Improved Glycemic Control among Thai Children and Young Adults with Type 1 Diabetes Participating in the Diabetes Camp

Jeerunda Santiprabhob MD *,
Supawadee Likitmaskul MD *, Apiradee Sriwijitkamol MD *,
Thavatchai Peerapatdit MD *, Pairunyar Sawathiparnich MD *,
Wannee Nitiyanant MD *, Kitti Angsusingha MD *,
Chanika Tuchinda MD *, Sunthorn Tandhanand MD *

** Diabetes Education Program, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand*

Diabetes Education Program, Faculty of Medicine Siriraj Hospital has provided summer camps for Thai children with type 1 diabetes since 1990. The objective of this study was to evaluate the effectiveness of the diabetes camp in glycemic control.

Twenty male and forty-two female patients participated in the 5-day diabetes camp held in Karnchanaburi, Thailand in 2003. The mean age was 14.1 ± 4.3 years and the mean duration of disease was 4.5 ± 3.5 years. Fifty out of sixty-two patients returned for a 3-month-postcamp visit. The glycemic control improved significantly. The mean precamp and postcamp HbA_{1c} levels were 10.0 ± 3.1% and 9.0 ± 2.6% (p = 0.008) respectively. The diabetes camp is a valuable program for patients to learn diabetes-self management skills, especially in countries where the diabetes education programs are not always available.

Keywords: *Type 1 diabetes, Diabetes camp, Glycemic control, Self-monitoring of blood glucose (SMBG)*

J Med Assoc Thai 2005; 88(Suppl 8): S38-43
Full text. e-Journal: *http://www.medassocthai.org/journal*

Type 1 diabetes is a very challenging medical condition for all of involved individuals including patients themselves, parents, family members, and medical personnel. It requires intensive behavioral changes, frequent glucose monitoring and daily insulin injection. There is no other comparable illness that is so dependent upon what the child or adolescent does, day in and day out than diabetes[1]. Since Leonard F.C Wendt, MD started the first diabetes camp in Michigan in 1925, the concept of specialized residential camp for children with diabetes has become widespread throughout the U.S. and many parts of the world. The mission of the specialized camp for children and youth with diabetes is to allow them to enjoy the camping experience in a safe environment. The camp setting is an ideal situation for the specialized medical staffs to teach the diabetes self-management skills to the participants. Another important goal is to allow children with diabetes to meet with others and share their experiences. At the same time they also learn to be more responsible for their medical problems[2].

Type 1 diabetes in Thai population is not as common when compared to the Caucasian population. The annual incidence of diabetes in Thai children and adolescents was reported to be 0.19 case per 100,000 population during 1984-1985[3] and 0.3 to 0.5 case per 100,000 during 1991-1995[4]. Although the incidence of childhood diabetes is relatively low in Thailand, pediatric endocrinologists have faced with many problems in managing children with diabetes. In order for patients with diabetes to be able to achieve optimal

Correspondence to: Santiprabhob J, Division of Endocrinology and Metabolism, Department of Pediatrics, Faculty of Medicine Siriraj Hospital, Mahidol University 2 Prannok Road, Bangkok 10700, Thailand. Business telephone number: 66-2-419-7000 extension 5676. Business fax number: 66-2-419-7000 extension 5676. Mobile telephone number: 66-1-837-2299. Email address: sijst@mahidol.ac.th

glycemic control, they need to understand the disease and have sufficient knowledge in diabetes care which should be taught by skilled medical personnel. Shortage of pediatric endocrinologists, skilled diabetes nurses, and nutritionists in Thailand has the impact on the adequate management. Many diabetic children living in rural area are managed by general pediatrician and were not referred to the pediatric endocrinologists for proper diabetic treatment and education. Another problem is an inadequate blood glucose monitoring. Financial problem is one of the major factors for such inadequacy since glucometer and test strip are rather expensive and usually is not affordable by most families with diabetic children.

The Diabetes Education Program, Faculty of Medicine Siriraj Hospital serves most of the patient with type 1 diabetes in Thailand. We have been providing diabetes summer camps every 2 years since 1990. The goal of our summer camp is to broaden the knowledge in diabetes care to children and youth with type 1 diabetes from all part of the country, particularly to individuals who do not have the opportunity to receive proper education. During the 8th diabetes summer camp held in Karnchanaburi, in year 2003, glucometers and glucose test strips were provided to every participant during the camp and continued for their use for 3 more months after the camp ended.

The aims of this study were (1) to evaluate the general profiles of the participants, and (2) to determine the effectiveness of the diabetes camp on glycemic control among the participants.

Material and Method

Patients

Sixty-two patients (20 males and 42 females) with type 1 diabetes enrolled in the diabetes camp held in Karnchanaburi province, Thailand from April 7-11, 2003. Half of the participants were referred by their pediatricians. These patients had not been followed at our Institute. Several participants lived in rural areas. They were from families with lower socioeconomic status, requiring financial assistance to attend the camp. Written informed consent from the patients and their parents to participate in the camp was obtained. Medical records, including the participant s past medical history, height, weight, insulin regimen and dosage, and previous HbA_{1c} level were recorded. Ages of the participants ranged from 8.6 to 31.6 years with a mean age of 14.1± 4.3 years. Mean duration of disease was 4.5 ± 3.5 years. One male patient who was 31.6 years old also had β-Thalassemia/HbE disease.

All participants received the blood test for HbA_{1c} level before attending the camp and again at 3 months after the camp ended. HbA_{1c} was performed using Dimension® HbA_{1c} assay kit (Dade Behring Inc., Deerfield, Illinois). The HbA_{1c} measurement is based on a turbidimetric inhibition immunoassay (TINIA) principle (normal range 4.8-6.0%).

Glucometers and a 3-month supply of test strips were provided to every participant. Participants returned the glucometers at a 3-month postcamp meeting. The frequency of self-monitoring of blood glucose (SMBG) was determined by downloading data from glucometer into computer using Camit® Pro program (Roche Diagnostics, Mannheim, Germany).

The camp lasted 5 days. The medical personnel consisted of 8 endocrinologists, 5 endocrinology fellows, 11 nurses, 6 nutritionists, 1 psychologist, 10 medical students and 3 camping staffs who themselves were diabetic. The sixty-two participants were divided into 6 groups. Each groups consisted of 10-12 patients, and one of each of medical personnel.

During the camp, the participants performed SMBG 4 times a day (before breakfast, lunch, dinner and bedtime) or at anytime when there was a question of hypoglycemia or hyperglycemia. Urine ketones were obtained when blood glucose was greater than 250 mg/dl on two consecutive checks or greater than 300 mg/dl at any measurement. The medical personnel of each group reviewed blood glucose record with each patient and helped with modification of insulin dosage or regimen as necessary. Proper insulin injection technique was instructed. Nutritionists planned the diet for each participant, according to his or her physical requirement and reviewed each meal with participants. Three main meals and three snacks were provided daily.

The educational programs included small group discussion on various topics on diabetes self-management skills and lectures on the following topics: insulin therapy and injection techniques, the importance of diabetes control, blood glucose monitoring, exercise and diabetes, diabetic nutrition, complications of diabetes, how to handle special occasions e.g. sick days, party etc., and new therapies for diabetes. Social programs included physical activities such as mini-olympic, hiking and performances by participants at a water festival and farewell parties.

Results were reported as mean ± SD. Statistical evaluation was performed by paired-samples Student's *t* test and one-way ANOVA (SPSS 11.5 for Window, Chicago, Illinois). The level of significance was defined as $p < 0.05$.

Results

Precamp evaluation

The mean insulin dosage was 1.1 ± 0.4 unit/kg/day. Insulin regimens of the participants were shown in Table 1. Participants performed SMBG on average of 1.5 times/day.

HbA_{1c}

The mean precamp HbA_{1c} was 10.3 ± 3.2 %. Among sixty-two patients, 20 patients had good glycemic control ($HbA_{1c} \leq 8\%$), 12 patients had fair control ($HbA_{1c} > 8\%$ and $\leq 10\%$, and 30 patients had poor control ($HbA_{1c} > 10\%$). There was no relationship between glycemic control and ages of participants or duration of disease.

During camp

The average hypoglycemic episodes were 1.4 per individuals. There were 4 patients who developed mild diabetic ketoacidosis. They were treated with extra doses of subcutaneous insulin and ketoacidosis resolved uneventfully. The mean insulin dosage at the end of the camp was 1.1 ± 0.3 unit/kg/day.

Postcamp evaluation

HbA_{1c}

Fifty out of sixty-two participants returned for a 3-month postcamp meeting. The other twelve patients did not attend the postcamp meeting due to long distance traveling and to financial problem.

Table 1. Insulin regimens

Insulin regimen	Number of patients
Premixed insulin* twice a day	26
NPH and Regular (or Lispro) twice a day	21
NPH and Regular (or Lispro) at breakfast, Regular (or Lispro) at dinner and NPH at bedtime	5
NPH at breakfast and premixed insulin* at dinner	3
NPH twice a day	2
NPH at breakfast	2
NPH and Regular at breakfast and dinner, Regular at lunch	1
Premixed insulin* at breakfast and Regular at dinner	1
Premixed insulin* at breakfast	1

* Premixed insulin used by the participants: Humulin 70/30, Mixtard 30

Table 2. Comparison of mean pre-postcamp HbA_{1c} levels between glycemic control groups

Precamp glycemic control	Number of patients	Mean precamp HbA_{1c} ± SD (%)	Mean postcamp HbA_{1c} ± SD (%)	p
≤ 8%	17	6.9 ± 0.9	7.5 ± 1.1	0.036
> 8% and ≤ 10%	12	9.1 ± 0.6	8.4 ± 0.7	0.007
> 10%	21	13.1 ± 2.1	10.6 ± 3.4	0.002

Table 3. Mean postcamp HbA_{1c} among subjects with different frequency of SMBG

Frequency of SMBG per day	Number of patients	Postcamp HbA_{1c} (%)
0.5*	7	10.1 ± 1.6
1	10	9.1 ± 3.2
2	16	9.0 ± 2.8
3	11	7.3 ± 0.9

*Patients checked blood glucose once every other day

The glycemic control was significantly improved. Mean precamp and postcamp HbA_{1c} levels were 10.0±3.1% and 9.0±2.6%, respectively (p = 0.008).

Patients in fair and poor glycemic control groups had significant reduction in postcamp HbA_{1c} level but patients in a good glycemic control group had increased level of postcamp HbA_{1c} (Table 2). Among 21 patients in a poor control group, 12 patients (40%) had reduction of HbA_{1c} (precamp HbA_{1c} - postcamp HbA_{1c}) ≥ 1%.

SMBG and glycemic control

Forty-four out of fifty patients who returned for a postcamp meeting had records of SMBG. The average SMBG was 1.8 times/day. Patients with frequent SMBG had better glycemic control but the difference was not statistically significance (p = 0.091). Results are shown in Table 3.

Discussion

We found that over half of our participants had suboptimal glycemic control prior to attending the camp. There are several factors that contributed to poor glycemic control. They are lack of knowledge in diabetes care, infrequent SMBG, and improper insulin regimen. All participants were on conventional insulin regimen and forty percent of them used premixed insulin. Some used only intermediate-acting insulin and some injected insulin only once a day. We found it was quite difficult to introduce more proper insulin regimen to these patients since they would not be followed by us after the camp. But insulin modification improved glycemic control in some patients significantly. For example, a 25 years old female participant previously on one injection a day of premixed insulin, was changed to twice daily injections. Her HbA_{1c} level decreased drastically from 13.6% to 7%.

The effect of diabetes camp on metabolic control is a matter of debate. Beneficial effect of diabetic summer camp on glycemic control was shown in some studies [5-7]. One study had shown improvement in knowledge of diabetes management among the campers but there was no improvement of glycemic control [8]. In our study, the glycemic control improved significantly and such improvement was more pronounced in patients with previous poor control. Such result occurred in spite of no increase in frequency of SMBG.

Monitoring of glycemic status done by patients and health care providers is considered a cornerstone of diabetes care. Results of monitoring are used to assess the efficacy of therapy and to guide adjustments in medical nutritional therapy, exercise, and medications to achieve the best possible blood glucose control. For most patients with type 1 diabetes, SMBG is recommended three or more times daily[9]. One study demonstrated that having easy access to glucometer strips, provided free of charge to patients, increased the frequency of SMBG[10]. Increase in frequency of SMBG in patients with type 1 diabetes was associated with better glycemic control[10, 11]. At 3-month postcamp visit, there were forty-four subjects with glucometer records. Although we had emphasized the beneficial effect of SMBG and provided test strips free of charge, only 25% of subjects performed SMBG 3 times daily. None of the subjects tested 4 times daily on a regular basis. Subjects with more frequent glucose monitoring had better glycemic control. However there was no statistically difference in HbA_{1c} level among patients with different frequency of SMBG. This could be due to the small numbers of subjects. It was clearly shown that even when the financial problem was not an issue, patients still hesitated to perform frequent SMBG. This could be due to inadequate understanding by patients about the benefits of SMBG results, inconvenience of testing in terms of time requirements, and patient s physical and psychological discomfort.

Most camps found it advisable to decrease the home insulin dosage by 10-20% on arrival at camp to avoid hypoglycemic episodes[2, 12]. At our camp, we did not decrease the insulin dosages upon arrival but insulin doses were modified according to the previous day's data. Hypoglycemic episodes were not uncommon. We found that many patients were competing to lower their blood glucose levels. If the premeal blood glucose was high, some patients would try to lower their blood glucose by increasing level of exercise, drinking large amount of water or decreasing amount of food intake rather than increasing the dose of insulin. Some patients felt that requiring higher insulin dose was a reflection of failure on their parts.

Overall, the participants got along very well. Small group arrangement has helped. We saw the improvement of the relationship among the patients and between the patients and medical personnel as the camp went on.

The diabetes camp provided invaluable experience for children and youth with diabetes. We held a rather large camp of 62 patients in a short duration. A small group arrangement with sufficient medical personnel in each group allowed us to implement the important diabetes self-management skills. This knowledge helped the patients to improve their glycemic control despite no increase in frequency of SMBG. The experience the participants had earned at the camp was useful not only to improve their glycemic control and to prevent complication but also to help them live with the disease more comfortably as well as improved sense of well-being. Because of friendly atmosphere, relationships were formed among patients and with medical personnel. It also gave the physicians and nurses the opportunity to understand behavior and thoughts of children with diabetes better. This experience could not occur easily in the clinic setting.

In conclusion, we found that the diabetes camp helped to improve the glycemic control, at least on a short period of time. Long term effects will need to be determined. We strongly recommend children with diabetes to participate in this type of special camp. Attending the diabetes camp is an opportunity for patients to be re-educated on diabetes self-management skills and to exchange personal experience with others. Small group arrangement with skilled medical personnel is recommended to heighten the effectiveness of the diabetes camp.

Acknowledgements

This data was presented at the 3rd Biennial Scientific Meeting Asia Pacific Paediatric Endocrine Society (APPES), Kobe, Japan, 2004. The authors wish to thank all the members of Diabetes Education Program and everyone who contributed their time and professional support while working together for children with diabetes at the 8th diabetes summer camp in Karnchanaburi. We gratefully acknowledge Ms. Saowalak Hunnangkul for her helpful assistance with statistical analysis.

References

1. Brink J. Diabetes camping and youth support programs. In: Lifshitz F, editor. Pediatric endocrinology. New York: Marcel Dekker; 1996. p. 671-6
2. Kaufman F, Schatz D, Silverstein J. Diabetes care at diabetes camps. Diabetes Care 2004;27 (Suppl 1): S129-31.
3. Tuchinda C, Angsusingha K, Chaichanwalanakul K, Likitmaskul S, Vannasaeng S. The epidemiology of insulin-dependent diabetes mellitus (IDDM): report from Thailand. J Med Assoc Thai 1992;75:217-22.
4. Panamonta O, Laopaiboon M, Tuchinda C. Incidence of childhood type 1 (insulin dependent) diabetes mellitus in northeastern Thailand. J Med Assoc Thai 2000;83:821-4.
5. Strickland AL, McFarland KF, Murtiashaw MH, Thorpe SR, Baynes JW. Changes in blood protein glycosylation during a diabetes summer camp. Diabetes Care 1984;7:183-5.
6. Misuraca A, Di Gennaro M, Lioniello M, Duval M, Aloi G. Summer camps for diabetic children: an experience in Campania, Italy. Diabetes Res Clin Pract 1996;32:91-6.
7. Fuertes Alija JJ, Ruiz Perez E, Galindo Jimeno M, Ergueta Martin P, Gonzalez Sarmiento E. Evaluation of metabolic control in a summer camp for diabetic children (Villarcayo 1991). An Med Inter 1993;10:173-5.
8. Semiz S, Bilgin UO, Bundak R, Bircan I. Summer camps for diabetic children: an experience in Antalya, Turkey. Acta Diabetol 2000; 37:197-200.
9. Goldstein DE, Little RR, Lorenz RA, Malone JI, Nathan DM, Peterson CM. Tests of glycemia in diabetes. Diabetes Care 2004;27 (Suppl 1): S91-3.
10. Nyomba BL, Berard L, Murphy LJ. Facilitating access to glucometer reagents increases blood glucose self-monitoring frequency and improves glycaemic control: a prospective study in insulin-treated diabetic patients. Diabet Med 2004;21: 129-35.
11. Latalski M, Jaworska J, Dziemidok P. Frequency of self-monitoring in relation to metabolic control in patients with type I and type II diabetes treated at the diabetic clinic of the Institute of Agricultural Medicine in Lublin. Wiad Lek 2002;55 (Suppl 1):305-12.
12. Braatvedt GD, Mildenhall L, Patten C, Harris G. Insulin requirements and metabolic control in children with diabetes mellitus attending a summer camp. Diabet Med 1997;14:258-61.

ผู้ป่วยเบาหวานชนิดที่ 1 มีผลการควบคุมระดับน้ำตาลในเลือดดีขึ้นหลังเข้าค่ายเบาหวาน

จีรันดา สันติประภพ, สุภาวดี ลิขิตมาศกุล, อภิรดี ศรีวิจิตรกมล, ธวัชชัย พีรพัฒน์ดิษฐ์, ไพรัลยา สวัสดิ์พานิช, วรรณี นิธิยานันท์, กิตติ อังศุสิงห์, ชนิกา ตู้จินดา, สุนทร ตัณฑนันทน์

โครงการให้ความรู้โรคเบาหวาน คณะแพทยศาสตร์ศิริราชพยาบาลได้จัดค่ายเบาหวานสำหรับผู้ป่วยเด็กเบาหวานชนิดที่ 1 ตั้งแต่ปี พ.ศ. 2533 จุดประสงค์ของการศึกษานี้ เพื่อประเมินประโยชน์ของการจัดค่ายเบาหวานต่อการควบคุมระดับน้ำตาลในเลือดในผู้ป่วยที่ได้เข้าร่วมค่ายเบาหวาน ผู้ป่วยชาย 20 ราย และผู้ป่วยหญิง 42 ราย ได้เข้าค่ายเบาหวานที่จัดขึ้นที่ จ.กาญจนบุรี ในปี พ.ศ. 2546 เป็นเวลา 5 วัน อายุเฉลี่ยของผู้เข้าค่ายคือ 14.1 ± 4.3 ปี และเป็นเบาหวานนาน 4.5 ± 3.5 ปี ผู้ป่วย 50 รายจากทั้งหมด 62 ราย ได้รับการประเมินการควบคุมระดับน้ำตาล 3 เดือนหลังเข้าค่าย พบว่าการควบคุมระดับน้ำตาลดีขึ้นอย่างมีนัยสำคัญ ค่าเฉลี่ย HbA_{1c} ก่อนเข้าค่ายเท่ากับ 10.0 ± 3.1 % และหลังเข้าค่ายเท่ากับ 9.0 ± 2.6 % (p = 0.008)

ค่ายเบาหวานนับเป็นกิจกรรมที่มีประโยชน์สำหรับผู้ป่วย ทำให้ผู้ป่วยได้เรียนรู้ทักษะที่สำคัญในการดูแลตนเอง โดยเฉพาะในประเทศที่การให้ความรู้แก่ผู้ป่วยเบาหวานยังไม่เป็นที่แพร่หลาย