

Effects of Diabetes Self-Management Education on Glycaemic Control in Children With Insulin-Dependent Diabetes Mellitus

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ABSTRACT

Objective: To evaluate the effect of diabetes self-management education (DSME) on glycaemic control (HbA1c) in Pakistani children suffering from type-1 diabetes mellitus.

Study Design: Quasi-experimental study.

Place and Duration of Study: This study was conducted at the Diabetic OPD of National Institute of Child Health, Karachi, from April to September 2009.

Methodology: Sixty children with a mean age of 9.94 years with type-1 Diabetes mellitus (T1DM) were selected conveniently from the diabetic OPD. The patients along with their parents/caregivers attended a modular series of diabetes self-management education program consisting of 2 sessions. Customized program was designed to educate children regarding general information about the disease, basic insulin therapy, planning for hypoglycaemia, hyperglycaemia, activity, traveling and basic nutritional management. It was conducted by a multidisciplinary paediatric diabetes team including an endocrinologist, general paediatrician, nutritionist and diabetic nurse. The educational sessions were followed by monthly revision exercises. HbA1c levels were measured at baseline and after 3 months and compared using paired sample t-test.

Results: Out of a total of 60 patients, 50 completed the trial. There was a significant decrease in the HbA1c levels after the DSME program. The mean pre- and postintervention HbA1c levels were 9.67 ± 0.65 and 8.49 ± 0.53 respectively with a p-value < 0.001 .

Conclusion: In the studied group, DSME programs helped to improve glycaemic control. It should be an integral part of patient treatment in diabetic care setups.

Key words: Type-1 Diabetes mellitus. Diabetes self-management education. HbA1c. Children.

INTRODUCTION

Diabetes mellitus is a group of metabolic diseases characterized by chronic hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycaemia is associated with long term damage, dysfunction and failure of various organs, in particular the eyes, kidneys, nerves, heart and blood vessels.¹

Type-1 diabetes is the most common form of diabetes in children in most parts of the world, although reliable data are still unavailable in several countries.² Incidence is the lowest in China and Venezuela (0.1 per 100,000 per year) and the highest in Finland and Sardinia (37 per 100,000 per year).³ In Pakistan the actual number of diabetic children is unknown but is estimated to be around 61,196 and is increasing with every passing year.⁴

Management of T1DM in children and adolescents is a challenge for health care practitioners. The importance

of optimal control in children and adolescents to prevent the long-term complications of diabetes is already well recognized.^{5,6} Improving diabetes care for children and young people requires educational programs, to provide the knowledge and skills necessary to make informed choices, to facilitate self-directed behaviour changes and ultimately to reduce the risk of complications. Diabetes self-management education (DSME) is the process of teaching individuals with diabetes in all aspects of the disease.¹ Studies carried out across the globe especially with short-term follow-up demonstrated positive effects of DSME programs on knowledge, frequency and accuracy of self-monitoring of blood glucose; self-reported dietary habits and glycaemic control.⁷⁻¹²

There is no local study available on the aforementioned topic and this aspect of management of children with T1DM is yet to be applied appropriately in Pakistan. Therefore this study was undertaken to evaluate the effect of diabetes self-management in children with type-1 Diabetes.

METHODOLOGY

This study was conducted at the Diabetic Clinic of the National Institute of Child Health, Karachi, from April to September 2009. Sixty registered T1DM patients with their parents/caregivers were selected conveniently

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Received December 24, 2009; accepted November 15, 2010.

from the diabetic OPD during a 6 weeks recruitment period (January to February 2009) which was not included in the study duration. Those children with diabetes related micro- or macro-vascular complication, psychological disorder, under 3 years of age, with incomplete data and those who were visiting diabetic clinic of any other hospital for second opinion were excluded. On completion of sample selection stage, the subjects were divided into 6 groups in numerical order. Each group comprised 10 patients and their parents/guardians. A questionnaire-cum-interview method was adopted to collect information about the family history of the disease, age at the onset of the disease, height, weight and body mass index (BMI) and insulin regime. HbA1c levels of the subjects were measured at baseline and postintervention. The normal range for HbA1c was taken as 4.8-6.0%. No changes to the insulin regime and average dose were made.

Based on international guidelines, four specially designed educational modules customized according to the local needs were developed by the research team.^{13,14} According to the international society for paediatric and adolescent diabetes (ISPAD) education should be provided by an interdisciplinary team and initial learning should be reinforced by written guidelines and booklets which should be appropriate to the child's age and maturity.¹⁴ The modules included leaflets/booklets and power point presentations translated in Urdu. Information given in either the ways was the same. Keeping in view children's interest and comprehension level, the written matter was illustrated by colourful pictures and shapes. To encourage and motivate the children specially designed diabetic kits named Kid Sacs were also arranged for them. Details of the modules and diabetic kits are given in Table I. The modules were divided into two sessions; each for an hour and a half. The mode of education was power point presentation. For convenience of patients to come on diabetic OPD, it was decided that the sessions should be held on the same day.

First session was conducted by a paediatric endocrinologist and general paediatrician. The topics covered in the session were module 1, 2 and 3. Second session was delivered by the nutritionist assisted by diabetic nurse. The discussion topic was module 4.

Each group underwent these sessions separately for 2 consecutive OPDs. At the end of the educational sessions, kid sacs were distributed amongst the patients. Free glucometers along with 3 months supply of strips for at least 1 test daily were provided to the patients along with log books to ensure record keeping and uniformity in test results.

Monthly follow-up visits were also scheduled for the subjects group-wise, involving reinforcement of advice, revision of educational modules, problem identification and adjustment.

Table I: Details of the DSME modules and Kids Sac.

Module No. 1: What is type 1 Diabetes mellitus:

General information about the disease, it's causes and symptoms, basic insulin therapy.

Module No. 2: Insuline therapy:

Insulin types commonly used in children.
Dose preparation.
Injection sites and method of injecting insulin.
Where, how and how long can the medicine be stored?
Importance of blood sugar monitoring.
Types of blood sugar monitoring.
Monitoring procedure.
Importance of blood sugar record keeping.

Module No. 3: Planning for special needs:

Hyperglycaemia, it's causes, symptoms and management.
Hypoglycaemia, it's causes, symptoms and management.
Sick day's management.
Physical activity, its advantages in diabetes, advice and planning.

Module No. 4: What should I eat?

What is healthy diabetic diet?
Techniques for weighing and measuring food.
Importance and use of portion estimation.
Importance of frequency and timing of meals in diabetes.
Meal management for sick days, physical activity and travelling.
Individual diet plan.

Kid Sac items in each sac:	Quantity
Glucometer	1
Glucometer strips	25x3
Blood sugar monitoring log book	1
Dietary diary with individual diet plan	1
Modules leaflets	1 copy each
Diabetic bracelet	1
Diabetic ID card	1
Diabetic toy with highlighted injection sites	1

Individual calendars for each group were formed, which included the group number, dates and time line for the educational sessions, dates for HbA1c tests (baseline and after 3 months), dates for follow-up visits were explained and given in written form to every individual of the respective group. A telephonic reminder was given to each patient 1 week prior to the scheduled educational session.

Data analysis was on SPSS version 15.0. Qualitative data i.e. gender, family history, educational status etc. was expressed as numbers and percentages and quantitative data i.e. age, age at onset, and blood investigation including HbA1c was expressed as mean and standard deviation. Paired sample t-test was used for comparison of pre and post HbA1c. The level of significance is defined as $p < 0.05$.

RESULTS

The study population comprised of 45.8% males and 54.2% females with a mean age of 9.94 years. Their characteristics are given in Table II. Only 50 patients completed the trial. The drop-out was 29.5%. Most dropped out patients did not attend the follow-ups for personal reasons and a few did not come after the

Table II: Characteristics of the 50 patients who were enrolled and completed the study.

Clinical characteristics of study group	N=50
Positive family history of the disease	39
Body mass index (kg/m ²)	15.49±1.92
Age at the onset of the disease (years)	8.15±3.02
Insulin regime	
Two injections daily	86.1%
Four injections daily	13.9%

Data is expressed as mean ± SD

recruitment phase. No overall changes to the insulin regime and average dose were made during this period. A significant decrease in the HbA1c was observed in the study group. The pre- and post-intervention HbA1c were 9.67 ±0.65% (95% CI 9.02-10.32) and 8.49 ±0.53 (95% CI 7.96-9.01) % respectively. Mean difference in HbA1c before and after the intervention was 1.174 (95% CI 0.684-1.66) % which was highly significant (p < 0.001).

DISCUSSION

A comprehensive DSME program was developed in accordance with international guidelines and delivered by a multidisciplinary paediatric diabetes team for the first time in the diabetic OPD of NICH, Karachi. The project was aimed at changing the conventional treatment regime and to improve glycaemic control by raising the level of treatment offered to Pakistani T1DM children. Similar to the results of international researches,⁷⁻¹² this study has also shown a significant decrease of HbA1c levels.

Interactive group programs of patients education helps to stimulate interaction among participants, which enhance the efficacy of education: peer listening improves learning.^{15,16} There are around 450 patients registered in the diabetic clinic of NICH, the weekly patient turnover is around 50. This large turnover obstructs the medical team to give much time to every patient resulting in ambiguities and poor control. This program provided an opportunity to the patients and their family members not only to voice their opinions and worries freely but also to learn a lot about diabetes self-management. The interactive group sessions not only improved the relationship among the study population and medical personal but also helped in understanding patient's behaviour and thoughts better. The introduction was built in such a way as to stimulate group discussion through open questions etc. All participants and the research team alike contributed to the discussion followed by their personal knowledge and experience sharing.

Self-monitoring blood sugar (SMBG) is an important part of glycaemic control and is recommended at least 3 or more times daily for T1DM patients.¹⁷ Many similar studies in their programs have laid special emphasis on regular SMBG and made special arrangements to insure its practical application by the patients.⁷⁻¹⁰ Santiprabhob

et al. evaluated the effects of DSME in Thai children and young adults in a diabetic camp and found out that the patients with frequent SMBG had better glycaemic control (p=0.09) as compared to others. In this study due to lack of awareness and low socioeconomic conditions most patients were not doing SMBG regularly. Free glucometers along with 3 months supply of strips for at least one test daily were provided to the patients along with log books to ensure record keeping.

Medical nutrition therapy (MNT) is an integral component of diabetes management.¹⁸ The health professional of greatest expertise in providing MNT for diabetes is the registered dietitian (RD).^{14,19-21} Each 1% fall in HbA1c is associated with a 3% decrease in micro-vascular complications. Studies have shown that the implementation of Nutrition Practice Guidelines (NPGs) reduce the HbA1c to 1% to 2% in the first 3 months.²⁰ Most similar studies had taken in account the pivotal role of MNT and nutritional education by dietitians.⁷⁻¹⁰ The BMI score of the patients in this study was 15% which is considerably low and indicates poor nutritional status. As NICH has no nutrition department; all the subjects had never seen a dietitian in the past and were unaware of the NPGs. For the most part, the nutritional counselling was done by general paediatricians. Generally, nutritional management included elimination of all sweet tasting foods including fruits or starchy vegetables; eating less to have better glycaemic control was a common practice. In this study a complete educational session conducted by the study nutritionist was devoted to the nutritional management of T1DM. Dietary booklets with basic dietary guidelines and individual meal plans were provided and portion estimation of foods and importance of measuring and weighing foods was also explained to the patients/caregivers. Many self-imposed dietary restrictions were unsanctioned.

According to current international paediatric guidelines the treatment and education of children and youth with diabetes need to be delivered by a certified multidisciplinary team consisting of a paediatric diabetologist, a specialized diabetic nurse educator, a dietitian as well as an associated child psychologist, and a social worker.¹⁴ In Pakistan, mostly diabetic care is delivered by general practitioners (GP) as diabetes care teams giving well directed diabetes education are lacking in the country. Shahpurwala *et al.* conducted a study to determine the approach of GP towards diabetes management and concluded that majority of the GPs under-diagnose and under- educate these patients, only 38% of them used the correct level of fasting blood glucose (≥ 126 mg/dl) as the cut-off for diagnosing diabetes.²² Loveman *et al.* conducted a systematic review to assess the clinical effectiveness and cost effectiveness of educational interventions and included 24 studies. The results showed a long lasting improvement in metabolic control

and reduction in complications in T1DM patients.¹² Khowaja *et al.* conducted a study to find out the cost of diabetes care in outpatient clinics of Karachi.²³ It showed that the country's annual mean direct cost for each diabetic patient is approximately Pakistani rupees 11,580 (US\$ 197) and the poorest segment of the society is spending 18% of their total family income on diabetes care. However, the resources can be saved by a reduction in diabetes co-morbidities through improved diabetes care. The results of this study show that proper and well directed DSME program delivered by trained personal helps to improve glycaemic control without undue emphasis on the number of insulin injections and favourably altering various long-term risk factors in T1DM but over a shorter period of time.

CONCLUSION

In paediatric diabetic care, age-appropriate, demand-oriented and individualized practical information and skills training are vital to achieve good metabolic control. However, further studies are warranted to determine long-term effects.

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