

GLYCEMIC CONTROL, QUALITY OF LIFE AND SELF-CARE BEHAVIOR AMONG ADOLESCENTS WITH TYPE 1 DIABETES WHO ATTENDED A DIABETES CAMP

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Abstract. A prospective study was conducted at the tenth Siriraj diabetes camp with the objectives of evaluating the effectiveness of diabetes camp on 1) glycemic control, 2) knowledge, 3) quality of life, and 4) self-care behavior of adolescents with type 1 diabetes (T1D) who participated in the diabetes camp. During the 5-day camp, twenty-seven participants (mean age 15.6±2.1 years, mean duration 6.3±3.0 years) were taught diabetes self-management education (DSME) and engaged in psychosocial support sessions. Post-camp activities were held every 3 months and participants were followed for 12 months post-camp. Glycemic control was assessed prior to the camp, then every 3 months. Knowledge level was assessed prior to the camp, at the end of the camp, and every 3 months. Diabetes self-care behavior and quality of life were evaluated prior to the camp, at 3 months and 12 months after the camp. After attending the camp, participants had improvement in knowledge but there were no changes in HbA1c levels or quality of life scores. Quality of life was not consistently associated with HbA1c. In general, participants did not perceive their quality of life was poor or feel having diabetes affected their social life. The issue participants worried about most was whether they would develop complications from diabetes. There were several weak points found among participant self-care behavior, particularly in diet-related matters. Despite no improvement in glycemic control, participants gained knowledge from attending the camp. Diet related self-care behavior is difficult for teenagers with T1D to be compliant with.

Keywords: type 1 diabetes, diabetes camp, quality of life, self care, HbA1c

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INTRODUCTION

Type 1 diabetes (T1D) is a complicated medical condition. The disease is common among youth and causes a burden for patients and their families. Upon diagnosis, patients and their families are

taught diabetes self-management education (DSME) including insulin injection, self-monitoring of blood glucose (SMBG), medical nutrition therapy, insulin dosage adjustment, and prevention and treatment of hypo-/hyperglycemia, etc. Having diabetes requires many behavioral changes that may cause stress to the patients and their families.

During the past two decades, there has been increasing interest in studying emotional stress, self-care behavior and quality of life among patients with T1D. One study reported children with T1D may have a similar quality of life as non-diabetic children (Laffel *et al*, 2003). However, some studies have shown adolescents with diabetes have a lower life satisfaction and health perception than healthy adolescents (Faulkner, 2003; Graue *et al*, 2003). Studies have shown perceptions of quality of life are influenced by age and gender of patients. Graue *et al* (2003) reported, "Older adolescents were more worried, perceived a greater impact of diabetes on daily life and had lower diabetes-related life satisfaction". Some studies found girls with diabetes have less satisfaction with life than boys (Faulkner, 2003; Graue *et al*, 2003). Studies on the association between glycemic control and quality of life among adolescents with diabetes have produced conflicting results (Ingersoll and Marrero, 1991; Grey *et al*, 1998; Guttmann-Bauman *et al*, 1998; Hoey *et al*, 2001; Graue *et al*, 2003; O'Neil *et al*, 2005; Hassan *et al*, 2006; Nardi *et al*, 2008). In some studies, patients with a lower HbA1c reported a better quality of life (Guttmann-Bauman *et al*, 1998; Hoey *et al*, 2001; Hassan *et al*, 2006; Nardi *et al*, 2008).

Since 1990, Siriraj Diabetes Center, Faculty of Medicine Siriraj Hospital, has organized a biennial 5-day diabetes camp (Likitmaskul, 2006). The purpose of this

camp is to provide patients with DSME and psychosocial support. Another objective of the camp is to improve patient glycemic control. During the 8th and 9th Siriraj diabetes camps, a short-term improvement in glycemic control was seen among camp attendants (Santiprabhob *et al*, 2005, 2008). During those camps, 50-70 patients were divided into small groups consisting of 10-12 patients. Each group was supervised by medical staff, including an endocrinologist, a nurse and a nutritionist. The DSME was given mostly as lectures. During the 9th camp, we addressed the importance of SMBG where patients were provided glucometer and glucose test strips (Santiprabhob *et al*, 2008). Three months after camp an improvement in glycemic control was seen. However, the improvement in glycemic control did not last to 6 months post-camp.

During the 10th diabetes camp, we changed the method of providing DSME to one in which most of the sessions were interactive and problem-solving. There were also activities focused on psychosocial issues. Post-camp activities were held every 3 months and patients were followed-up for 12 months post-camp. A prospective study was conducted during and after the 10th diabetes camp. The objectives of the study were to evaluate the effectiveness of diabetes camp on 1) glycemic control, 2) knowledge, 3) quality of life, and 4) self-care behavior among adolescents with T1D who participated in the camp.

MATERIALS AND METHODS

Patients

Patients with T1D, older than 12 years old, who had a basic knowledge of diabetes self-management and were able to care

for themselves, were invited to attend the 10th diabetes camp and participate in the study. Participant data collected included age, onset and duration of T1D, insulin dosage and regimen, frequency of SMBG, and education level.

Informed consents were obtained from participants who were 18 years or older. Parental consent and child assent were obtained if the participants were younger than 18 years.

This study was approved by the Ethics Committee of Siriraj Hospital, Mahidol University.

Interventions

The 10th diabetes camp was held at Suan Saen Palm Training Home, Kasetsart University Kamphaengsaen campus, Nakhon Pathom Province, during April 2-6, 2007.

Participants were divided into 5 groups. Each group consisted of 6-8 participants, 1-2 endocrinologists, 1 endocrinology fellow, 1-2 nurses, and 1 nutritionist. The participants were provided with a glucometer and a 6-month supply of glucose test strips. During the camp, the participants performed SMBG four times a day (before meals and at bedtime). The physicians in charge of each group helped participant understand the relationship between activities, food intake, insulin and blood glucose levels. The physicians also taught participants how to adjust insulin dosages when necessary.

During the camp, participants attended all activities, including DSME, sessions focused on psychosocial issues and social activities.

DSME

One of the objectives of this camp was to help T1D teens improve their diabetes self-management skills and be able to solve daily diabetes-related

problems. Most of the DSME topics were done as problem-solving scenarios. Each group was given a case scenario, which they had to discuss, find ways to solve problems and present their thoughts to others. At the end of each session, medical staff helped to clarify how to solve the problems. The topics included: 1) how to improve glycemic control, 2) how to handle unusual events and activities *eg*, sick days, parties, etc, 3) how to prepare for exercise, 4) diabetes medical nutrition, 5) chronic complications of diabetes, and 6) diabetes foot care.

A child psychologist and team conducted a "DM teach and talk" session in which each group was given a task to educate their diabetic peers on the following topics: 1) telling your friends at school about diabetes; 2) teaching new-onset T1D peers about insulin, 3) sharing your secret on being able to adhere to a healthy diet, 4) motivating and teaching your diabetic peers the importance of exercise, 5) sharing your technique on controlling blood sugar, and 6) motivating your diabetic friends to stay healthy in order to prevent developing diabetes complications.

Psychosocial support session

Another objective of this camp was to help T1D teens live with diabetes more comfortably by providing psychosocial support and arranging activities to increase their self-esteem. These sessions were organized by a psychiatrist, a developmental and behavioral pediatrician and a counselor from the National Institute for Child and Family Development. Most sessions were done by asking each group of participants to discuss the topics and share their thoughts with others. At the end of each session, medical staff shared their views and suggested ways to help the participants to be more confident and

able to live with diabetes more happily.

The sessions included: 1) how to make friends, 2) how participants view their school-life, 3) what it is like to be teenagers and have diabetes, and 4) how participants plan their future.

There was also a sharing-experience session with former diabetes camp attendees where they revealed how they encountered struggles living with diabetes but were able to be successful in their lives.

Social activities

Social activities included games before starting each educational session, a sports day, and a performance by participants at a farewell party.

Post-camp activities

After camp ended, the participants were asked to attend activities 3, 6, 9, and 12 months later. Post-camp activities focused on: 1) enhancing a participant's knowledge about diabetes care, 2) continuing friendships between camp participants, and 3) organizing activities that would benefit camp participants and others.

Measures

To evaluate the effectiveness of diabetes camp and post-camp activities on glycemic control, HbA1c levels were obtained from each individual prior to the camp, 3, 6, 9, and 12 months post-camp. The HbA1c was performed using a Dimension[®] HbA1c assay kit (Dade Behring, Newark, DE). The HbA1c measurement is based on the turbidimetric inhibition immunoassay (TINIA) principle.

In order to assess the knowledge gained from attending the camp and post-camp activities, participants were tested for their level of knowledge before attending the camp, at the end of the camp, 3, 6, 9, and, 12 months post-camp, using

the same 40 multiple-choice questions covering topics about diabetes self-care and nutrition.

To determine the psychosocial benefits of the camp, quality of life was assessed for each individual prior to the camp, 3, and 12 months post-camp. The modified Diabetes Quality of Life for Youth (DQOLY) instrument developed by Ingersoll and Marrero (Ingersoll and Marrero, 1991) was translated into the Thai language by Tachanivate (Tachanivate, 2007). The Thai version of the DQOLY was used in this study with permission. The DQOLY questionnaire consisted of 3 subscales: diabetes life satisfaction (17 items), disease impact (23 items) and disease-related worries (11 items). The satisfaction subscale was rated from 5 (very satisfied) to 1 (very dissatisfied). The impact subscale was rated from 5 (never) to 1 (all the time). The worry subscale was rated from 5 (never) to 1 (all the time) and 0 if it was not applicable. The score for each scale was translated into a transformed score ranging from 0 to 100. Higher scores indicated a more positive perception towards quality of life. In the assessment, a general self-rating of overall health was included. The answer was framed as a four-point scale rating (1 = poor, 2 = fair, 3 = good, and 4 = excellent).

For each individual, if any subscale of the DQOLY was either not answered or answered as non-applicable for more than 50% of the total items, those subscales were excluded from the analysis.

To assess participant self-care behavior, a questionnaire developed by Tachanivate (2007) was used with permission. There were 38 items divided into 8 topics: personal hygiene care (3 items), dietary control (7 items), medication taking (6 items), physical activity (3 items), SMBG

(4 items), problem solving (8 items), stress management (3 items), and reducing risk of diabetes complications (4 items). Seventeen items were scored using the total number for the last seven days the participants performed the diabetes self-care behavior in daily life (rated from 0 to 7). Twenty-one items were scored using the frequency the participants performed diabetes self-care behavior during the previous three months [rated from 0 (no events happened) to 5 (always)]. Higher scores reflected good self-care behavior.

Participants were also asked what they thought about their glycemic control in which the answers were good, fair, and poor.

During the pre-camp assessment, participants were asked whether their parents were involved in their diabetes care and which diabetes-related tasks were the most difficult to be compliant with.

Statistical analysis

Demographic data collected included age, sex, duration of diabetes, academic level, SMBG frequency, and number of insulin injections, reported as mean \pm SD, frequencies, and percentages. The HbA1c level, knowledge score, and DQOLY assessment were reported as mean \pm SD. Self-rated health and self-care behavior were reported as percentages. Repeated measures analysis was used to compare of pre- and post-camp HbA1c levels, knowledge, and DQOLY. A Friedman test was used to compare the distribution of self-rated health and participant perceptions of their glycemic control. The Pearson's and Spearman's correlation coefficients were used to evaluate the relationships between HbA1c levels and self-rated health and DQOLY subscales for normally and not normally distributed data, respectively. The data were analyzed using SPSS

version 16.0 software (SPSS, Chicago, IL). The level of significance was set at $p < 0.05$.

RESULTS

Participants

Thirty-five participants attended the diabetes camp and consented to participate in the study. Twenty-seven participants completed the 12-month study: 14 males and 13 females with a mean age of 15.6 ± 2.1 years and a mean duration of diabetes of 6.3 ± 3.0 years. Baseline characteristics of camp participants are shown in Table 1.

Three male and 5 female teens did not complete the study; their mean age and mean duration of disease were 16.2 ± 2.8 years and 7.1 ± 4.8 years, respectively. Although, not statistically significant, the drop-out teens had higher pre-camp HbA1c levels than those who completed the 12-month study ($11.3 \pm 4.1\%$ vs $8.3 \pm 1.8\%$, $p = 0.079$).

Post-camp activities

After camp ended, there were meetings at 3, 6, 9, and 12 months post-camp. A charity lunch was held at an elderly home where the camp participants helped take care of the elderly and put on a performance. Among the 27 participants, 15 participants (53.6%) attended at least 80% of post-camp activities: 8 of them attended all 5 post-camp activities.

Glycemic control

One participant did not have a HbA1c level 9 months post-camp, thus the analysis of glycemic control was performed among 26 participants. The mean HbA1c levels among camp participants prior to camp and at 3, 6, 9, and 12 months post-camp are shown in Table 2. There were no statistically significant differences between pre-camp and post-camp mean HbA1c levels ($p = 0.806$).

Table 1
Baseline characteristics of camp participants.

	Female	Male	Total
Number	13	14	27
Age (years)	16.3±2.3	14.9±1.7	15.6±2.1
Duration (years)	6.4±2.9	6.2±3.2	6.3±3.0
Academic level			
Grade 6	1	1	2
Junior high school	4	8	12
High school	5	5	10
College	3	0	3
SMBG frequency (times/day)			
1-2	5	5	10
3	4	4	8
≥4	4	5	9
Insulin injections			
2	5	5	10
3	2	4	6
4	4	3	7
CSII (insulin pump)	2	2	4
HbA1c (%)	8.6±2.3	8.0±1.1	8.3±1.8

Table 2
Mean HbA1c levels at prior to camp and 3, 6, 9, and 12 months post-camp (*n*=26).

Time	Pre-camp	3 months post-camp	6 months post-camp	9 months post-camp	12 months post-camp
Mean HbA1c (%)	8.3±1.8	8.4±1.4	8.4±1.4	8.2±1.5	8.3±1.9

Knowledge levels

Because of a problem with the knowledge assessment 3 months post-camp and a lack of test results in 3 participants, the knowledge assessment 3 months post-camp was excluded from analysis. The knowledge assessment test results prior to camp, at the end of camp and at 6, 9, and 12 months post-camp are shown in Table 3. After attending camp, participants had a significant improvement in knowledge and were able to maintain this knowledge gained 12 months post-camp ($p < 0.001$).

DQOLY

There were 4 and 2 participants answered non-applicable for more than 50% of items on the worry subscale obtained pre-camp and 12 months post-camp, respectively. Thus, only 21 participants were included in the analysis of the worry subscale and overall DQOLY. The DQOLY scores pre-camp, 3, and 12 months post-camp are shown in Table 4. There was no differences in satisfaction ($p = 0.575$), impact ($p = 0.071$), worry ($p = 0.358$), or overall DQOLY ($p = 0.263$) scores between pre-camp and 3, and 12 months post-camp.

Table 3
 Knowledge test of participants at pre-camp, end of camp, 6, 9, and 12 months post-camp using 40 multiple-choice questions ($n=27$).

Time	Score	Significance of knowledge difference post-camp
Pre-camp	29.1±5.4	
End of camp	32.6±4.3	<0.001
6 months post-camp	33.3±5.0	<0.001
9 months post-camp	33.3±4.9	<0.001
12 months post-camp	33.0±4.8	<0.001

There was no significant difference between male and female participants in perceptions of life satisfaction ($p=0.655$), impact ($p=0.769$), worry ($p=0.109$) and overall DQOLY ($p=0.711$). Nevertheless, female participants were noted to have a lower worry score than male participants at every assessment.

Self-rating of overall health

Twenty-four participants rated their overall health at each assessment; at least 50% of them thought their general health was good compared to others their age (Table 5). Three months post-camp, more participants thought their health was good and few participants perceived their health as poor. During the 12-month follow-up period, there were no significant differences in the distribution of self-rated health ($p=0.735$).

Correlation between HbA1c level, self-rated health, satisfaction score, impact score, worry score, and overall DQOLY score

We examined the relationships between HbA1c levels and self-rated health and DQOLY prior to camp and 3, and 12 months post-camp. HbA1c levels were not consistently associated with DQOLY; only during pre-camp assessment was the HbA1c level weakly correlated with

satisfaction subscale ($r=0.459$, $p=0.016$) and overall DQOLY ($r=0.398$, $p=0.040$). Self-rated health was correlated with all subscales and overall DQOLY during the pre-camp assessment (satisfaction: $r=0.655$, $p<0.001$; impact: $r=0.537$, $p=0.005$; worry: $r=0.482$, $p=0.013$; overall DQOLY: $r=0.663$, $p<0.001$). Three months post-camp, self-rated health was weakly correlated with impact subscale ($r=0.425$, $p=0.030$) and overall DQOLY ($r=0.453$, $p=0.020$). At 12-month post-camp assessment, self-rated health was correlated with worry subscale ($r=0.725$, $p<0.001$) and overall DQOLY ($r=0.515$, $p=0.010$). Self-rated health was not related to HbA1c levels during any assessment.

DQOLY items with highest and lowest scores

In each subscale of the DQOLY, we evaluated 4 items with consistently highest scores and one item with the consistently lowest score during each assessment. In the satisfaction subscale, the four highest scoring items (most satisfied) were: 1) How satisfied are you with your friendships? 2) How satisfied are you with how your classmates treat you? 3) How satisfied are you with your current medical treatment? 4) How satisfied are you with your work, school, and household

Table 4
DQOLY assessment prior to camp, 3, and 12 months post-camp (number of participants is in parentheses).

Time	Pre-camp			3 months post-camp			12 months post-camp		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
Satisfaction	68.9±12.8 (13)	68.6±10.8 (14)	68.7±11.5 (27)	67.1±12.1 (13)	66.2±10.3 (14)	66.6±11.0 (27)	68.0±11.7 (13)	64.6±8.7 (14)	66.3±10.2 (27)
Impact	76.2±12.6 (13)	79.0±9.2 (14)	77.6±10.8 (27)	75.0±13.4 (13)	71.5±10.7 (14)	73.2±12.0 (27)	74.8±14.3 (13)	71.6±13.2 (14)	73.1±13.5 (27)
Worry	78.9±17.8 (11)	89.2±8.7 (10)	83.8±14.8 (21)	76.9±16.5 (11)	84.2±12.0 (10)	80.4±14.6 (21)	75.9±14.8 (11)	85.7±10.8 (10)	80.5±13.7 (21)
Overall DQOLY	73.7±12.5 (11)	76.1±6.7 (10)	74.8±10.0 (21)	71.5±12.5 (11)	72.1 ±8.0 (10)	71.8±10.3 (21)	71.5±12.4 (11)	73.4±10.0 (10)	72.4±11.1 (21)

activities? The item with lowest score (least satisfied) was: How satisfied are you with your attendance at school?

On the impact subscale, the 4 items with highest scores (least impact) were: 1) How often do you find that your diabetes prevents you from going out to eat with your friends? 2) How often does your diabetes keep you from biking? 3) How often are you teased because you have diabetes? 4) How often do you find that your diabetes prevents you from participating in school activities? The item with lowest score (most impact) was: How often do you find yourself explaining what it means to have diabetes?

On the worry subscale, the 4 items with the highest score (least worry) were: 1) How often do you worry that teachers treat you differently because of your diabetes? 2) How often do you worry whether someone will not go out with you because you have diabetes? 3) How often do you worry that because of your diabetes you are behind in terms of dating, or going to parties with your friends? 4) How often do you worry about whether you will be able to complete your education? The item with lowest score (most worry) was: How often do you worry you will have complications from your diabetes?

Diabetes self-care behaviors

Results are reported as percentage of participants who usually (those who answered 6-7 days or often-all the times performed the diabetes self care.

Personal hygiene. Prior to attending camp, 44% of participants had examined their skin for rashed, abscesses, and other lesions. The number of participants who examined their skin did not increase significantly after attending the camp. Thirty-seven percent of participants washed their hands before checking their blood glucose

Table 5

Self-rating of overall health prior to camp, 3, and 12 months post-camp (reported as percentages).

	Pre-camp (n=24)	3 months post-camp (n=24)	12 months post-camp (n=24)
Poor	-	12.5	4.2
Fair	50.0	20.8	37.5
Good	50.0	62.5	54.2
Excellent	-	4.2	4.2

or injecting insulin. That number increased to 55.5% 3 months post-camp; but then decreased to 40.7% 12 months post-camp.

Dietary control. Before attending camp, only 44.4% of participants ate an appropriate quantity of food in relation to insulin dose and activities. Three months post-camp, more participants (51.8%) ate an appropriate quantity of food, but that number decreased to 33.3% 12 months post-camp.

During the pre-camp assessment, 55.5% of participants usually ate very sweet food and/or fruit. Twelve months post-camp, that number decreased to 33.3%. With each assessment, only 33-37% of participants ate on time.

Before attending the camp, only 18.5% of participants exchanged rice with other carbohydrates when they did not want to eat rice. After attending the camp, the number increased to 33.3% at 3 and 12 months post-camp.

Insulin injections. At each assessment, more than 50% of participants injected insulin on time, checked insulin color and character, rotated injection sites, waited 30-60 minutes after injecting regular insulin before eating, and adjusted insulin according to blood glucose levels.

Physical activities. At each assessment, fewer than 25% of participants walked

or did household chores for at least 30 minutes and fewer than 50% exercised 5 days or more per week.

Few participants checked their blood glucose prior to exercising (pre-camp: 18.5%, 3 months post-camp: 18.5%, 12 months post-camp: 22.2%).

Before attending the camp, only 22% ate more snacks when exercising vigorously; the number of participants who did rose to 29.6% by 3 months post-camp, but decreased to 18.5% by 12 month post-camp.

Self-monitoring of blood glucose. Before attending the camp, only 22.2% of participants checked their urine for ketones when their blood glucose was above 300 mg/dl; this number did not increase after attending the camp.

At each assessment, more than 60% of participants checked their blood glucose before injecting insulin and 50-60% always checked their blood glucose when having hypoglycemic symptoms.

Problem solving. When having low blood glucose symptoms, more than 50% of participants treated themselves with sweetened drink (pre-camp: 66.6%, 3 months post-camp: 59.2%, 12 months post-camp: 70.3%).

Before attending the camp, only 37%

Table 6
Participants' perceptions of their glycemic control prior to camp, 3, and 12 months post-camp (reported as percentages).

	Pre-camp (n=27)	3 months post-camp (n=27)	12 months post-camp (n=27)
Poor	14.8	11.1	18.5
Fair	81.5	85.2	77.8
Good	3.7	3.7	3.7

of participants ate complex carbohydrates after hypoglycemic symptoms resolved. The numbers rose to 51.8% and 48.1% at 3 and 12 months post-camp, respectively.

Prior to attending the camp, 50% of participants carried sugar cubes or snacks when they traveled; these numbers did not increase significantly after attending camp.

Stress management. Before attending the camp, only 22.2% of participants asked others for help when they were not able to handle stress; this number rose to 24% and 40.7% at 3 and 12 months post-camp, respectively. At each assessment, 37-40% of participants talked to others when they felt upset.

Reducing risk of diabetes complications. At each assessment, more than 80% of participants had regular follow-ups with their physicians every 2-3 months and more than 70% consulted medical staff about diabetes management.

Before attending the camp, 48.1% of participants asked their physicians about their recent HbA1c levels; this number increased to 51.8% and 62.9% at 3 and 12 months post-camp, respectively.

Before attending the camp, 40.7% of participants asked their physician regarding yearly screening for diabetes complications; this number increased to 51.8%

and 48.1% at 3 and 12 months post-camp, respectively.

Perception of glycemic control and diabetes-related tasks

When participants were asked what they thought about their glycemic control at each assessment, most thought their glycemic control was fair (Table 6). During the 1 year of follow-ups, there were no significant differences in perceptions of glycemic control ($p=0.74$).

During pre-camp assessment, 22 participants (81.5%) reported that their parents were involved in diabetes care. Regarding the most difficult diabetes-related tasks according to participant opinions, 23 thought adhering to a diabetic diet was the most difficult task, 2 said injecting insulin, one said SMBG, and one thought none were difficult.

DISCUSSION

One of the objectives of this study was to evaluate the effectiveness of diabetes camp on glycemic control. In this study, there was no improvement in glycemic control among participants, although they demonstrated improved knowledge after attending the camp. The effect of diabetes camp on glycemic control is controversial. One study found yearly HbA1c levels among camp attendants showed no im-

provement in glycemic control despite an increase in knowledge (Semiz *et al*, 2000). Some studies with short term follow-up periods from 2 weeks to 3 months (Strickland *et al*, 1984; Misuraca *et al*, 1996; Post *et al*, 2000) and one study with a longer term follow-up period of 9.5 months (Wang *et al*, 2008) found children with T1D had improved glycemic control after attending camp. Our previous 6-month prospective study conducted during the 9th diabetes camp revealed a short-term beneficial effect of the diabetes camp on glycemic control 3 months post-camp but this improvement in glycemic control did not last to the 6 months (Santiprabhob *et al*, 2008). In the present study, lack of improvement in glycemic control could be partly explained by inappropriate diabetes self-care behavior among participants. It is possible the participants did not apply the knowledge in their daily diabetes self-care.

There were several weak points found in participant self-care behavior, particularly diet-related behavior, preparing for exercise, checking urine ketones when having a high blood glucose, and taking extra complex carbohydrate after managing hypoglycemic symptoms. After attending the camp, there were a few improvements seen; these included fewer participants eating very sweet food, more participants doing carbohydrate exchanges, more participants taking extra complex carbohydrates after having symptoms of hypoglycemia and more participants interested in consulting their physician regarding their HbA1c levels and yearly screening for diabetes complications. Diet-related matters seemed to be the most difficult task for teenagers with T1D to adhere to. In order to improve glycemic control, in-depth and frequent assessment of patient self-care behavior and their competence in

solving daily diabetes-related problems is required and a positive attitude towards performing daily diabetes-related tasks needs to be promoted.

There were no differences in quality of life scores prior to camp and 3, and 12 months post-camp. Generally, the participants did not perceive their quality of life as poor. A study by Tachanivate (2007) reported similar results. A cross-sectional study consisting of 102 Thai adolescents with T1D (mean age 14.7 years, age ranged 12-18 years) revealed satisfaction, impact, worry, and overall DQOLY scores of 65.6 ± 12.1 , 70.5 ± 11.5 , 78.6 ± 14.0 , and 68.7 ± 9.8 , respectively (Tachanivate, 2007). In our study the participants had satisfaction, impact, worry, and overall DQOLY scores during the pre-camp assessment of 68.7 ± 11.5 , 77.6 ± 10.8 , 83.8 ± 14.8 , and 74.8 ± 10.0 , respectively. We found the satisfaction subscale had the lowest scores of the subsets of DQOLY, while worry subscale had the highest score. This could reflect while their life satisfaction was fair, our camp participants did not have many diabetes-related worries.

We found participants were satisfied with their friendships, classmates, work and school activities, and current medical treatment. They were least satisfied with the time they were absent from school due to diabetes-related matters. The issue that had the greatest impact on participants, although occurring infrequently, was explaining to others what it means to have diabetes. The issue participants worried about most was whether they would get complications from diabetes. They rarely worried about how having diabetes interfered with their social lives (*eg*, going out on dates, going out with friends), whether they would be able to complete their education or be treated differently by their teachers.

The relationship between metabolic control and quality of life is controversial. The lack of association between metabolic control and quality of life in our study was similar to other previous studies (Ingersoll and Marrero, 1991; Grey *et al*, 1998; Graue *et al*, 2003; O'Neil *et al*, 2005). This finding suggests glycemic control may not have a strong impact on participant perceptions of quality of life. Other studies have shown patients with better glycemic control had a higher quality of life. A study by Hoey *et al* (2001) among 2101 adolescents aged 10-18 years from 17 countries revealed an association between metabolic control and quality of life in which participants with a lower HbA1c had lower impact, fewer worries, and greater satisfaction. A study conducted by Guttmann-Bauman *et al* (1998) of 69 adolescents with T1D aged 10-20 years found adolescents with a higher HbA1c level had a lower quality of life.

In this study, there was no association between perceived health and HbA1c levels. Although most participants felt their glycemic control was fair, at least 50% perceived their health was good compared to others their age. Our participants' perceptions regarding their general health may be different from their perceptions of glycemic control.

This study had some limitations. First, it contained small number of participants; only 27 participants were followed for 12 months; only half of them regularly attended post-camp activities. Second, there was a selection bias; only adolescents with T1D who had a basic knowledge about their disease and were able to care for themselves were recruited. These participants may have had better psychosocial support from their diabetes care providers and families, which could have had an effect on their perceptions

of quality of life. Thus, participants in this study may not be representative of adolescents with T1D in general.

In summary, no improvement in glycemic control, self-care behavior or quality of life after diabetes camp was seen in this study, however we did learn about participant self-care behavior and perceptions regarding quality of life. Diabetes self-care management, particularly diet-related self-care, is a difficult task for teenagers with T1D to be compliant with. Glycemic control did not seem to have an effect on participant perceptions of quality of life. Most participants thought their glycemic control was fair, they did not perceive themselves to have a poor quality of life nor did they perceive diabetes had a negative effect on their social life.

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