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Low Self-Efficacy Lead to Failure in Adopting CHO-Counting Approach to Control Diabetes: Pilot Study

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Abstract: This study aimed to evaluate the impact of self-efficacy in adopting carbohydrate counting behavior on their glycemic control, lipid profile and body weight among patients with type 2 diabetes. Self-efficacy was measured using chwarzer and Renner self-efficacy scale. All patients, regardless of their self-efficacy score, received an intervention composed of tailored diet plans based on the carbohydrate counting method. Anthropometric and laboratory measurements were performed at baseline, 3 and 6 months after the intervention. The short-acting insulin dose was modified based on the total amount of carbohydrate per meal. Two patients (1 and 2) out of five recorded high self-efficacy scores. A significant decrease (p<0.001) in FBG, HbA1c, total cholesterol and LDL and an increase in HDL levels were observed in patients 1 and 2 when baseline readings compared to the six-month readings. A decrease in daily insulin dose was observed after the intervention for patients 1 and 2. The significant differences were also found in weight, BMI and body fat percentage after intervention period. Regarding the three patients (3, 4 and 5) who recorded low self-efficacy scores, a significant improvement was found in total cholesterol and triglycerides in patients 3 and 4. It could be concluded that high self-efficacy for adopting carbohydrate counting-based dietary regimens may be effective in improving health status for patients with diabetes.

Key words: Jordan, diabetes, self-efficacy, carbohydrate counting, glycemic control

INTRODUCTION

Diabetes Mellitus is considered a global health problem (Wild *et al.*, 2004) that is increasing in an alarming rate. In Jordan, the prevalence is high and continues to rise (Ajlouni *et al.*, 2008). Diet is a major corner stone in managing and controlling diabetes mellitus especially type 2 (Williamson *et al.*, 2004; Makrilakis and Katsilambros, 2003; Bradley and Speight, 2002). Carbohydrate counting is an applicable and effective tool in controlling glycemic response in patients with diabetes following intensive insulin regemin (Gillespie *et al.*, 1998; Kulkarni, 2005; American Diabetes Association: Clinical Practice Recommendations, 2008). However, incorporating the carbohydrate counting behavior into daily life requires motivated patients with high self-efficacy (Bagozzi and Edwards, 1998; Fuhrmann and Kuhl, 1998). Bagozzi and Edwards (1998) demonstrated that self-confident clients can successfully adopt dietary behavior with low risk of relapse into their old unhealthy behaviors (Bagozzi and Edwards, 1998). This study aimed to investigate the impact of carbohydrate counting on controlling glycemia in patient with high versus low self-efficacy.

MATERIALS AND METHODS

Medical files of 5 patients with type 2 diabetes who are using intensive insulin therapy were carefully investigated. Selection criteria were patients aged 45 to 55 years, diagnosed with type 2 diabetes and prescribed to follow intensive insulin therapy. The study was according to the Declaration of Helsinki and consent form was obtained from each patient. The study fulfilled the requirements of Hashemite University Institutional Review Board.

Baseline data: Data about patient's anthropometrics (body weight, height Body Mass Index (BMI) and total fat percentage), laboratory tests (Fasting Blood Glucose (FBG), Glycated Hemoglobin (HbA1c), total cholesterol, triglycerides, Low-Density Lipoprotein (LDL) and High-Density Lipoprotein (HDL)) and self-efficacy to adopt healthy eating were recorded. Self-efficacy was measured using Schwarzer and Renner self-efficacy scale (Fuhrmann and Kuhl, 1998). The scale consists of 5 items, each of which started with "I can manage to stick to healthful foods even if....". Each item was rated by a 4-point scale. Hence, the range of sum scores was

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from 5-20. Having self-efficacy score less than 10 was considered as low score.

Intervention: Patients were counseled by a dietitian (PhD holder) on one to one bases every 2 weeks for 6 months.

First session
The following activities were carried out during the first session:

- **Insulin:** carbohydrates ratio was tentatively calculated for each patient
- **Tailored diet plans according to patient's food preference and appropriate insulin:** Carbohydrates ratio were prescribed for each patient. Diets were based on each patient's recommended intakes of energy, protein (15%), fat (30%) and carbohydrate (55%). The importance of consuming whole-grain cereals, legumes and other low-glycemic index foods was highlighted. The carbohydrate counts were distributed into three main meals and 3 snacks
- Patients were instructed to perform intensive charting based on self-monitoring of blood glucose and food record keeping. Charting was done for a week on a daily bases. Patients were trained on the proper use of a glucometer for self-monitoring of blood glucose (SMBG) levels. Patients were asked to measure and record preprandial blood glucose for breakfast meal and postprandial blood glucose for lunch and dinner meals.

Second session
Two weeks later, patient's charts were carefully reviewed and their tentative insulin: Carbohydrates ration was adjusted accordingly under the endocrinologist supervision.

Subsequent sessions: Carbohydrate counting essentials were delivered to patients based on structured educational activities including education about food portion size estimation, glycemic index, managing hyper and hypoglycemia using CHO counting approach, physical activity, suitable types and amounts dietary fat. Visual aids such as food models were used when necessary.

Follow up data: Patient's anthropometric data and lab tests were measured at 3 months and at 6 months of the intervention.

RESULTS
High self-efficacy and readiness for change and adopting the new lifestyle and the tailored diet plans were found higher in patients 1 and 2 than the other patients (Table 1). The efficacy scores were 16 and 15 for patients 1 and 2, respectively. While patients 3, 4 and 5 they were uncertain about all of the items.

Table 2 shows that there was a significant improvement in body weight, BMI, total fat percentage, FBG, HbA1c, total cholesterol, triglycerides, LDL and HDL in patients 1 and 2 when comparing the results of the baseline with the readings at the end of the nutrition intervention. In addition, there was a reduction in total energy intake as well as the number of carbohydrate count from the baseline to month 3 and 6 in both of them (Table 2). Accompanied with reduction in insulin dose in patients 1 and 2 could be seen in Table 2. On the other hand, the results of the other three patients showed no significant differences between body weight, BMI, total fat percentage, FBG and HbA1c measurements before or after applying the carbohydrate counting system as illustrated in Table 2. However, total cholesterol and triglycerides results were significantly improved in patients 3 and 4 at the end when compared to the baseline values.

DISCUSSION
Numerous studies suggest that self-efficacy can positively affect the initiation and performance of appropriate diabetes self-care behaviors (Schwarzer

Table 1: Self-efficacy scores of the patients

Item	Patient				
	1	2	3	4	5
I can manage to stick to healthful foods, even if I need a long time to develop the necessary routines.	3	3	2	1	1
I can manage to stick to healthful foods, even if I have to try several times until it works.	4	3	3	2	2
I can manage to stick to healthful foods, even if I have rethink my entire way of nutrition.	4	4	1	1	2
I can manage to stick to healthful foods, even if I don't receive a great deal of support from others when making my first attempts.	2	3	2	1	2
I can manage to stick to healthful foods, even if I have to make a detailed plan.	3	2	1	2	2
Total	16	15	7	7	9

(1) very uncertain (2) rather uncertain (3) rather certain (4) very certain

Table 2: Changes in anthropometric and laboratory variables of patients had high and low self-efficacy score

Parameters	Patient 1			Patient 2			Patient 3			Patient 4			Patient 5		
	Base-line	3 months	6 months	Base-line	3 months	6 months	Base-line	3 months	6 months	Base-line	3 months	6 months	Base-line	3 months	6 months
Self-efficacy scores		16			15			7			7			9	
Weight (kg)	96.0a	88.1b	85.2b	101.5a	95.2b	87.9c	147.5	149.2	146.9	80.8	78.8	77.6	128.8	125.2	124.6
BMI	37.5a	34.5b	33.3b	36.4a	34.1b	31.6c	48.3	49.0	48.1	32.0	31.2	30.6	51.6	50.2	49.9
Total body fat (%)	45.6a	41.3b	37.4c	49.6a	44.3b	40.1c	53.8	52.6	51.6	39.4	39.5	38.8	51.0	52.3	50.3
Energy level	1600	1400	1400	1750	1550	1550	1800	1600	1600	1500	1300	1300	1700	1500	1500
Carbohydrates (g)	220	193	193	240	213	213	248	220	220	206	179	179	234	206	206
Number of	15	13	13	16	14	14	17	15	15	14	12	12	16	14	14
Carbohydrate count															
Insulin dose	65	55	50	90	78	75	90	90	90	45	45	45	75	75	75
FBS	244a	98b	92b	324a	125b	99c	213a	188b	199b	202	216	210	309	298	303
HbA1c	12.2a	9.3b	7.0b	13.5a	9.8b	7.7c	11.2	11.6	10.9	10.0	9.7	10.2	12.5	12.3	11.8
Total cholesterol	185a	162b	155b	212a	194b	178c	213a	198b	189bc	166a	182a	180bc	134	130	136
Triglycerides	363a	152b	90b	265a	207b	165c	186a	164b	159bc	239a	214b	203b	57	55	60
LDL	80a	84a	68b	98a	95a	90a	103	105	98	80	82	81	-	-	-
HDL	27a	47b	45b	35a	39a	52b	34	37	35	46	51	52	-	-	-

BMI: Body mass index
FBG: Fasting blood glucose
HbA1c: (Glycated hemoglobin), total cholesterol, triglycerides
LDL: Low-density lipoproteins
HDL: High-density lipoproteins
Different letter means significant difference at p<0.05

and Renner, 2000; Aljasem et al., 2001; Johnston et al., 2002; Krichbaum et al., 2003). This finding is supported by the results found among this report cases; following carbohydrate counting based dietary regimens was more effective for the patients with high self-efficacy scores. This is may be due to increase adherence showed by patients with high self-efficacy. Adhering to the dietary regimens and carbohydrate counting was monitored by SMBG and food records. Moreover, the improvement in body weight, BMI, body fat percentage, FBG, HbA1c, total cholesterol, triglycerides, LDL and HDL was significant in patients with high self-efficacy scores. Many studies demonstrated that the main improvement was detected in HbA1c (Scavone et al., 2010; Dias et al., 2010; Bergenstal et al., 2008), However, no study showed the effect of following carbohydrate counting on improving BMI, body weight, body fat percentage, FBG, LDL, HDL, triglyceride and/or total cholesterol among patients with diabetes. A study conducted by Laurenzi et al. (2011) showed that carbohydrate counting can improve quality of life, reduces BMI, waist circumference and HbA1c (Laurenzi et al., 2011). The reduction in body weight, BMI and body fat percentage seen among studies cases could be attributed to the decrease in total calorie intake when compared to the usual food intake. The synchronization between rapid-acting insulin and carbohydrate counts eaten in each meal was the main contributor in improving glycemic control in the presence on high self-efficacy. This could be seen in patients 1 and 2 in which their FBG level and lipid profile were improved after 6 months of nutrition intervention. However, the increase in HDL in both patients 1 and 2 could be attributed the increase in physical activity which those two patients committed to practice daily.

The results of body weight and body fat percentage of all patients with low self-efficacy showed a trend of decrease after six-months of intervention.

In this case report we presented two adult female patients with high self-efficacy score and found that self-efficacy is an important factor for improving body weight as well as glycemic and lipid profiles. Therefore, working with patients on increasing their self-efficacy before starting carbohydrate counting may give better results and more glycemic control.

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