

## Glycemic control in diabetic children and adolescents after attending diabetic camp

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### Abstract

**Background** Type 1 diabetes mellitus (T1DM) is an emerging disease worldwide. Glycemic control in pediatric T1DM patients is a challenge in diabetes management. Attending diabetic camp has been associated with improved glycemic control in diabetic children and adolescents.

**Objective** To determine the effect of diabetic camp attendance on glycemic control in children and adolescents with T1DM

**Methods** A cross-sectional, non-experimental study was done in December 2010 at a diabetic camp held in Bogor, Indonesia. The two-day camp educated diabetics about T1DM, including insulin use, meal planning, exercise, monitoring and complications. The diabetic camp was attended by 28 children and adolescents, consisting of 5 boys and 23 girls, aged 7 - 18 years. Eighteen participants completed the requested data for our study. Glycosylated hemoglobin (HbA1c) was measured before and 3 months after subjects attended the camp. Participants also filled the Pediatric quality of life (PedsQL) questionnaire. We compared HbA1c levels before camp and 3 months after, by Stata 19.

**Results** Before camp, the mean HbA1c was 9.18% (SD 2.48) and 3 months after camp it was 8.67% (SD 1.62), a statistically significant improvement ( $P=0.004$ ). The PedsQL revealed that none of the subjects had poor quality of life.

**Conclusion** Glycemic control in T1DM children and adolescents was significantly improved 3 months after attending diabetic camp compared to that before attending camp. According to subjects' self-assessment by PedsQL questionnaire, no subjects indicated a poor quality of life for the duration of their illness. [Paediatr Indones. 2011;51:294-7].

**Keywords:** Glycemic control, type 1 diabetes mellitus, diabetic camp, HbA1c, quality of life

Type 1 diabetes mellitus (T1DM) is one of the most frequent chronic diseases in children globally.<sup>1</sup> Epidemiological studies indicate that there has been a gradual, but steady increase in the incidence of T1DM in both developed and developing countries.<sup>1,2</sup> Children with T1DM have many responsibilities in disease management, periodic routine medical care, as well as daily treatment. Proper management can prevent and delay the progression of acute or long-term complications.<sup>3</sup> Therefore, improved self-care is crucial for T1DM management in young patients.<sup>4</sup>

Children and adolescents move through stages in which lifestyles, knowledge, skills, attitudes and disease characteristics change over time. Therefore, comprehensive and continuous education is needed to maintain compliance of care.<sup>4</sup> Diabetic camp is an ideal place to provide education and self-care guidance, delivered in a way acceptable for children and adolescents.<sup>5</sup> The recommendations for diabetes management of children at a diabetes camp are similar to the standard outlined by the American

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Diabetes Association for T1DM children in day care settings.<sup>6,7</sup> The camp's mission, especially for children and youth with diabetes, is to allow them to have a camping experience in a safe environment. An equally important goal is to enable children with diabetes to meet and share their experiences, while they learn to be more personally responsible for their own care.<sup>8</sup> The educational goals for children with T1DM are the five pillars of good self-metabolic control which consist of: 1) general overview of T1DM management, 2) insulin injection, 3) nutrition planning 4) exercise, and 5) monitoring of the disease. Those pillars were applied in daily camp activities as a model for their daily lives.<sup>6,7,8,9,10,11,12</sup>

Some studies have shown that diabetic camps have a beneficial effect on metabolic control in T1DM patients.<sup>13,14,15</sup> An Italian study showed significant improvement in HbA1c levels for patients who were followed up monthly for 3 months after the camp.<sup>14</sup> We aimed to observe if attending diabetic camp improved glycemic control. We were also interested in the correlation between glycemic control and patients' quality of life.

## Methods

Data were obtained from children and adolescents with T1DM attending diabetic camp in Bogor, from 28 to 29 December 2011. Camp participants came from Jakarta, West Java, South Sumatera, Kalimantan and East Java. Study subjects were 24 adolescents and 4 children aged 7 – 17 years. All subjects had T1DM, except one teenage girl with type 2 diabetes mellitus (T2DM). Participants were divided into groups of 5 – 6 campers with one endocrinology fellow serving as a tutor. Only 18 subjects' data could be analyzed, due to 10 dropping out during follow-up.

In the two-day camp, participants received structured education about T1DM, insulin injection and adjustments, nutritional planning, exercise, monitoring and complications. There were also practice sessions for self-monitoring of blood glucose measurements, injecting insulin and counting carbohydrates before every meal or snack.

All participants were required to examine and record their blood glucose during the camp. Data was collected by each mentor and reported to the camp

medical manager. All blood glucose monitoring was done by the participants themselves and examined by each mentor. This task was undertaken at least 4 times daily, before each meal (three times per day), and anytime during the day or night when participants felt unwell or the mentor perceived there to be the possibility of a very high or low glucose level. Campers were given a target blood glucose in the range of 100 – 180 mg/dL and avoidance of hypoglycemia. If blood glucose was > 250 mg/dL, blood ketone level was measured and the insulin dose was adjusted until no ketones were found in the blood and blood glucose levels had decreased. Measurements were performed using Accu Check<sup>TM</sup> glucose meters provided by PT Roche, Indonesia.

Measurement of campers' HbA1c levels was carried out before camp, as well as 3 months after camp by Prodia Laboratory, Jakarta.

PedsQL<sup>TM</sup> questionnaires were filled by all participants during camp and collected by the camp manager. We used the general PedsQL form version 4.

## Results

Of the 28 camp participants, there were 5 boys and 23 girls, aged 7 – 18 years. Data was collected in December 2010 – March 2011. One participant had T2DM and the remainder had T1DM. Nine participants did not complete their HbA1c examination three months after the camp, due to loss on follow-up and one participant was hospitalized due to hyperglycemia with high ketones while at the camp. PedsQL questionnaires were completed by the 28 participants, but we were only able to collect complete study data from 18 participants.

Mean age, mean HbA1c levels pre- and post-camp, mean blood glucose levels during camp and mean PedsQL results are shown in **Table 1**. The PedsQL results showed that all subjects reported good quality of life. Upon personal analyses, no subject reported having a poor quality of life. We found that the mean HbA1c level improved significantly 3 months after camp attendance compared to the pre-camp level. Mean HbA1c levels were 9.18% (2.48) before camp and 8.67% (1.62) after camp ( $P = 0.004$ ). (**Table 1**)

**Table 1.** General characteristics

Characteristics	Mean	SD	P value
Age, years	13.3	2.78	
HbA1c, %			
Pre Camp	9.18	2.48	0.004
Post Camp	8.67	1.62	
Blood glucose during camp, mg/dL	200.55	95.75	
PedsQL	20.5	9.12	

HbA1c = glycosylated hemoglobin A1c

## Discussion

Several studies have reported the benefits of youth diabetes camps for diabetic self-management. However, there have been few studies on the effect of diabetes camp on metabolic control.<sup>13,15</sup> We found significantly improved glycemic control in subjects after they had attended diabetes camp. Similar results were reported in an American study, in which a twenty-day diabetes camp was associated with improved HbA1c levels in long-term follow-up, ranging from 3 to 29 months. The improved HbA1c levels were probably induced by frequent exercise, pre-planned meals, diabetes education, and a structured self-care environment with supervised insulin injections, blood glucose monitoring and meal planning by diabetic camp tutors.<sup>22</sup>

Although we observed good results in our study, a diabetes camp in Mississippi reported no improvement of metabolic control after intervention.<sup>21</sup> Another study involving 20 children in a 10-day camp with a specially arranged high volume – low intensity exercise regimen reported that improvement only lasted for two months after the camp.<sup>23</sup>

We also found the average PedsQL level in our subjects was below 50, suggesting that all camp participants had a good quality of life. A study using the Problem Areas in Diabetes (PAID) questionnaire following 38 diabetic children after attending diabetes camp observed an improvement in subjective feelings about difficulties with their diabetes. The study also found that this improvement of subjective feelings correlated to improvement of glycemic control (HbA1c levels). That improvement lasted for only 1 year after the camp, then decreased during the second year of observation.<sup>24</sup> Since diabetes is a chronic metabolic disease, treatment is needed throughout a lifetime. For T1DM, the most

common treatment is insulin injection. Children and adolescents with diabetes almost always face numerous daily challenges, which are different from those of other children of similar age. To cope with these problems, children with diabetes and their families should acquire the knowledge, proper skills and right attitude about diabetes, especially T1DM. Continuous education is mandatory for them, so as to promote the development of healthy behavioral changes to effectively control their metabolism and insulin treatment.<sup>17,18,19,20,21</sup> We found that activities such as camps for diabetic children have several benefits, most notably for each child to experience a healthy, motivational attitude towards self glycemic control. We have demonstrated in our camp events that glycemic control can be improved. Other important factors are emotional and behavioral improvements due to peer group support during and after the camp.<sup>22</sup>

There were some limitations in our study. Our diabetic camp was only a 2-day course, a short time compared to the average summer camp held for 7 days. Two days is a relatively short time to educate children and adolescents on behavioral changes. Another limitation was that our sample size was small and participants came from only certain areas in Indonesia, so the results may not be representative of the Indonesian pediatric T1DM population. Perhaps adolescents attending the camp were already well-adjusted and more outgoing. Therefore, they would be expected to have better glycemic control after camp. Further studies are needed to identify the factors affecting glycemic control improvement after camp, the optimal camp duration and the camp's activities which will bring better outcomes in glycemic control in diabetic children and adolescents.

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