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Assessment of knowledge among Saudi diabetic children/ adolescent at Riyadh city

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Abstract: Background Puberty is a period of rapid growth and hormonal changes and is often characterized by deterioration in glycemic control, and all of these factors may promote the development of diabetes complications. Diabetes Mellitus (DM) is a serious disease and it causes a number of chronic diseases such as Ketoacidosis, cardiovascular disease, renal failure, and neuropathy. The purpose of the study was to determine the knowledge level of student regarding diabetic management and its effect on their health. Methods: A descriptive study design was used. A non-probability Convince sample of diabetic children/ adolescents the total sample 85 child/ adolescents patient met the study criteria age between 10 to 15 years. The study was conducted at in one governmental health care center in Riyadh city. Knowledge was measured by using (DKT) used to assess diabetes related knowledge of the respondents as regards diagnosis, treatment, complications and lifestyle. Results. The result showed that two third of the children (42.2%) were in the age group more than 14years (i.e. early adolescence stage), 99% of the children had type 1 diabetes mellitus (48.4% males and 50.6% females). While 41.5%, for both gender had the onset of diabetes since 1 year. More than have used insulin two times a day (55.6%), the majority of the sample didn't know which type of insulin they used (57.8%) As regard children's if they do reds blood sugar at home moat more than half do it twice a day in addition the majority used blood test by strips. Also in this study the older children were found more educative and development in their self-care than younger children CONCLUSION This research is an important first step in identifying areas for continued intervention efforts for children/adolescents with type I diabetes, their parents, nurses and diabetes educators. Future researchers should examine additional factors related to children's and adolescents' knowledge, including differences in what they know and want to know based on the child's gender, age, glycemic control, and diabetes management practices.

Keywords: Child/Adolescent, Diabetes Mellitus, Type I Diabetes Mellitus, Diabetes Mellitus Knowledge

1. Introduction

The World Health Organization (WHO) defines diabetes mellitus (DM) as a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. It is now one of the most common non-communicable diseases globally [(1)]

Diabetes is one of the most common diseases in school-aged children. According to the 2011 National Diabetes Fact Sheet, about 215,000 young people in the US under age 20 had diabetes in 2010. This represents 0.26 percent of all people in this age group [(2)].

Type I diabetes causes an estimated 5–10% of all diabetes cases or 11–22 million worldwide. In 2006, it affected 440 thousand children under 14 years of age and was the primary cause of diabetes in those less than 10 years of age. The incidence of type I diabetes has been increasing by about 3% per year [(3).] Type I diabetes was previously known as juvenile diabetes to distinguish it from type 2 diabetes, which generally has a later onset. However,

it is one of the most common chronic diseases of childhood after asthma and mental retardation [4].

In addition, in the USA, approximately one of every 400-600 children has been diagnosed with type I diabetes, where the pancreas does not produce the insulin necessary for the metabolism of carbohydrate. The onset of type I diabetes typically occurs in childhood or adolescence, and can result in serious medical complications if not properly managed. The Diabetes Control and Complications Trial Research Group(DCCT) and Centers for Diabetes Control (CDC) have found that maintaining blood glucose concentrations measured by HbA1c within normal range delays the onset and slow the progression of complications[5,6,7]

The Complications from diabetes such as coronary artery and peripheral vascular disease, stroke, nephropathy, neuropathy, amputations and blindness are resulting in increasing disability, reduced life expectancy and enormous health cost for most societies.

The incidence rates of acute complications of the diabetes mellitus such as severe hypoglycemia and diabetic ketoacidosis (DKA) is the leading cause of mortality (usually stemming from cerebral oedema) and morbidity in children with type I diabetes. DKA in children develops quickly and is, much more than in adults, related to severe morbidity and squeal of associated medical complications. In addition to the normal developmental challenges of childhood and adolescence, the additional burden of diabetes, and especially intensive management, may be difficult for many children to deal with. Treatment that is more intensive coincides with increased psychological pressure on children with diabetes and family members. This may add to the development of psychosocial complications such as adjustment problems, issues with self-esteem, depression, and particularly in adolescent girls, eating disorders. In one study in adolescents and young adults who had diabetes since childhood, about one-third needed either psychological or psychiatric counseling after (on average) 15 yr following onset of their diabetes.[3].

Diabetes Mellitus (DM) is a serious disease and it causes a number of chronic diseases the same as Ketoacidosis, cardiovascular disease, renal failure, and neuropathy [8] On the other hand, Growth and development are important indicators of a child's overall health and so it is with diabetes. If a child with diabetes has very good blood glucose control, growth and development should be normal. However, if the child has many high blood sugars and has many episodes of ketoacidosis, it can have a serious effect on growth and development.

Puberty is a period of rapid growth and hormonal changes and is often characterized by deterioration in glycemic control, and all of these factors may promote the development of diabetes complications it has been discussed whether early, pre-pubertal, glycemic control contributes to the development of microvascular complications to a lesser degree than in later stages [9].

Knowledge is considered as one of the important causing factors for people to behave in certain way. Gaps in knowledge or in convict information can result in destructive health behaviors. There is also a positive correlation between the knowledge and overt behavior. On the other hand, the educator to achieve the goal of health education, she/he has to identify the client's needs and interest also identify the knowledge deficit of the client and identify the relevant content of instruction for the program. As failure to assess the clients' knowledge before beginning, an educational effort will lead to ineffective health education program and wasting of effort and resources [10, 11].

Generally, there is increasing amount of evidence to suggest that patient education for people with chronic diseases such as diabetes is an essential component of disease management. [12] So as a unique role of pediatric nurse, as a member of the health care team, in self-management of diabetic children. She has to educate the children to the best of their ability in understanding their condition in such a way that they know enough about their management and self-care in order to change their life-style and improve the quality of their life and prevent the complication[8].

Furthermore, the patients themselves play critical role in prevent its complications. The success of long-term maintenance therapy and good metabolic control for diabetes depends mainly upon the patients' compliance with the therapeutic plan and a fundamental change in their behavior. In addition, Knowledge of diabetes can thus prevent the impending chronic co-morbidities of diabetes mellitus, which influence significantly on the quality of life of the diabetic patient. On the other hand, poor knowledge of diabetes is associated with increased rate of hospitalization for unstable diabetes. [13]

One of the recommendations from a statement of the American Diabetes Association, Education is best provided with sensitivity to the age and developmental stage of the child, with regard to both the educational approach and the content of the material delivered. For the preschooler, education likely will be directed toward the parents and primary caregivers, whereas for most adolescents (after consideration of their emotional and cognitive development), education should be directed primarily toward the patient, with parents included, this education should be continuing education by the DM educator. [2]

2. Problem Statement

Diabetes Mellitus (DM) has become the most common non-communicable chronic metabolic disease worldwide.[1] The frequency is projected to reach 285,000,000 in the year 2025, the prevalence of type I diabetes mellitus in Saudi Arabian children/ adolescents is 109.5 per 100,000 [14]. as the incidence increasing every year among the children /adolescent in Saudi Arabia It requires continuing medical care and education to prevent its acute and chronic

complications by comprehensive education about management as the cornerstone of diabetes care is education. Therefore, this study is for Assessment of Knowledge among Diabetic Children/ Adolescents

3. Aims of the Study

The study aims to:

1. Determine the knowledge level of student regarding diabetic management and its effect on their health
2. Identify the relationship between the dependent variable (knowledge score related to diabetic management and independent variable.

4. Theoretical Framework

Health Belief Model (HBM) helps to undrestand why patients may accept or reject preventative health services or adopt healthy behaviors. HBM proposes that people will respond best to messages about health promotion or disease prevention when the following four conditions for change exist:

- The person believes that he or she is at risk of developing a specific condition.
- The person believes that the risk is serious and the consequences of developing the condition are undesirable.
- The person believes that the risk will be reduced by a specific behavior change.
- The person believes that barriers to the behavior change can be overcomed and managed.

There are six major concepts in HBM

- Perceived Susceptibility: refers to a person's perception that a health problem is personally relevant or that a diagnosis of illness is accurate.
- Perceived severity: even when one recognizes personal susceptibility, action will not occur unless the individual perceives the severity to be high enough to have serious organic or social complications.
- Perceived benefits: refers to the patient's belief that a given treatment will cure the illness or help to prevent it.
- Perceived Costs: refers to the complexity, duration, and accessibility and accessibility of the treatment.
- Motivation: includes the desire to comply with a treatment and the belief that people should do what.
- Modifying factors: include personality variables, patient satisfaction, and socio-demographic factors [15, 16].

5. Operational Definition

Knowledge will measured by using (DKT) used to assess diabetes related knowledge of the respondents as regards diagnosis, treatment, complications and lifestyle modifications and covered knowledge regarding optimal glucose control levels, hypoglycemia and recognition of micro vascular and macro vascular complications, diet and exercise.

5.1. Conceptual Definition

Knowledge is the sum of what is known and resides in the intelligence and the competence of people.

6. Materials and Methodology

6.1. Setting

The study was conducted at in one governmental health care center in Riyadh city, which serve a large number of diabetic children/ adolescents, .In that center the diabetic clinic is held 2days/ week, which, provides secondary care.

6.2. Sampling

A non-probability Convince sample of diabetic children/ adolescents who fulfilled the following criteria compromised the sample of this study:

1. Age between 10 to 15
2. Both Genders (male & female).
3. Diagnosed as diabetes mellitus at least for 6 months.
4. Free from other chronic diseases.
5. Saudi nationality.
6. Can read and write Arabic.

6.3. Study Design

A descriptive study design

Tools: one tool was used for data collection.

A Structured interviewing questionnaire: developed by the researcher with title "A questionnaire measurement of information in child/ adolescent with diabetic" to collect data regarding socio-demographic Variables Surrounding the pediatrics with DM and seconded part to assess the medical History. Data was collected through a personal interview with parents/legal guardians of adolescents with DM characteristics including age in years, residence, educational status of parents and subjects and monthly family income in Saudi Riyals.

Knowledge was measured by using modifying (DKT). The Diabetes Knowledge consists of 23 knowledge test items developed by the Michigan Diabetes Research Training Center (MDRTC). These 23 items represent a test of general knowledge of diabetes. It consists of 23 questions but we cancel 2 questions after experts report as it's not understood by our client; 14 general multiple choice test and 9- item insulin subscale used to assess diabetes related knowledge of the respondents as regards diagnosis, treatment, complications and lifestyle modifications. This part also covered knowledge regarding optimal glucose control levels, hypoglycemia and recognition of micro-vascular and macro-vascular complications, diet and exercise. Each correctly answered question earned a score of 1 and a total score was summed

and converted to percentage with 23 or 100% being the maximum score, the 21-item test takes approximately 15 minutes to complete.

In addition we divide scoring for the total to three category from (19-21) excellent, (16-18) very good, (15-12) good and (less than 12) poor.

6.4. Data Collection

The permission was taken from Administration to collect the data in the center ,the oral consent Taken from the patients and from his parents to participate in our study after explain the prepuces of the study ,the data was collected over 5 weeks the total sample 85 child/ adolescents patient but 2 was not include as not fallow the criteria . Each child was individually interviewed after explaining the purpose of the study and obtaining his/her and his/her family approval for participation in the study.

6.5. Ethical Consideration

Once the subjects will be identified, the purpose of the study will be explained to the participant and that their responses will be kept confidential and anonymous. They will be informed that they will not oblige to take part in the study and will be free to withdraw at anytime. Anonymity will be maintained by using code numbers on the questionnaire forms. Participants will give their consent to participate. In addition, information regarding the study will be provided.

6.6. Data Analysis

To analyze the collected data we used Statistical Package for Social Sciences (SPSS) program version 16 for data entry then data were analyzed. Data were coded and transferred into specially designed formats. The following statistical analyses were performed:-

A. Descriptive analysis, which included frequency, percentage, means and standard deviation.
B. Significant chi –square were used to test for significance difference between children's knowledge & their gender and age the level of significance selected for this study was 0.01 and 0.05.

7. Results

Is dealing with the analytical aspect of data, the findings of this study are presented in two parts:-

Part I: Characteristics of diabetic children/ adolescents and their families, which included:

A-Bio-social data of diabetic children/ adolescents and their parents.

B- Medical history of diabetic children/ adolescents

Part II: Diabetic children knowledge

Part I. Characteristics of Diabetic Children/ Adolescents and Their Families

Table 1. *Frequency distribution of the study sample according to biosocial characteristics of Diabetic Children/ adolescent (N=83)*

Bio-social characteristics of Diabetic Children's	Frequency	Percent
Age		
8-10 years	16	19.3
10-12 years	16	19.3
12-14 years	16	19.3
more than 14 years	35	42.1
Total	83	100.0
Gender		
Male	41	49.4
Female	42	50.6
Total	83	100.0
Rank between the siblings		
First	14	16.8
Middle	45	54.3
last	24	28.9
Total	83	100.0
Education		
Primary	39	47.0
intermediate	24	28.9
high (Secondary) school	20	24.1
Total	83	100.0

Table I shows biosocial characteristics of diabetic children, namely age, gender, birth order and level of education. About two third of the children (42.1%) were in the age group more than 14years (i.e. early adolescence stage), while the rest of the sample was between the age group 8-12 years old (i.e. late school age stage.), with same percent19.3% the total percent 57.9%**.** In relation to gender, (50.6%) were females, while 49.4% were male. As regards their birth order, the highest percentage was for the middle child (54.3%), while the lowest percentage (16.8%) was for first child and 28.9% for the last child. Slightly less than half of children (47%) were in primary schools. Followed by intermediate school with (28.9%) and (24.1%) for high school

Table 2. *Frequency distribution of the study sample according to the parents' biosocial characteristics (N = 83)*

The parents' biosocial characteristics	Frequency	Percent
level of education of the mother		
Illiterate	21	24.4
Read and write	14	16.8
Primary	13	15.8
Intermediate	15	18.2
High school	12	14.5
Collage	8	9.1
Total	83	100.0
level of education of the father		
Illiterate	10	12.1
Read and write	13	15.7
Primary	16	19.2
Intermediate	16	19.2
High school	15	18.1
Collage	13	15.7
Total	83	100.0
The function of the mother		
Do not work	69	83.1
Work	14	16.9

The parents' biosocial characteristics	Frequency	Percent
Total	83	100.0
The function of the father		
Do not work	20	24.1
Work	63	75.9
Total	83	100.0
Family income		
Less than 3000 in month	19	22.9
3000-7000 in month	35	42.2
7000-10000 in month	13	15.7
More than 10000 in month	16	19.2
Total	83	100.0
Is there one in the family is a diabetic?		
Yes	41	49.4
No	42	50.6
Total	83	100.0

The parents' biosocial characteristics are presented in Table II. Most of fathers completed primary and secondary education with percent of (19.2%) compared to slightly near of fourth of mothers (18.2 %) complete secondary school. While, slightly less than one quarter of mothers (24.4%) were illiterate, compared to (12.1%) of fathers. On the other hand, (15.7%) of fathers and 9.1% of mothers had university education. On the contrary, the majority of mothers were house-maker (83.1%), and 24.1% of fathers were retired. Only 75.9% of fathers and 16.9% of mothers were working. It is revealed from the table that (42.2%) there income range from 3000SR-7000SR and near to 1quarter less than 3000SR and (19.2%) they are more than 10000SR.the table show clear the history of DM in the family is equal with no history. (49.4% v 50.6%).

Table 3. *Frequency distribution of the study sample according to Medical history of diabetic children /adolescent (N = 83)*

	Frequency	*Percent*
How long have you had diabetes?		
Less than one year	31	37.3
One year - 5 years	35	42.1
5-10 years	10	12.1
More than 10 years	7	8.5
Total	83	100.0
How many times a day do you take insulin?		
one time	4	4.8
two times	53	63.8
3 times	9	10.8
4 times	17	20.6
Total	83	100.0
Type of insulin used		
Fast acting	11	13.3
Short acting	2	2.4
Average acting	4	4.8
Long acting	18	21.7
I do not know	48	57.8
Total	83	100.0
Do you read the level of sugar at home?		
Yes	77	92.7
No	6	7.3
Total	83	100.0
How many times do you read your sugar level?		
twice	47	56.7
3 times	16	19.2
4 times	13	15.7
6 times	7	8.4
Total	83	100.0
How many days a week?		
Everyday	2	2.4
3 days in a week	36	43.5
5 to 7 days	29	34.9
Before doc's visit	16	19.2
Total	83	100.0

The table shows the type and onset of diabetes mellitus and the level of glycemic control of the diabetic children is illustrated in Table III. It was found that 99% of the children had type 1 diabetes mellitus (49.4% males and 50.6% females).

Less than half of the diabetic children (37.3%, for the study sample had the onset of diabetes less than one year, since 1 years to less than 5 years, (42.1%). On other hand from 5 years to 10 years is (12.2 %) compare to with the children/adolescent had diabetic more than 10 years with percent 8.5%. This table also shows more than have of the child used insulin two time a day (63.8%) while the majority didn't know which type of insulin they used (57.8) while only 21.7% know the type of insulin. As regard children's if they do reds blood sugar at home moat of them do (92.7%)and more than half do it twice a day and clear from the same table that slightly near to the half do it daily. in addition the majority used blood test by strips.

Part II: Diabetic Children/ Adolescents Knowledge

Table 4. *Diabetic Children/ Adolescent Knowledge about Diabetes Mellitus.*

	Frequency	Percent
Very good	6	7.2
Good	34	41.0
Poor	43	51.8
Total	83	100.0

Less than half of participants have an average of good to very good knowledge (41.0%vs 7.2%) & More than half of the diabetic children (51.8) have poor knowledge about diabetes mellitus, that means educating children about diabetes is essential but also raise another question if we need to target parents of diabetic children.

Table 5. *Diabetic Children/ Adolescent Knowledge about Diabetes Mellitus according to their Gender.*

Gender	Level of knowledge								Chi-Square
	V. Good		Good		Poor		Total		
	N	%	N	%	N	%	N	%	
Male	2	2.4	19	22.9	21	25.3	42	50.6	.837
Female	4	4.8	15	18.1	22	26.5	41	49.4	
Total	6	7.2	34	41.0	43	51.8	83	100.0	

The above tables shows that no statistical significant differences were found between male and female children for their level of knowledge

Table 6. *Diabetic Children/ Adolescent Knowledge about Diabetes Mellitus according to their age.*

Age	*Level of knowledge*						Total		Chi-Square
	V. Good		Good		Poor				
	N	%	N	%	N	%	N	%	
8-10 years	0	0.0	4	4.8	11	13.3	15	18.1	
10-12 years	1	1.2	6	7.2	9	10.8	16	19.3	*.281**
12-14 years	2	2.4	6	7.2	10	12.1	18	21.6	
> 14 years	3	3.6	18	21.6	13	15.6	34	41.0	
Total	6	7.2	34	40.8	43	51.8	83	100.0	

Diabetic children/adolescent knowledge about diabetes mellitus and their age, it is clear from the table statistical significant was observed as regard the knowledge of the diabetic children and age, poor knowledge with little flirtation between the age group.

8. Discussion

Prior to discussing the results, it should be emphasized that a difference in knowledge scores does not infer a lack of intelligence in any of the race groups, but rather a historical deficiency in the particular group regarding knowledge about diabetes mellitus and also inequalities of the past with regard to proper education, health services and health education[(17)]

The World Health Organization (WHO) defines diabetes mellitus (DM) as a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. It is now one of the most common non-communicable diseases globally. [(15)]

It's clear from our result the majority age is between 14-15 years this support by The WHO Diabetes Mondial (WHO DIAMOND) reported data on type 1 diabetes have shown a worldwide increase incidence and variation (over 400-fold) with the highest occurring in Finland (over 45 per 100,000 under the age of 15 years) and the lowest in parts of China and Fiji, North-South as well as racial and population variations were reported. It is said to be more common in Caucasians than Asian and Negroid races. Therefore, both genetic and environmental factors were incriminated to explain these variations [(1).]

In addition, the study reflects that Most of children have limited knowledge related to nutrition and appropriate diet for diabetes, which is significance, by choice inappropriate answers. as 41% selected peanut butter as highest food in carbohydrate and corn (51.8%) as highest in fat, 36.1% free food as any food that says sugar free on the label, 43.4% unsweetened fruit juice have no effect on blood glucose. From other side, the most important nutrition intervention that usually expected child known it to manage low blood glucose when experience symptoms, however, children even do not know types of appropriate diet can or can't be used to treat the symptoms as relevant by selected wrong option cup of skimmed milk 51.8% as food not be used to treat low blood glucose. This support as Several studies have shown that exchange diet is difficult to understand and implement without knowing the carbohydrate content of food [(20),] and that many children with diabetes do not improve glycemic control and their parents cannot understand and follow food exchange and calculate calorie. Also can cause of pediatric behavior this support by [(22)] mission in his study Diet is integral to successful diabetes care, yet dietary education methods remain controversial and poorly evaluated.

In general, it is consider the more than half of children in this study have limited or no education related the diet and effect the diet in diabetic management.

The result of this study revealed that diabetic children know these manifestations of diabetes mellitus hypo and hyperglycemia. This may be related to the fact that children themselves can easily detect these manifestations, as they feel them whenever fluctuation of their blood glucose level occurs.It was prior expectation that children have adequate information about how monitor blood glucose, since most of them have to do blood glucose check at home.

Self-management of diabetes is the ultimate goal for all children with diabetes, with insulin dosing decisions based on interpretation of blood glucose results. Self-monitoring of blood glucose allows children with diabetes and their families to measure blood glucose levels rapidly and accurately.

Most of them knew the best way to measure blood glucose level is blood testing which was a significant 68.7%, linked infection to increased blood glucose level, which also present 75.9%. In addition to that, how the insufficient insulin dosage (too much or not enough) affect the blood glucose level. On the other hand, children (DM) is a serious disease and it causes a number of chronic diseases the same as Ketoacidosis, cardiovascular disease, renal failure, and neuropathy[(9)]

Moreover, the result show the diabetic children have limited knowledge about the sings of complication as they answer by only 21 % vomiting is a sign of ketoacidosis as well as what they need to do when forget to take insulin before meals. As supported by [(1)] in his study mention that the incidence of diabetic ketoacidosis at onset among children in Arab countries varies from 10-80%.

Regarded the Exercise offers many health-promoting benefits for children with diabetes, and intervention strategies that promote life-long physical activity should be encouraged. Children showed a great understanding of exercise role in reduce the blood glucose level and increase

the controlling as 75 to 80% agreed by selecting right answer. This may be a result of children's improper education by their diabetologist, nurse educators or dietitian. On the other hand thy have poor knowledge about DM diagnosis and this may caused by lack of explanation by physician.

Over result shows less than half (53.1%)of participant have an average of poor knowledge and the rest rang from good and v.good which means the educating children about diabetes is essential, this result supported by [10]A statement of the American Diabetes Association " Proper diabetes education for a child and family of a child with type 1 diabetes is intense and complex, and requires educators with a set of skills including good communication, compassion, sensitivity, humor, and in-depth knowledge of childhood diabetes". In addition, Studies suggest that to be effective, educational interventions need to be ongoing.[9] The patients with childhood onset type I diabetes developed detectable diabetes complications after 12 years of diabetes. Inadequate glycemic control, also during the first 5 years of diabetes, seems to accelerate time to occurrence, whereas a young age at onset of diabetes seems to prolong the time to development of micro- vascular complications [18], which clear from our above table the more poor knowledge can lead to this complication our result indicate the near to 1 quarter their age more than &equal 12 years.

In this study the older children were found more educative and development in their self-care than younger children. On the other hand, older age group are in the formal-operational thinking and respond to the management instructions more than the younger age group who are in pre-operational level according to Piaget cognitive development theory[19]

9. Conclusion

This research is an important first step in identifying areas for continued intervention efforts for children/adolescents with type I diabetes, their parents, nurses and diabetes educators. Future researchers should examine additional factors related to children's and adolescents' knowledge, including differences in what they know and want to know based on the child's gender, age, glycaemic control, and diabetes management practices.

Recommendation

- Consultation with a dietician to develop/discuss the medical nutrition plan is encouraged
- Evaluate height, weight, BMI, and nutrition plan annually
- Calories should be adequate for growth and restricted if child becomes overweight.
- Periodically test postprandial, before- and after-exercise, and nocturnal glucose levels.
- Children and adolescents with type 1 diabetes should adhere to the CDC and American Academy of Sports Medicine recommendations for a minimum of 30–60 min of moderate physical activity daily
- Blood glucose monitoring before exercise is recommended with a suggested intake of 15 g of carbohydrate (amount may need to be less in younger children—10 g, for example) for a blood glucose level below target range before exercise; for vigorous physical activity expected to be >30 min, an additional 15 g of carbohydrate may be necessary
- For prolonged vigorous exercise, hourly blood glucose monitoring during the exercise, as well as blood glucose monitoring after completion of exercise, is recommended to guide carbohydrate intake and prospective insulin dose adjustment for recurring exercise events
- At the onset of a new sports season, frequent blood glucose monitoring during the 12-h post exercise period should be undertaken to guide insulin dose adjustments
- In the child or adolescent (particularly if overweight/obese), physical exercise should be encouraged and sedentary activity discouraged.
- Encourage campaign for diabetic children to improve their independently and self-care practices.
- Cooperate with Mass media should have an increasing role in diabetic education.
- Formulate education programme about DM

For Further Study

1. A study must be conducted to investigate the barriers health education
2. A study need to be conducted for further investigation of children's knowledge and practice

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