect of food program education on FBS [9, 20, and 26]. The finding of some studies have demonstrated the effectiveness of training using new educational methods, such as SMS via mobile phone, in management of the complications of diabetes mellitus [22]. Nonetheless, further studies are needed to investigate the effectiveness of using modern techniques in training and management of diabetic patients. The present study had some limitations, the first of which being the short study period. Another limitation of the study was that we did not record the physical activity and daily dietary program of the patients.

In conclusion, the results of the recent studies and the present one revealed the effectiveness of using educational programs in reduction of FBS and HbA1C levels and prevention of the complications of diabetes in diabetic patients.

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