

# An Improvement in Quality of Life and Metabolic Status (HbA<sub>1c</sub>) in Type 1 Diabetic Patients by Multiple Educational Programs

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*Objective: The present study aimed to assess the quality of life (QOL) and metabolic status (HbA<sub>1c</sub>) of adult type 1 diabetic (T1D) patients by multiple diabetes educational programs.*

*Methods: Diabetes educational programs were conducted for 3 months with next 2 years, follow up on improvement of QOL and glycated hemoglobin (HbA<sub>1c</sub>) in adult T1D patients. An epidemiological study was conducted on various parameters such as age, gender, duration of diabetes, diet, family history of diabetes, daily glucose monitoring frequency, and hypoglycemic events (in the past 3 months). The QOL was assessed by using 15 set diabetes quality of life (DQOL) questionnaire in 96 consecutive patients at Baseline (Before) and then at 6, at 12, and at 24 months after education program, decreased in DQOL score noted as improvement in QOL. The average HbA<sub>1c</sub> level was estimated before and after the programs (at 6, 12, and 24 months).*

*Results: The rate of patient response to educational programs was 78.04% (n=96) at end of 24 months. The prevalence of T1D was higher in men than in women. The overall DQOL score was significantly (P<0.05) decreased at 6 months from 63.79±2.5 to 49.29±4.71 (22.73% reduction); furthermore, continuous reduction in DQOL was noted at 12 and 24 months after educational programs. Patients exhibited greater satisfaction and diminished impact of diabetes after the educational programs were noted at 6 months after educational programs and it was maintained up to end of the study. The HbA<sub>1c</sub> level was significantly (P<0.001) decreased at 6 months (7.79±0.94 vs 7.06±0.51; ~10% reduction) and at 12 months (7.79±0.94 vs 6.87±0.46; ~12% reduction) and further reduction was noted at 24 months (7.79±0.94 vs 6.81±0.51; ~13% reduction). The frequency of self-monitoring of blood glucose increased and numbers of hypoglycemic events were decreased after educational programs.*

*Conclusion: Our study revealed that appropriate diabetes education and counseling can lead to improvement in QOL and metabolic status of T1D patients.*

## Introduction

Type 1 diabetes mellitus (T1DM) is a chronic metabolic disorder of pancreas characterized by insulin deficiency, which occurs due to autoimmune destruction of  $\beta$  cell in islet of Langerhans or due to idiopathic reasons, and

trauma or diseases of pancreas are responsible for such pathological condition in child or adolescence. The insulin-producing  $\beta$  cells regulate an individual's blood glucose levels. Therefore, the deficiency of insulin in T1DM patients condemns them to regulate and control their blood

glucose levels by insulin treatment. If the blood glucose levels are allowed too high, there is high risk of developing long-term complications such as diabetic retinopathy, peripheral vascular disease, ischemic heart disease, diabetic neuropathy, diabetic nephropathy, amputation, and stroke. Overly tight glucose control is required to decrease the incidence of hypoglycemic events (hypos), which may lead to a period of unconsciousness or seizures, which may require emergency treatment. Effective diabetes control involves a balancing act on a patient's part, entailing self-observation (normally achieved through undertaking self-monitoring of blood glucose [SMBG]), discipline, and most fundamentally risk management. Most of the T1DM patients struggle to achieve good blood glucose control. Although it is recognized that the reasons for this are multifaceted, a patient's poor understanding of the disease, and a lack of education and instruction on how to manage it effectively have been widely implicated.<sup>1</sup>

Education, counseling, and awareness play an important role in the management of diseases. In diabetes patient, education and counseling are viewed as cornerstones of diabetes management, because self-management can contribute significantly to improvement of glycemic control, quality of life (QOL), and reduction in long-term complications. The role of cognitions, the routines at the time of the diagnosis, and the emphasis on weight loss are analyzed as prerequisites for effective education. Many of previous studies concern the effects of interventions aiming at the improvement of the QOL, well-being, and glycemic control for diabetes patients. Intervention studies apply the use of the modern media such as television, Internet, and computer-based education.<sup>2</sup>

Health-related quality of life (HRQOL) provides a multidimensional perspective that encompasses a patient's physical, emotional, and social functioning.<sup>3</sup> Diabetes mellitus is a typical chronic metabolic condition that places serious constraints on a patient's activities. There is a need for extensive education and behavior change to manage the condition. Lifestyle changes must incorporate careful dietary planning, use of medication, and for all patients with diabetes mellitus the use of insulin and home blood glucose monitoring techniques.<sup>4</sup>

Patient education program in diabetes is essential for successful self-care and for obtaining good result in diabetes management. It provides the necessary knowledge and skill to the diabetic patient, which may help him/her to cope better with this condition. Mainly two different approaches are used for education: individual and/or group education.<sup>5</sup>

This prospective study was aimed to evaluate the outcome of hospital-based diabetes educational programs on QOL in T1DM patients. The principal outcome was to determine whether or not such educational programs can result in any benefit on improving QOL and metabolic status (HbA<sub>1c</sub>) of T1D patients.

## Patients and Methods

### Study Design

Present study was carried out at DiaCare – Advance Diabetes Care Center, Ahmedabad, India, from April 2011 to March 2013. Patients with T1DM were registered for diabetes educational programs and encouraged to participate. Patients are eligible for education programs if the duration of diabetes was more than 6 months and age above 15 years. Those patients were included who were able to understand the Gujarati language, who were not visually handicapped, or did not have advanced neoplastic diseases or secondary diabetes. Informed consent was taken from each patient and parental consent was taken for patients aged below 18 years.

### Epidemiological Study

An epidemiological study was carried out on patients who agreed to participate in diabetes educational programs as per protocol approved by the Independent Ethics Committee of Dia Care Research, Ahmedabad, India. Various parameters such as age, gender, duration of diabetes, diet, family history of diabetes, daily glucose monitoring frequency, and hypoglycemic event in past 3 months were evaluated in epidemiological study.

### Therapeutic Educational Programs

Diabetes educational programs were set up to accommodate groups of 15–20 patients, and last for 2–3 days per month for 3 months in a hospital setting, with subsequent 2 years' follow-up. The multidisciplinary diabetes education team consists of diabetes specialist, medical doctor, retina specialist, diabetes specialist nurse, dietitian, and podiatrist.

We reviewed literature for diabetes-specific quality of life (DQOL) measures and, based on literature review, the DQOL questionnaire (Table 1) was prepared and reviewed by the DiaCare team. The interactive educational methods and content used rely upon active patient participation.

The objective was to draw from both individual and group resources, starting with the experiences of each patient, to acquire new competencies and to put them into practice. Totally 123 patients were encouraged to participate and were enrolled for programs.

The session begins with a roundtable discussion on the theme, "What does diabetes and its treatment mean to you?" At this time, the patients get to know one another, and are encouraged to express their feelings about their ill health and its treatment, and what they expect to gain from the programs. Group sessions are structured around several themes, including diet, physical exercise, insulin therapy, and prevention and management of acute as well chronic complications. In addition, all participants receive an explanation of the principles of insulin therapy. If the patients wish to acquire the skills and confidence to adjust

**Table 1 | Fifteen set questionnaire for evaluation of diabetes quality of life**

Sl no	Question	Score				
		1	2	3	4	5
A	How satisfied are you with time managing diabetes?	Very satisfied	Moderately satisfied	Neither	Moderately dissatisfied	Very dissatisfied
B	How satisfied are you with your current treatment?	Very satisfied	Moderately satisfied	Neither	Moderately dissatisfied	Very dissatisfied
C	How satisfied are you with your sex life?	Very satisfied	Moderately satisfied	Neither	Moderately dissatisfied	Very dissatisfied
D	How satisfied are you with glucose maintenance time?	Very satisfied	Moderately satisfied	Neither	Moderately dissatisfied	Very dissatisfied
E	How satisfied are you with your current food habit?	Very satisfied	Moderately satisfied	Neither	Moderately dissatisfied	Very dissatisfied
F	How satisfied are you with burden on your family?	Very satisfied	Moderately satisfied	Neither	Moderately dissatisfied	Very dissatisfied
G	How satisfied are you with exercise time?	Very satisfied	Moderately satisfied	Neither	Moderately dissatisfied	Very dissatisfied
H	How satisfied are you with time spent getting checkups for your diabetes?	Very satisfied	Moderately satisfied	Neither	Moderately dissatisfied	Very dissatisfied
I	How satisfied are you with your knowledge about your diabetes?	Very satisfied	Moderately satisfied	Neither	Moderately dissatisfied	Very dissatisfied
J	How often does subject has a bad night's sleep?	Never Very Sometimes Often All the time	Very seldom	Sometimes	Often	All the time
K	How often does the subject feel diabetes limits career?	Never Very Sometimes Often All the time	Very seldom	Sometimes	Often	All the time
L	How often does subject worry about missing work?	Never Very Sometimes Often All the time	Very seldom	Sometimes	Often	All the time
M	How often does subject have pain with treatment?	Never Very Sometimes Often All the time	Very seldom	Sometimes	Often	All the time
N	How often does subject feel physically ill?	Never Very Sometimes Often All the time	Very seldom	Sometimes	Often	All the time
O	How often does a subject break diet to avoid telling other about diabetes?	Never Very Sometimes Often All the time	Very seldom	Sometimes	Often	All the time

**Question number A–I for satisfaction and J–O for impact of diabetes, total DQOL (A–O) score for QOL: minimum 15 and maximum 75, DQOL score for satisfaction minimum 9 and maximum 45, DQOL score for impact minimum 6 and maximum 30.**

their insulin treatment to better match their lifestyle, then greater emphasis is placed on insulin therapy, including an extra day during which a glucidic fast was undertaken. Each day, treatments are discussed with the patients and modifications made, if necessary. The follow-up of each patient consists of an additional class along with the usual individual follow-up by the diabetologist and team.

### Data Collection

QOL was measured using 15 set of DQOL questionnaire for T1D. A questionnaire was completed anonymously by patients before starting the programs, and then at 6, 12, and 24 months after education programs. The change in DQOL score was noted as per five-point Likert scale and decreased score was interpreted as an improvement in QOL (Table 1). HbA<sub>1c</sub> was measured by high-performance

liquid chromatography (HPLC) before, and then 6, 12, and 24 months after, the educational programs.

### Outcomes

The principal outcome of the study was change in total DQOL score from baseline to the end of the study. Derivative outcomes were as follows:

- Changes in overall DQOL score at 6, 12, and 24 months after programs.
- Changes in metabolic control (HbA<sub>1c</sub>).
- Identification of the medical factors such as age, gender, duration of diabetes, diet, family history, frequency of glucose self-monitoring, level of metabolic control, and frequency of hypoglycemia associated with improvement in QOL.

### Statistical Analysis

All the data are expressed as the mean ± SD. The data were statistically analyzed by using one-way analysis of variance (ANOVA) by using Primer 3 software, followed by Bonferroni test. The ANOVA was performed between baseline outcome and outcome obtained at 6, 12, and 24 months after the education program. Whereas *P*<0.05 was considered as statistically significant.

### Results

The characteristic, of patients who participated in diabetes education programs were noted and shown in Table 2. A total of 123 patients were encouraged to participate in programs. Of them, 96 (78.04%) patients with T1D successfully completed or responded to programs, while the remaining 27 patients were excluded from the study due to change in their residence or did not answer well and other personal reasons.

In total, 96 patients, 54 (56.25%) men and 42 (43.75%) women, completed the study successfully, with mean age 27.16±6.43 years and average duration of diabetes 9.04±5.56 years. The higher study populations, approximately 65% of patients, were suffering from diabetes since past 1–10 years, while 14.58% patients were suffering from diabetes since past 11–20 years; rest 4.16% of patients were suffering from diabetes since more than 20 years. Results of the present study have shown that 94.79% of study population was following a vegetarian diet, while the remaining 5.2% of study populations was nonvegetarian (Table 2).

The patients were asked for hypoglycemic events in the past 3 months prior to baseline visit, which was considered as baseline. Twenty-four numbers of hypoglycemic events including 14 mild, 8 moderate, and 2 severe hypo events were noted at baseline visit. A drastic reduction (56%) in hypoglycemic event was observed with no severe hypoglycemic event after the educational programs (Fig. 1).

Table 2 | Medical characteristic of patients

Parameters	n=96
Men n (%)	54 (56.25%)
Women n (%)	42 (43.75%)
Age (years)	27.16±6.43
<b>Duration of diabetes (years)</b>	9.04±5.56
<1	0
1–10 years	62 (64.58%)
11–20 Years	30 (31.25%)
>20 years	4 (4.16%)
<b>Baseline HbA<sub>1c</sub> (%)</b>	7.79±0.94
<b>Treatment n (%)</b>	
CSII	3 (3.12%)
MDI	93 (96.87%)
<b>Daily blood glucose self-monitoring n (%)</b>	
0–1 time/day	52 (54.16%)
2–3 time/day	44 (45.83%)
≥4 time/day	00 (00.00%)
<b>Family history of type 1 diabetes n (%)</b>	
Yes	26 (27.08%)
No	70 (71.91%)
<b>Diet n (%)</b>	
<b>Vegetable</b>	91 (94.79%)
<b>Nonvegetable</b>	5 (5.2%)
<i>Mean ± SD</i>	

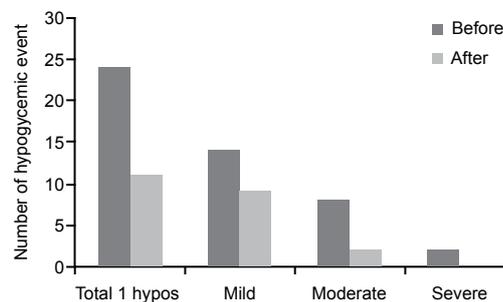


Figure 1. Effect of educational programs on hypoglycemic events.

Higher percentage of participants was monitoring their blood glucose one time a day before programs. After educational intervention, the frequency of one-time blood glucose monitoring was noted at 0%, while two or more than two times blood glucose monitoring frequency increased sharply, which is shown in Fig. 2.

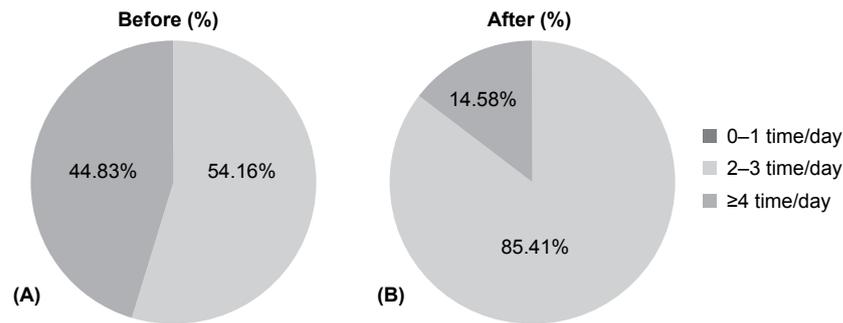


Figure 2. Daily glucose self-monitoring frequency. (A) Before education programs; (B) After educational programs.

The HbA<sub>1c</sub> level of all patients was estimated before programs and the mean value was found to be 7.79±0.94%. After education programs, HbA<sub>1c</sub> level estimated and re-examined at different time intervals, the level of HbA<sub>1c</sub> was significantly ( $P<0.001$ ) decreased at 6 months after educational intervention (7.79±0.94 vs 7.06±0.51; approximately 10% reduction compared to baseline) and at 12 months after educational intervention the average value of HbA<sub>1c</sub> was found to be 6.87% (approximately 12% reduction compared to baseline) and then at 24 months after educational intervention average the HbA<sub>1c</sub> level was found to be 6.81% (~approximately 13% reduction compared to baseline) (Fig. 3).

The principal outcome (change in QOL) of study was evaluated by using DQOL score. A decreased score is interpreted as an improvement or change in QOL due to educational programs. Total DQOL score was assessed in 96 patients who had regularly attended or responded well to programs.

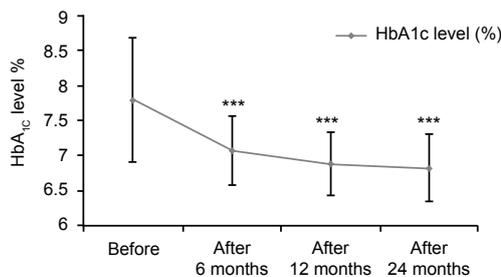


Figure 3. Effect of diabetes educational program on HbA<sub>1c</sub> level. Data are expressed as mean ± S.D (n=96), \*\*\* $P<0.001$ , when compared to baseline (before).

The total DQOL score was significantly ( $P<0.05$ ) decreased from 63.79±2.5 versus 49.29±4.71 with 22.73% reduction at 6 months after the program as compared to baseline. Moreover, a continuous reduction was observed in total DQOL score at 12 months and 24 months after educational programs as compared to baseline. A maximum reduction (39.19%) in DQOL score or change in QOL was note at 24 months after educational programs (Table 3).

A DQOL score for satisfaction was significantly ( $P<0.05$ ) decreased and increased satisfaction level with 23.75% reduction in DQOL score for satisfaction at 6 months after the programs as compared to baseline. A maximum satisfaction level increased at 24 months after the programs. Impact of diabetes on QOL was higher before programs and significantly ( $P<0.05$ ) decreased from 25.9±3.28 to 20.4±3.73 (21.23% reduction), 25.9±3.28 to 16.66±2.69 (35.67% reduction), and 25.9±3.28 to 15.58±4.25 (39.8% reduction) at 6 months, 12 months, and 24 months, respectively (Table 3).

## Discussion

An absolute indispensable tool for management of disease is patient education, which is a long and dynamic process.<sup>6</sup> Follow-up of patient during educational programs and evaluation of the efficacy of education programs are among the most difficult and complicated problems in the field of incorporating diabetes education.<sup>7,8</sup> There seem to be a wide variability in the process of carrying out the therapeutic education intervention at most of the diabetic centers, in terms of both the resources and time allocated to it, including

Table 3 | Evaluation of DQOL score over 2 years

DQOL score	Before (baseline)	After 6 months	After 12 months	After 24 months
Total DQOL score	63.79±2.5	49.29±4.71*	41.48±4.62*	38.79±4.51*
Satisfaction	37.89±3.41	28.89±3.68*	24.82±5.23*	23.21±3.82*
Impact of diabetes	25.9±3.28	20.4±3.73*	16.66±2.69*	15.58±4.25*

Data are expressed as mean ± SD (n=96). \* $P<0.05$ , when compared to baseline (before).

teaching methods used. Previous studies have shown that, in this context, one-to-one teaching methods based simply on an information-delivery session with the patient remaining passive are not effective.<sup>9</sup>

The basic aim of the presented therapeutic education intervention study is to teach the patient how to manage his treatment, which requires specific teaching methods that take into account the special needs of the individual in terms of perceptions about health, feelings about diabetes and its treatment, and strategies for coping. Present study shows that the education programs help a great deal in improving metabolic control (HbA<sub>1c</sub>) and QOL of diabetic patient; the education program to improve QOL of diabetic patients is one of the main targets in diabetes management. The task of educational team is to deliver an interactive group session that relies on the analysis of problem and learning from past experience, and searching for solution.

As per our present findings, patients with T1DM have expressed greater satisfaction with treatment and their life in general after these educational programs. At the end of the study their QOL was improved, which was characterized by decreased DQOL compared to baseline. Education can reduce anxiety and increase patients' self-empowerment by acting as therapeutics. The essential role of feelings of self-confidence and psychological well-being in the long-term maintenance of good metabolic control has already been demonstrated in studies where lack of self-confidence was correlated with poor HbA<sub>1c</sub> levels.<sup>10,11</sup>

According to the results of our presented study the diabetes education programs are increasing knowledge, improvement in HbA<sub>1c</sub>, and QOL with increasing self-confidence. The knowledge of disease is very important to patient for the management of diabetes. In our study the participants had significantly decreased the DQOL score of satisfaction with treatment, impact of diabetes compared to baseline. Decrease in HbA<sub>1c</sub> level is mostly due to change in behavior and it is a measure of a person's blood sugar level. It has shown that long-term, near-normal HbA<sub>1c</sub> levels decrease the risk of diabetic complications.<sup>12</sup> Although there are some doubts about association between knowledge and metabolic improvement of people with DM, some authors have reported beneficial effects of patients education on lowering HbA<sub>1c</sub>.<sup>13</sup>

One of the main objectives of management of diabetes is to improve the QOL of patients so that they can have as normal a life as possible.<sup>14</sup> The QOL of diabetic patients is one of the main targets in management. It is an important outcome measure that should be routinely examined in clinical practice concerning evaluation of patient education.<sup>15</sup> In this study the QOL of patients increased significantly after 8 months of educational program due to increase in awareness, knowledge, and understanding of disease as well treatment-related aspects.

Diabetes educational programs encouraged patients to do more exercise, which also helped to improve physical and psychological health. The study confirms that diabetes education programs are effective in management of diabetes and improve metabolic control and HRQOL. One of the reasons why people do not manage their diabetes fully may be lack of knowledge.<sup>16</sup> Several studies have concluded that lack of knowledge of self-care skills and wrong information or misunderstanding of the therapeutic plan were major aspects of involuntary noncompliance.<sup>17</sup> However, knowledge should not be overestimated because people may know what to do but do not transfer it into practice.<sup>15</sup> The success of diabetes treatment and its management depends largely upon patient compliance with the prescribed medications with better understanding of disease.<sup>17</sup>

The changes in several habitual and behavioral parameters such as diet habits, exercise, and blood glucose monitoring are required for better outcome of treatment. The greatest barriers to lifestyle change are related to dietary and exercise behavior with few barriers associated with medication and glucose testing.<sup>18</sup> The diabetes education programs decrease the incidence of hypoglycemic event, increase the frequency of daily blood glucose self-monitoring, and improve QOL of diabetic patients.

## Conclusions

In conclusion, 8 months after our diabetes educational programs, we observed significant improvement in QOL, as assessed using DQOL score scale. The patients reported greater satisfaction with current treatment, and reduced impact of diabetes on their daily life. Our study suggests that the appropriate measure of educating and counseling the patients can lead to improvement in QOL and metabolic status (HbA<sub>1c</sub>) of T1D patients. Thus, this study underscores the benefits to other diabetes care centers that the QOL and metabolic status of T1D patients can be improved by multiple educational interventions.

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***“The only true wisdom is in knowing you know nothing.”***

— Socrates