Diabetes Self-Management Education to Empower Adolescents with Type I Diabetes

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Abstract:

The study was aimed to assess the effectiveness of diabetes self-management education (DSME) to empower adolescents with type I diabetic. A quasi experimental design was used in this study. Setting: The study was conducted in Diabetic Pediatric Out-Patient Clinic at Children Hospital affiliated to Ain Shams University. Subjects**:** A purposive sample of 52 adolescents out of 316 aged from twelve to eighteen years, who have type I diabetes as a chronic illness one month ago their blood glucose level uncontrolled. Data were collected by structured questionnaire sheet to assess knoweldge, adolescent medical record, adolescent follow-up log book and observation checklist to assess practice regarding to seven items of DSME. These tools were used three times pre/post after three months and after six months follow-up. The study revealed that, there was a statistically significant difference between pre/post, pre/follow-up and post/follow-up implementation of DSME sessions. The study concluded that DSME had empowered adolescents toward achieve self-care. It could be recommended that DSME could be applied to all age of children especially adolescents to guide the intervention and improve the care.

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1. Introduction

Diabetes is the commonest endocrine metabolic disorders in childhood. The general incidence is around (2/1000). Most patients of diabetes in children are "type I Diabetes or insulin-dependent diabetes". It is an autoimmune disease characterized by autoimmune destruction of pancreatic islets leading to beta cell failure and decrease or absence of insulin secretion[1].

Approximately in every 400-500 children and adolescents one has type I Diabetes. Incidence is similar in male and female, lower in African Americans than white and markedly less common in Hispanics, Asia Americans and Americans Indians[2, 3].

Traditionally, the success of patients to manage their diabetes has been judged by their ability to adhere to a prescribed therapeutic regimen. A great deal of effort has been spent in developing methods for measuring compliance, techniques and strategies to promote adherence. Unfortunately, this approach does not match the reality of care. The serious and chronic nature of diabetes, the complexity of its management and the multiple daily self care decision that diabetes require mean that being adherent to a predetermined care program is generally not adequate over the course of a patient life with diabetes[2, 4].

The status of diabetes education in the Arabic countries is a real frustration, despite the importance of diabetes education as a cornerstone. Diabetes self-care management education is the cornerstone of the care for all individual with diabetes who wants to achieve successful health related outcome[5]. The primary purposes of DSME are to provide knowledge and skills training, help individuals identify barriers; facilitate problem solving to achieve effective self-care behavior[6].

Seven diabetes self-care behavior measures determine the effectiveness of DSME at the individual levels as being active (exercise), eating, medication taking, monitoring of blood glucose, problem solving for blood glucose highs, lows and sick day, reducing risk of diabetes complications, living with diabetes[7].

Diabetes management is a team effort. Physician, nurse, dietitians and other health-care professional contribute their expertise and long term implementation to design of therapeutic regimens that will enable patients to achieve the best possible metabolic control[8].

Empowerment means that the patient is at the center of team, and supported by the family, patient has the responsibility for day to day implementation of the treatment plan. Therapy will be most effective if patient understands the regimen, is not ambivalent about the value, and was mastered skills to do required tasks correctly. Therefore, the clinical management of diabetic relies on patient self management[9].

Significance of the study:

Type I diabetes is currently the outstanding health problem in developed as well as developing countries. It creates increase family stress, requires constant adaptation by adolescent and the family member and poses challenge to nurse to better

understand meet the needs of these adolescents and their families.

Diabetes self-management education. (DSME) can be helpful for type I diabetes to promote their self-care practice and compliance to management therapy that consequently will improve their physical, social and mental wellbeing.

Aim of the study

This study was aimed to assess the effect of DSME to empower adolescents with type I Diabetes through:

1- Assessing adolescent's knowledge regarding DSME.

2- Assessing adolescent's practice regarding DSME.

3-Developing, implementing and evaluating the outcome of DSME.

Research hypotheses:

The implementation of DSME will empower adolescents with type I Diabetes through improving adolescent's knowledge and practice toward seven diabetic self-care.

2. Subjects and Methods:

I. Research design

This is a quasi experimental research design.

Research setting:

The study was carried out in Pediatric Hospital Out-Patient Clinic at Children Hospital affiliated to Ain Shams University.

Subjects:

A purposive sample consisted of 52 adolescent selected out of 360 adolescents with type I Diabetes attending the previous mentioned setting on a regular basis, one month ago their blood glucose level uncontrolled.

Their age ranged 12 to 18 years with mean age 14.3±3.2 male were representing 53.8 while female46.2% and 42.3% of the studied subjects having family history of diabetes the mean illness duration were 6.2±2.9 years.

Tools of data collection:

The following tools were designed by the researchers.

▪ **Structured Questionnaire Sheet:**

It was designed and written in Arabic language based on pertinent literature. It included two parts; the first part for demographic characteristic of adolescent with type I diabetes as regards age, sex, educational level, as well as the duration of illness and their family history of diabetes. The second part

for knowledge about the seven items of diabetes self care such as exercise, eating, medication taking, monitoring of blood glucose, problem solving for blood glucose high and low as well as sick days, reduction of diabetes complication and living with diabetes. The researchers used the questionnaire in at regular interval after (3) months (post-test) then after six (6) months to assess the effect implementation of DSME.Scoring system was developed. Each item used its own score which were 10, 15, 15, 15, 15, 15, 20, and 15 respectively

Adolescent Medical Record:

It was used by the researchers to look for all investigations done for each adolescent.

▪ **Observational Cheklists:**

The observation checklists were used to assess the adolescents' practices toward insulin dose preparation, self-insulin administration, and self blood glucose monitoring self urine analysis for sugar and acetone and self foot care. Scoring system was used. Each procedure was done had its own score which was 20, 10, 10, and10

▪ **Adolescent follow-up Log Book**:

It was a documentation and provides evidence of collaboration among staff, providers and referral sources which designed by hospital administrative staff, the researchers follow the written report each month of each particular adolescent to follow the presence of any complication happened or expected to be happened as well as daily recorded nutritional intake and food preferences.

Tool had been validated by five expertise in the field.

II. Operational design:

1- Preparatory phase:

A review of the past and current related literature covering aspects of self management education for diabetes care was done using available book, articles, periodicals and magazine, in addition to internet search to get acquainted with the research problem and to develop the study tools.

▪ **Pilot study:**

A pilot study was carried out 10 adolescents, of both gender and chosen randomly to test the assessment sheet and its applicability on the studied sample, in order to identify the best methods to collect data and identify obstacle or problem in data collection. The pilot study samples did not included in the current studied sample.

Field work

The actual field work was carried out from the September (2006) up to the end of May (2007). The studied subject was divided into eight (8) groups; each group consisted of 6-7 adolescents.

The researchers met each group twice/week for 45 to 60 minutes. The time of implementation was from 6-7 week for each group. So the implementation of the DSME was achieved with 6-7 months.

The DSME was performed in phases:

A. Assessment phase: it was done for adolescents who have diabetes prior to the implementation the content of DSME (pretest).

The objective of this phase was to assess adolescent's self management knowledge deficit as well as skills deficit which create barriers for problem solving, coping skill to achieve self care behavior and behavior change (baseline assessment). Although the researcher's responsibility to identify the knowledge's deficit as well as skills, it is the patient job to provide an accurate medical and educational history and to acknowledge what must be learned to undertake in the DSME.

B. Planning phase: based on the base line assessment of adolescents' need development of the content of DSME sessions, the researchers identify the topics and teaching approaches that are most appropriate for each particular adolescent. The plan for the education becomes a negotiation between the researchers and the adolescents with type I Diabetes. The content was being active (exercise), eating, medication taking (insulin action and dosage adjustment), monitoring blood glucose, problem solving for Blood Glucose high and low ,sick days and reduces risk of diabetes complication and living with diabetes (psychosocial adjustment).

C. Implementation phase: The objective of sessions aim at helping the adolescents who has diabetes to develop self-care behavior,i.e to develop independent level in relation to disease process, nutrition, physical activity, medication, proper technique for blood glucose monitoring, prevention of acute complication, hypo, hyperglycemia, care of feet, change bad habits to reduce health risk factors for diabetes complication .

D. The evaluation phase: The pre assessment tools were repeated again after three months implementing of DSME session (posttest) to measure the effect of the implementation and after 6 months (follow-up).

Administrative design:

An official request was submitted to the director of medical and nursing offices of the previously mentioned hospital for their approval to conduct the study.

Ethical design:

Approval of the ethical committee and administrative approval was obtained. Adolescents' informed consent was obtained. Confidentiality of data and results were considered.

Statistical design:

Statistical analysis

According to the responses obtained from adolescent, a scoring system was followed to obtain the outcome of children DSME.

Data enter and analyses were done using the statistical package for social science (SPSS). Statistical tests were used to determine whether there was a significant difference or not. The following statistical techniques were used; percentages, arithmetic mean standard deviation, paired t test and chi-square.

- $t_{(1)}$ between the study group before / after implementation
- $t_{(2)}$ between the study group before / follow-up
- $t_{(3)}$ between the study group after / follow-up
- $X^2_{(1)}$ between the study group before / after implementation
- $X^2_{(2)}$ between the study group before / follow-up
- $X^2_{(3)}$ between the study group after / follow-up

3. Results:

Table (1) clarified that there was a statistical significant difference between pre and post implementation of DSME related to the seven items of diabetes self-care behavior.

As observed in table (2) there was a statistical significant difference in total knowledge of adolescents regarding to self-care pre and post, post and follow pre and follow.

Table (3) revealed that there was a highly statistical significant difference related to Diabetes self-care practices, pre, post and at follow up.

Considering total self-care practice table (4) revealed that there was a high statistically significant difference pre/post implementation of (DSME) as regards total self-care practice among adolescents with type I Diabetes

Table (5) revealed that the relation between adolescents' knowledge and their characteristic was not statistical significant (P >0.05).

Table (6) revealed that the relation between adolescents' practice and their characteristics was not statistical significant (P >0.05).

Table (1): Mean Score Knowledge of adolescents with Type I Diabetes Regarding the Seven Items of Self-Care Pre, Post and Follow-up DSME.

Adolescents' knowledge	Mean ± SD			t test & p value		
	Before	After	Follow up	t(1)	t(2)	t(3)
Disease process (10)	4.2 ±3.2	7.1 ±2.2	9.9 ±2.1	29 P<0.005	13 P<0.005	30 P<0.005
Nutritional Knowledge (15)	6.5±3.2	11.4±2.2	10.1±2.6	49 P<0.005	45 P<0.005	11.7 P<0.005
Knowledge about exercise. (15)	8.2±2.1	13.1±0.9	11.8±1.6	24.5 P<0.005	36 P<0.005	13 P<0.005
Knowledge about self medication taking (20)	10.8±3. 3	18.2±2.5	16±1.3	24.7 P<0.005	17.3 P<0.005	73.3 P<0.005
Record keeping and monitoring blood glucose (15)	6.3±3.7	13.1±1.2	11.3±2.7	34 P<0.005	50 P<0.005	9 P<0.005
Signs and symptoms of hyper and hypoglycemia.(15)	9.3±2.1	13.1±1.1	11.5±1.6	38 P<0.005	33 P<0.005	16 P<0.005
Complication of diabetes and sick days. (15)	8.1±2.2	13±1.2	12.1±1	49 P<0.005	20 P<0.005	25 P<0.005
Psychosocial adjustment (15)	7.3.3±1.6	12.7±2.7	10.5±3.8	27 P<0.005	11 P<0.005	9.5 P<0.005

Table (2): Mean Score of Adolescents' Total Knowledge of Regarding Self-care Pre, Post and Follow-up.

Total knowledge (120)	Mean ±SD	Paired t-test	
		t	P-value
Pre implementation	55.2 ± 12.4	t (1): 88	<0.05
post implementation	90.4 ± 15.1	t (2): 79.4	<0.05
At follow up	82.2 ± 10	t (3): 11.5	<0.05

Table (3):   Mean Score of Adolescents' Practices Regarding Self-care practices Pre, Post and Follow-up.

Children's Practice	Mean ± SD			t test & p value		
	Before	After	Follow up	t(1)	t(2)	t(3)
Self insulin preparation & administration.(20)	9.1 ±3.4	15.2 ±2.2	14.8 ±2.1	30.5 P<0.005	27 P<0.005	40 P<0.005
Self monitoring blood glucose.(10)	5.8±1.8	9.1±0.8	8.6±1.4	31 P<0.005	51.4 P<0.005	8.8 P<0.005
Self urine testing for sugar & ketones(10)	6.1±3.4	8.1±1.1	7.9±1.3	21.6 P<0.005	36.7 P<0.005	10 P<0.005
Self foot care.(10)	4.3±1.7	8.1±1.1	7.5±1.3	47.5 P<0.005	53.3 P<0.005	20 P<0.005

Table (4): Mean Score of Adolescents' Total Practices of Regarding Their Self-care Pre, Post and Follow-up.

Total practice (50)		Paired t-test	
	Mean±SD	t	P-value
Pre implementation	21 ± 11.3	t(1): 50	<0.05
post implementation	41 ± 8.2	t(2): 85.5	<0.05
At follow-up	38.1 ± 10.2	t(3): 9.6	<0.05

Table (5): Relation between Adolescent's Knowledge and their Characteristics Pre, Post and Follow-up for DSME

Children's characteristics	Total Number = 52(100%)					
	Before		Immediate after		Follow up	
	Unsatisfactory	satisfactory	Unsatisfactory	satisfactory	Unsatisfactory	satisfactory
	No (36)	No (16)	No (7)	No (45)	No (11)	No (41)
Age						
12>15	24	10	5	29	7	27
15≥18	12	6	2	16	4	14
X^2 and p value	X^2_1 0.2 p > 0.05		X^2_2 0.1 p > 0.05		X^2_3 0.2 p > 0.05	
Sex						
Male	18	10	6	22	8	20
Female	18	6	1	23	3	21
X^2 and p value	X^2_1 4 p > 0.05		X^2_2 2.7 p > 0.05		X^2_3 5.3 p > 0.05	
Level of education						
Preparatory	8	6	3	11	4	10
Secondary	28	10	4	34	7	31
X^2 and p value	X^2_1 2.4 p > 0.05		X^2_2 1.9 p > 0.05		X^2_3 1.7 p > 0.05	
Duration of disease						
> 5 years	18	8	4	22	6	20
5 > 10 years	9	3	1	11	2	10
10 years & more	9	5	2	12	3	11
X^2 and p value	X^2_1 0.7 p > 0.05		X^2_2 0.6 p > 0.05		X^2_3 0.5 p > 0.05	
Family history of diabetes						
No	17	13	4	26	6	24
Yes.	19	3	3	19	5	17
X^2 and p value	X^2_1 5.3 p > 0.05		X^2_2 5.3 p > 0.05		X^2_3 0.1 p > 0.05	

Table (6): Relation between Adolescent's Practice and their Characteristics Pre, Post and Follow-up for DSME

Children's characteristics	Total Number = 52 (100%)					
	Before		Immediate after		Follow up	
	Unacceptance	Acceptance	Unacceptance	Acceptance	Unacceptance	Acceptance
	No (34)	No (18)	No (8)	No (44)	No (10)	No (42)
Age						
12>15	20	14	4	30	6	28
15≥18	14	4	4	14	4	14
X^2 and p value	X^2_1 2.8 p > 0.05		X^2_2 2.02 p > 0.05		X^2_3 1.1 p > 0.05	
Sex						
Male	16	12	5	23	6	22
Female	18	6	3	21	4	20
X^2 and p value	X^2_1 2.1 p > 0.05		X^2_2 2 p > 0.05		X^2_3 0.5 p > 0.05	
Level of education						
Preparatory	9	5	3	11	4	10
Secondary	25	13	5	33	6	32
X^2 and p value	X^2_1 0.5 p > 0.05		X^2_2 1.1 p > 0.05		X^2_3 1.6 p > 0.05	
Duration of disease						
> 5 years	15	11	5	21	7	19
5 > 10 years	9	3	2	10	2	10
10 years & more	10	4	1	13	1	13
X^2 and p value	X^2_1 2.4 p > 0.05		X^2_2 3.8 p > 0.05		X^2_3 3.4 p > 0.05	
Family history of diabetes						
No	17	13	6	24	5	25
Yes.	17	5	2	20	5	17
X^2 and p value	X^2_1 3.5 p > 0.05		X^2_2 2.7 p > 0.05		X^2_3 1.5 p > 0.05	

4. Discussion:

The prevalence of diabetes is increasing globally and the rate of increase is higher in developing countries. Topics to be included in diabetes patient education are numerous and vary according to type of diabetes, patient age and other individual characteristics[8].

The study subjects consisted of a purposive sample of adolescence with type I diabetes and the age ranged from twelve to eighteen with mean 13.1±3.6. Also in relation to characteristics of adolescent which are early adolescent from 12 to 15 years and late adolescent from 15 to 18 years. This present study revealed that half of the study adolescent belonging to age 12 to 15 years, these findings are in agreement with findings of[11-12] who found that the peak incidence of diabetes was between 12-15 years. Also **ISPA** consensus guideline of[13], reported that more than half of type I diabetes are diagnosed before the age 15 years. That age group can manage body change and a strong sense of self identity. This managing during puberty, diabetes management and blood glucose control become more difficult.

The mean illness duration 6.2±2.9 years attending the previously mentioned setting on regular basis, one month ago their blood glucose level fluctuated this may be due to the fact of body change. These findings were contradicted with findings of[10] who stated that adolescents aged 13-19 years are the only age groups who evidence based data for diabetic control at a higher level than that achieved by adults.

As regarding family history of diabetes the current study showed that less than half the studied sample had family history of diabetes. The present study result is similar to the result illustrated by[8] who mentioned that the risk of diabetes to family members of an individual with type I diabetes is significantly higher compared with the general population and added that the statistical risk of a family member developing type I diabetes is linked to the genetic similarities of the family member.

Recent advances in knowledge, therapies and technology have greatly enhanced the ability to effectively care for patient with diabetes. In spite of these advances, patient with diabetes still experience less than optimal blood glucose level as well as acute and long term complication. Health care professional are often frustrated by their patients' care inability to make change in their behavior, in addition, people with diabetes sometimes feel that they are "just blood sugar number" to their provider. Clearly there is a gap between the realities of diabetes care. One of the key to close this gap is effective diabetes self management education[14].

On determining the effectiveness of diabetes self management education on empowering adolescent toward seven diabetic self care management, the present study revealed that there was statistical significant difference in mean score of adolescent before and after implementation of DSME related to the seven diabetic self care. This proved that the extend to which DSME had a positive effect on empowering those adolescents.

The present study revealed that there a was statistical significant difference before and after implantation of DSME related to diseases process as well as between after and follow-up which proved that DSME implementation is increase the adolescents understanding to their own disease, its causes and the illustration of signs and symptoms which indicate the presence of type I diabetes. This finding are in agreement with[6] diabetes who has similar reported that all type of patient with Diabetes often lack sufficient knowledge about their diseases and thus frequently have poor self management skills. The finding of the present study is similar to that[15] who found that diabetic children had poor knowledge about their disease. Theses finding point to the success of DSME in improving the knowledge of adolescent and this improvement was after 3 months as will as 6 months at follow-up.

Food is an important of diabetes treatment and health. The amount of type and timing of meals snacks must be behavior with insulin and exercise to maintain good blood glucose.

On determining the adolescent's knowledge about daily nutritional caloric requirement the present study revealed that there was a statistical significant difference between mean score of adolescent's knowledge pre and post DSME which proved the positive effect of DSME in empowering adolescent regarding achieving maintain body weight, normal growth and development by organizing their dietary intake post implementation all adolescent had ability for planning meal time on an individualized basis, the adolescent daily schedules provide optimum nutrition, reflected food preferences and make diabetes self-management education effective. Each adolescent in the present study realized post implementation that in spite of each one with diabetes have the same nutritional needs as individuals without diabetes, the amount and type of food and coordination with insulin delivery directly affect blood glucose level. This finding is supported by[16] who identify that successful long terms diabetic management depends on increase self reliance and increase responsibility in dietetic management.

Diabetes self-care management education is planned process that includes determining patient's individual education need the present study revealed

that one important adolescent's education need to be active and perform daily exercise Before the implementation of DSME adolescent did not understand exercise should be with caution in case of unstable blood glucose level, hypoglycemia as well as unawareness to avoid exercise when insulin action peaking unless appropriate glucose availability and option of increasing, pre exercise insulin dose but after the implementation all this aspect regarding exercise and physical activity understood and the mean score for this items changed from pre and post implementation.

On determining adolescents' knowledge about self medication taking there was statistical significant pre and post implementation as well as pre and follow-up, as all adolescent after the implementation had a decided to minimize symptoms of hypoglycemia and hyperglycemia. All of them gain understanding that increasing doses of insulin are required to meet these aims as weight and calorie intake increase with age as well as adolescent sure after gaining knowledge that total insulin deficit after having had type I diabetes 2-3 years and the hormonal and physiological change of puberty many induce a state of insulin resistance. During comparing the mean score after implementation with the follow-up a little drop in the mean score in the follow-up which proved the importance of continue of education as important item as well.

This result had been interpreted by[5] who stated that diabetes self management education is the cornerstone of care for all individuals with diabetes who want to achieve successful health related outcome. All patients if received proper guidance and education regarding diabetes care this will enable to make significant improvement in the coping skills to achieve effective self-care behavior and behavior change.

On determining adolescents' knowledge and reported practice about hypoglycemia and hyperglycemia, it was found that there was a statistical significant difference pre and post implementation as well as pre to follow. It is important to recognize the signs and symptoms of hypoglycemia and to know how treat it as well as hyperglycemia. In the pre implementation the adolescent able to implement their treatment for hypoglycemia but didn't understand what is the cause and its clinical signs but post implementation adolescent gain knowledge which enable them to identify the cause of hypoglycemia and hyperglycemia as well as able to differentiate between the clinical picture of both and methods of prevention. This result similar to[17] who reported that education regarding the prevention and treatment of hypoglycemia should include discussion of the cause

and symptom of hypoglycemia. This result again emphasizes the essential for DSME for empowering adolescent to follow treatment regimen.

Diabetes can result in acute and long term complications that diminish both quality and length of patient lives. Patient makes multiple decisions each day that directly affect their outcome. In the present study on investigation adolescents' knowledge about diabetes complication it was found that there was a statistical significant difference between the knowledge before the implementation and after implementation as will as the follow-up after six months which proved the extent to which the DSME had empower adolescent through raising their understanding about all expected short and long term complication and how to overcome it.

On determining adolescents' knowledge about their psychosocial adjustment pre DSME implementation, it was compared with post implementation, as most of them did not realize that there is a dramatic change in physical growth, cognitive development, social networks, school experience as well as family dynamic. Some adolescents especially early adolescent stop their self-care and try to prove that adolescent are independent on insulin therapy. Some girls are worried about their weight, many of them begin to secretly reduce their insulin therapy purge calories and lose weight but post implementation all this item had been corrected.

Later adolescent 15-18 years did not realize the growth change decrease and stabilize so do conflicts over diabetes self-care and their central decision regarding post high school plans for future. They may ignore their self-care. After implementation DSME the adolescent realized that the rejection of diabetes self-care will effect their achievement at school, as well as did not use their diabetes to avoid the conflicts at school. This result similar to what explained by[18] about psychosocial adjustment in type I diabetes.

On determining adolescent's practice regarding self-care behavior the present study revealed that there was statistical significant difference in the adolescent's total practice mean score pre, post and follow the total practice includes self preparation and administration of insulin, self monitoring blood glucose , self urine testing for sugar and ketones as well as foot care.

On investigation self insulin preparation and administration the present study proved that there was statistical significant difference in mean adolescent practice pre and post implementation of DSME.This result is supported by[15] who state that procedure of self insulin injection was carried out by

the majority of children after administration educational and practice session.

Regarding to monitoring blood glucose level by glucose strip the present study showed that these was a statistical significant difference pre to post as well as at follow up of implementation of DSME. This result similarly agreed with[19] who stated that monitoring blood glucose are useful in preventing hypoglycemia and adjusting insulin, diet and exercise, so that target blood glucose level are achieved.

On assessing adolescent's practice for urine testing for sugar and ketones the present study illustrated that there was a statistical significant in pre and post, pre and follow up the implementation of DSME. This finding similar to study performed by[20] who found that self urine testing for sugar and ketones was demonstrated correctly post education and practice session.

5. Conclusion:

The study concluded that, DSME for adolescent had a statistical significant effect on gaining knowledge as well as improving the skill and facilitates problem solving and coping skills to achieve self-care behavior and behavior change. Diabetes self-management education had empowered adolescent toward recognizing the seven diabetes self-care behavior.

Recommendations:

The study could be recommended:
1. The usage of DSME to all age group with type I diabetes for strengthen and empowering.
2. Further research studied is needed in order to study interrelation between DSME and behavior change in case of children with diabetes.

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