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Decrease in Self-Efficacy for Exercise at 12 Weeks after Exercise Education in Diabetic Patients

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Abstract

The purpose of this study was to investigate whether self-efficacy for exercise decreased 12 weeks after educational intervention in diabetic patients and whether this had an effect on glycemic control. Thirty-eight diabetic patients underwent a 2-week educational program and were then followed for 12 weeks after discharge. The intervention program was delivered by several types of medical professionals. Lectures on exercise were given by a physical therapist, who tailored exercise instructions for individual patients. The assessment of self-efficacy for exercise was performed using a scale from a previous study, modified for Japanese people. The scale consisted of four sub-items: physical fatigue, mental stress, lack of time, and poor weather. Measurements were performed at the time of discharge and 12 weeks after discharge. Glycated hemoglobin (HbA1c) levels were assessed as an index of glycemic control, and diabetic status and social status factors were recorded. The physical fatigue and lack of time components of the self-efficacy for exercise scale were significantly decreased 12 weeks after discharge. Positive correlations were found between HbA1c levels at 12 weeks and duration of diabetes, number of educational admissions, and presence of diabetic retinopathy. The results suggest that the factors that are difficult to reproduce during hospital education (physical fatigue and lack of time) are the ones that decrease after discharge. To clarify the relationship between changes in self-efficacy for exercise and glycemic control, further studies with an extended follow-up period (24 weeks or 48 weeks) are needed.

Keywords

Self-Efficacy, Exercise, Glycated Hemoglobin

1. Introduction

Self-efficacy is the belief of an individual in his/her ability to perform a particular activity and influence the level of effort and perseverance in spite of difficulties. In the prestigious work of Bandura, self-efficacy is a psychological factor affecting behavioral change [1]. Social cognitive theory (SCT), which is based on self-efficacy, can contribute to changes in lifestyle and weight loss in obesity [2]. In diabetic patients, a few studies have suggested that interventions based on SCT increase self-care levels and improve glycemic control [3] [4].

Self-efficacy for exercise has been shown to increase physical activity (PA) levels in diabetic patients [5]. As a result of intervention-based SCT, improvements in PA levels are maintained for 6 - 12 months [6]. Thus, higher self-efficacy for exercise increases PA levels, and the effect lasts for a period of time. In type 2 diabetic patients, elevated levels of PA affect glycemic control [7]. Interventions to reinforce self-efficacy for exercise play an important role in exercise therapy for diabetic patients. However, there are few studies investigating the relationship between changes in self-efficacy for exercise and glycemic control. If we could immediately recognize the decrease in self-efficacy for exercise, we would be able to determine the appropriate frequency of intervention after exercise education. Therefore, this study may contribute to the construction of exercise therapy programs for diabetic patients by incorporating socio-psychological factors.

We therefore hypothesized that self-efficacy for exercise decreases in the 12 weeks after an educational intervention in diabetes patients. In addition, we hypothesized that poor glycemic control correlates with decrease in self-efficacy for exercise. To test this hypothesis, the change in self-efficacy for exercise 12 weeks after an educational intervention was evaluated, and the correlation between self-efficacy for exercise and glycemic control was examined.

2. Methods

2.1. Subjects

The subjects were 48 diabetic patients admitted to the Japanese Red Cross Kanazawa Hospital between March 2015 and September 2016. The age of the subjects was 20 years or older. All the subjects were hospitalized for improvement of glycemic control and diabetes education consisting of a 2-week educational program. They were then followed up 12 weeks after discharge. Patients were excluded if they could not be followed up after 12 weeks or were hospitalized for a disease not related to diabetes. Two patients dropped out of treatment. Three were hospitalized for the treatment of other diseases. Three were treated by family doctors. Two patients moved to other areas. Thirty-eight subjects were Japanese living in the vicinity of Kanazawa City. The intervention program was performed by a doctor, a nurse, a dietician, a medical technologist, a pharmacist, and a physical therapist. The exercise therapy was performed by the physical therapist. The exercise therapy consisted of three parts, lectures on exercise, tailored individual counseling, and exercise practices, according to each patient's

individual lifestyle to enable them to continue the exercises after discharge. We particularly focused on instructions for exercising in poor weather, because of the high annual precipitation in the Hokuriku region.

Information on diabetes status (*i.e.*, status of vascular complications, injecting insulin, education hospitalization history) and social status (*i.e.*, living with family, working full time or part time) was collected. Diabetic polyneuropathy was defined as an abnormality in nerve conduction velocity or attenuation of protective sensation determined by 4.56 Semmes-Weinstein monofilament test. Retinopathy was defined as more than simple retinopathy. Diabetic nephropathy was defined as a urinary albumin/creatinine ratio of above 30 mg/g creatinine. HbA1c levels were measured at admission and at 12 weeks after discharge, as an index of glycemic control. All patients provided written informed consent before enrollment.

2.2. Self-Efficacy for Exercise

Self-efficacy for exercise was assessed using a scale from a previous study [8], modified for Japanese patients. The scale was a self-administered questionnaire and consisted of four sub-items: I am confident I can participate in regular exercise when I am tired (physical fatigue), when I am in a bad mood (mental stress), when I feel I do not have the time (lack of time), and when it is raining or snowing (poor weather) [9]. A five-point scale was used to rate each item (1 = I am not at all confident to 5 = I am very confident). The total possible score ranged between 4 and 20 points. Measurements were performed at the time of discharge and 12 weeks after discharge.

2.3. Statistics

For each variable, including patient characteristics and HbA1c levels, normal distribution was confirmed using the Kolmogorov-Smirnov test. The paired t-test was performed to assess differences in the total self-efficacy score between discharge and after 12 weeks. The Wilcoxon signed-rank test was performed to compare sub-item scores. In a correlation analysis, the correlation ratio was calculated for variables on the nominal scale, Pearson's correlation coefficient was calculated for variables with normal distribution, and Spearman's correlation coefficient was calculated for variables without a normal distribution. The significance level was set at $p < 0.05$.

3. Results

The patient characteristics are shown in Table 1. This was the first educational program for 55.3% of patients, accounting for more than half of the patients. The average of duration of diabetes was 7.9 (±7.3) years; the patients with short and long durations were mixed. Table 2 shows the total self-efficacy and sub-item scores at discharge and 12 weeks after discharge. Scores for physical fatigue and lack of time at 12 weeks after discharge were significantly lower than those at discharge. The scores in the other sub-items and total scores did not

change. Statistically significant positive correlations were found between HbA1c levels at 12 weeks after discharge and duration of diabetes, first education program, and presence of diabetic retinopathy (shown in Table 3).

4. Discussion

Although there was no difference in the total self-efficacy score between the time of discharge and 12 weeks later, the scores for physical fatigue and lack of time decreased significantly. Previous studies have indicated that being busy [10] [11] [12] and fatigued [13] affect PA and self-efficacy. However, other studies have shown that social support from families [12] [14] and spouses [10], environmental factors such as climate and traffic [10] [15] [16], and stressful life events [17] are related to PA. Thus, a multifaceted approach is important in exercise

Table 1. Patient characteristics.

Characteristic	n	Means ± SD or %
Age (years)	38	61.0 ± 12.6
Sex (male/female)	21/17	
Body–mass index (kg/m^2)	38	27.3 ± 7.0
Type of diabetes (type 1/type 2)	2/36	
Duration of diabetes (years)	38	7.9 ± 7.3
First educational program	21	55.3%
Diabetic polyneuropathy	16	42.1%
Diabetic retinopathy	7	18.4%
Diabetic nephropathy	6	15.8%
History of cerebrovascular disease	4	10.5%
History of coronary artery disease	5	13.2%
Injecting insulin	15	39.5%
Living with family	32	84.2%
Working full time or part time	17	44.7%
HbA1c at admission (%)	38	9.8 ± 2.1
HbA1c at 12 weeks after discharge (%)	38	7.2 ± 1.1

HbA1c, glycated hemoglobin; SD, standard deviation.

Table 2. Self-efficacy for exercise scores.

Score	At discharge	12 weeks after discharge	p value
Total score	15.3 ± 3.0	14.4 ± 4.0	0.12
Physical fatigue (5/4/3/2/1)	11/20/4/3/0	9/16/3/8/2	0.02
Mental stress (5/4/3/2/1)	6/23/4/4/1	10/13/8/5/2	0.48
Lack of time(5/4/3/2/1)	7/21/5/5/0	8/15/4/7/4	0.04
Poor weather (5/4/3/2/1)	9/18/3/7/1	12/15/3/7/1	0.67

Table 3. Correlations between HbA1c levels at 12 weeks after discharge and patient characteristics.

Characteristic	**Correlation coefficient**
Age	0.31
Sex	0.05
Body–mass index	0.00
Type of diabetes	0.09
Duration of diabetes	0.53††
First educational program	0.51††
Diabetic polyneuropathy	0.02
Diabetic retinopathy	0.40†
Diabetic nephropathy	0.06
History of cerebrovascular disease	0.11
History of coronary artery disease	0.14
Injecting insulin	0.01
Living with family	0.11
Working full time or part time	0.14
HbA1c at admission	−0.09
Total score of self-efficacy for exercise at discharge	0.05
Total score of self-efficacy for exercise at 12 weeks after discharge	−0.05

†$p < 0.05$; ††$p < 0.01$.

therapy. Our patients were instructed in exercise methods for poor weather and given advice about life events and utilization of social support. However, it is difficult to reproduce physical fatigue and lack of time during hospital education; therefore, patients may experience these issues for the first time after discharge, and this may explain why the physical fatigue and lack of time scores decreased in the 12 weeks after discharge. This suggests the necessity of interventions to reinforce self-efficacy for exercise to overcome physical fatigue and lack of time early after discharge.

HbA1c levels were correlated with duration of diabetes, first educational program, and diabetic retinopathy. It has been suggested that duration of diabetes, diabetic retinopathy [18], and treatment of diabetes (with or without insulin) [19] are related to HbA1c levels, and a relationship with self-efficacy has also been reported [20], [21]. However, in this study, there was no statistical relationship between HbA1c levels 12 weeks after discharge and the total self- efficacy score. The coefficient of variation of HbA1c level at 12 weeks was 0.15, so this group of patients may have had low variability in glycemic control; therefore a tendency for self-efficacy for exercise to be related to HbA1c level may not have been found. In a similar study, Torimoto *et al.* reported a correlation between HbA1c levels at 12 weeks after discharge and duration of diabetes [22], and our results agree. In other words, these patients group were not special pa-

tient groups. Therefore, we speculated that this result shows patient characteristics 12 weeks after exercise education.

A limitation of this study was the short follow-up period. Further studies extending the follow-up period to 24 or 48 weeks are needed. This may enable further changes in self-efficacy for exercise and glycemic control to be observed, and may clarify the relationship between them.

Since two patients who dropped out after discharge were not included in the analysis, another limitation of this study is the possibility of the patient group having a high self-efficacy for exercise. Moreover, since this study was performed at a single facility, we cannot exclude the influence of area-specific climatic conditions. In addition to longer-term study, it would be desirable to conduct a study at multiple hospitals that are providing exercise instruction during admission.

5. Conclusion

This study suggests that scores for self-efficacy-related factors that are difficult to reproduce during admission decrease after discharge. In order to clarify a relationship between changes in self-efficacy for exercise and glycemic control, further studies with follow-up periods of 24 – 48 weeks are needed.

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