

Assessment of the Primary and Intermediate School Staffs' Knowledge, Attitude and Practice on Care of Children with Type 1 Diabetes at School, Al-Jouf, Saudi Arabia

Al Duraywish A A^{1*}, Abdelsalam M Nail¹

ABSTRACT:

Background: Children with diabetes type 1 (T1DM) need close monitoring for their blood glucose, food intake, insulin therapy and physical activity during school hours in order to guard against the development of acute and long-term complications.

Objectives: To evaluate the current situation of management of T1DM in primary and intermediate schools children through assessment of the working staffs' attitude, knowledge and practice at Al-Jouf, Saudi Arabia.

Materials and Methods: This descriptive cross-sectional study enrolled consented voluntarily participating working staffs from primary and intermediate schools in Al-Jouf region, Saudi Arabia. A questionnaire (included 23 questions) testing knowledge, attitudes and practice regarding T1DM and care of diabetic children was used.

Results: 744 teachers were studied (62.1% females) where 58.1% of them were working in primary schools. Of all, 69% were class teachers, 20.4% administrators, 8.6% school counselors, and 2% physical education teachers. 75.4% of the participants had adequate general knowledge about diabetes. Only 43.78% of the respondents had specific knowledge about diabetes in the school and teachers with a family diabetic patient showed higher knowledge about diabetes vs. their counterparts. Only 16.0% of the participants reported that their schools have trained personnel in diabetes. Large proportion of study teachers' (94%) was willing to join a training program for care of diabetic students. Of the total group of teachers, 665 support recruitment of a school nurse.

Conclusion: Diabetes care training programs for school teachers and staffs, availability of school nurses and instigating collaboration between the diabetic center and the school is essential for safety of such diabetes student patients in the schools.

Keywords: Type 1 Diabetes mellitus, School teachers, Training programs, Diabetes care, Knowledge about diabetes, School nurse, Diabetes care at the school.

D iabetes mellitus is one of the most prevailing non-communicable diseases in children¹. In Saudi Arabia, the annual incidence rate of type 1 diabetes (T1DM) is 31.4 new children per 100,000 total population. 16,100 children in Kingdom of Saudi Arabia have T1DM which represent

25% of the total population of children with T1DM in the Middle East region's totaling to 60,700². These statistics demonstrate the rising incidence of the disease among children and the increased need for diabetes knowledge, care and management. Diabetes is a chronic, currently incurable disease that needs effective management in order to avoid the risk of emergence of its long-term complications such as blindness, vascular diseases, renal failure and neuropathy³⁻⁵.

The implementation of intensive insulin therapy and such rising prevalence of

1. Diabetes Research Center, College of Medicine, Aljouf University, Sakaka, Saudi Arabia.

*Correspondence to: Dr. Abdulrahman

Alduraywish

E-mail: dr-aaad@hotmail.com

T1DM highlight the role played by diabetes educators and school staffs. Compliance of the majority of children to the intensive diabetes treatment at school is deficient due mainly to lack of appropriate school staff support⁶. All children including those with diabetes mellitus have the right to learn and continue their education⁷.

In order to ensure that such student diabetic patients at school achieve their full capabilities while participating in academic and various school activities, partnership between health and education services is mandatory. Moreover, to assure the immediate safety, long-term well-being, and optimal academic performance of student diabetic patients, such proper diabetes care at school should be reinforced. This care should include blood glucose testing, caloric calculation, administration of insulin, activity and exercise within the school environment, awareness of the impact of stresses within the school environment, assistance if unwell, and emergency management of severe hypoglycemia and ketoacidosis⁸. Since T1DM prevails amongst young school children, basic knowledge about the disease should be indemnified within the schools environment – staffs, administrators, teachers and/or dedicated nurse.

Among such young children, to control blood glucose to an optimum level, it is essential to balance carefully food intake, physical activity and insulin⁹. Children with diabetes may require multiple doses of insulin while in school¹⁰. Some children may require someone to supervise or deliver insulin. Children with T1DM need to be active. Teaching the importance of physical activity is an essential healthy habit to enable the child well into adulthood. However, physical activity also impacts blood glucose levels, and teachers need to know how to respond to these

changes¹¹. Having trained personnel on care of diabetes, which know how to check blood glucose, inject insulin, and choose an appropriate snack when blood glucose levels are low, provides an enormous preventive measure.

The potential cognitive vulnerability associated with hypoglycemic seizures and chronic hyperglycemia among such group of students should be considered by the school teachers. Early detection of minor difficulties should be considered a priority employing assessment of the cognitive skills as a reflection of day-to-day control of the disease¹². Youth fail to meet HbA1C goals despite advances in diabetes management and their health and safety are at risk when medication, food, and physical activity are not balanced¹³.

The responsibility of the school administrators and educators is very critical in the monitoring and management of T1DM among diabetic school children, given the fact that school-age children spend the greater part of their day time in school. At present in Saudi Arabia, responsibility for the management of the disease among diabetic children of school age is often undertaken by the children and their parents.

To expand the umbrella of this management, school teacher should be equipped by satisfactory knowledge and get training to change their attitude and practical capacities to share actively in the management of disease.

To date, there are no reported studies investigating the awareness of school staffs, administrators, and educators about diabetes in school children in Saudi Arabia. Therefore, this study aimed to assess the knowledge, attitudes and practice of school staffs, administrators, and teachers towards participating in the efforts for managing T1DM and its complications amongst children while at school utilizing the primary and

intermediate schools at Sakaka City, Al-Jouf, Saudi Arabia as our sample.

MATERIALS AND METHODS:

This descriptive cross-sectional study was conducted in the period from January 2016 to March 2016 among school staffs, administrators, and educators working in primary and intermediate schools of four Sectors (Sakaka, DomatAljandal, Tabarjal and Sowair) in Al-Jouf region. The study included the respondent 744 participants out of the 1000 teachers targeted.

Their socio-demographic data (age, gender, working place, and type of school, job description, academic status and years of experience) were collected. The main study questionnaire included 23 questions testing knowledge, attitudes and practice regarding T1DM and care of diabetic children. The knowledge domain included 7 questions about manifestations of T1DM and hypoglycemia and preparation of diabetic children before physical activity sessions.

The attitude domain included 5 questions about management of hypoglycemia, willingness to have diabetic children in their classes, need for specialized nurse children, and for a training program to increase awareness of diabetes care at school. The practice domain included 11 questions regarding general affection of students with T1DM particularly attendance, academic performance, support of diabetic children, preparedness of diabetic children before their physical activity sessions and availability of special meals.

Additionally, the sources of the participants' information about the disease were recorded. The questionnaire was in Arabic language and all were closed-ended with three answers (yes, no, or unsure). A pilot study was done before conducting the survey that included 30 individuals not included in the study to assure validity of

the questionnaire and essential modifications were done.

Ethical approval was obtained from the Ethics and Research Committees of the College of Medicine, Aljouf University and Directorate of Education of Al-Jouf region.

Data analysis utilized the computerized Statistical Packages for the Social Sciences (SPSS; version 16). The demographic variables of participants were presented as numbers and percentages.

For calculation of knowledge score of diabetes, incorrect and unsure answers were given zero, whereas, the correct answer was given one point. The mean score for each section (General knowledge on diabetes, knowledge about diabetes at the school and situation about diabetes at the school) was calculated as the summation of the total possible score in each, and then it was expressed as percentage of total score in each.

The diabetes knowledge score was calculated based on the total marks of the three sections. Win Episcopes (version 2.0) was used to assess the Chi square to explore the association between the demographic variables (gender, type of school and family with diabetic children, level of education, years of experience and professional task) and good knowledge on T1DM. We expressed out data as frequency (n and %) and mean \pm SDM as appropriate.

RESULTS:

In this study, 744 participants completed the submitted questionnaires (74.4% response rate). Demographics, work description and education background of participants is depicted in Table 1.

General knowledge on diabetes: The results show that the overall general knowledge on diabetes of the participating teachers is 75.4%. Good level of awareness of the symptoms of DM prevailed among

majority of participants (73.4 - 96.8%), while awareness about symptoms of hypoglycemia was 87.9%.

Awareness was low regarding negative effect of T1DM on school children (48.8%), insulin as a replacement therapy (48.5%) and T1DM effect on attendance (47.7%). It was worth noting that awareness for management of hypoglycemia was high (84.3%; Table 2). Regarding their sources of information, 35.5% reported that they had this information as a part of their general knowledge. Teachers with a family diabetic child, with the higher level of education and longer career experience had enhanced knowledge of diabetes vs. their counterparts. Knowledge about diabetes in the school setting: with respect to the presence of diabetic children among the class students, 263 (35.3%) of participants reported presence of diabetic children in the class, 404 (54.3%) stated that they encounter diabetic children in

their class, while 16 (2.2%) were unsure about the presence of diabetic children in the class. 617 (82.9%) of participants were welcoming the presence of diabetic children in their class, while 86 (11.6%) stated that they would be worried having diabetic children in their classes, and 63 (5.9%) were unsure about accepting diabetic children in their classes. 561 (75.4%) of the participants answered that diabetic children could attend the physical education sessions. 125 (16.8%) of the teachers declared that they were unsure about this question, while 58 (7.8%) stated that diabetic children are not eligible to attend physical education classes.

Only 460 (61.8%) of the participants believed that the diabetic child should take sweets or juices before physical activities. Regarding diabetic emergencies, 558 (75.0%) of the participants reported absence of trained person who could deal with diabetic emergencies in their schools. 178 (23.9%) of teachers knew about

Table 1: Demographic and work information of the study participants.

Characteristics	Range (Mean \pm SDM) or n (%)
Age (range and mean \pm SDM), Years	23 – 60 (39.2 \pm 10.2)
Gender, Male/Female	282/462
Residence location:	
Sakaka	415 (55.8)
Domat Al Jandal	212 (28.5)
Sowair	64 (07.1)
Tarbajal	53 (08.7)
Education level:	
Bachelor's degree	603 (81)
Diploma	118 (15.9)
Master's degree	20 (2.7)
Doctorate degree	3 (0.4)
Years of experience: <10/ \geq 10 Years	262 (35.2)/482 (64.8)
Education sector: Primary/Intermediate	432 (58.1)/312 (41.9)
Professional title:	
Teachers	513 (69)
Administrators	152 (20.4)
Counselors	64 (8.6)
Physical educators	15 (2)

Table 2: Knowledge indicators about diabetes mellitus (DM) in the school setting among the studied population of teachers.

Questions	Answers		
	Yes n (%)	No n (%)	Unsure
DM leads to polyuria in diabetic student	720 (96.8)	8 (1.1)	16 (2.2)
DM leads to polydipsia in diabetic student	686 (92.2)	19 (2.6)	39 (5.2)
DM leads to fatigue and lack of concentration in diabetic student	569 (76.5)	78 (10.5)	97 (13.0)
DM leads to loss of weight in diabetic student	545 (73.3)	85 (11.4)	114 (15.3)
Type 1 DM is treated with insulin	361 (48.5)	154 (20.7)	229 (30.8)
Tremors and sweating means hypoglycaemia in diabetic student	587 (78.9)	34 (4.6)	123 (16.5)
The diabetic student should take sweets or juices before physical activities class	460 (61.8)	110 (14.8)	174 (23.4)

Table 3: Diabetes mellitus (DM) practice indicators among the studied population of teachers concerning children diabetes at the school setting.

Questions	Answers		
	Yes n (%)	No n (%)	Unsure
School children are usually affected by Type 1 DM	363 (48.8)	68 (9.1)	313 (42.1)
DM affects the student' academic performance	248 (33.3)	340 (45.7)	156 (21.0)
DM increases absence rate of diabetic student	355 (47.7)	253 (34.0)	136 (18.3)
Do you have any diabetic student in your class?	263 (35.3)	404 (54.3)	77 (10.3)
Do you give support to the diabetic children in your class?	672 (90.3)	34 (4.6)	38 (5.1)
Are diabetic children eligible to attend the physical education session?	561 (75.4)	58 (7.8)	125 (16.8)
Does your school present special meals for diabetic student?	44(5.9)	656 (88.2)	44 (5.9)
Does your school appoint somebody to look after the diabetic students?	154 (20.7)	518 (69.6)	72 (9.7)
Is there any trained person to check blood sugar and inject insulin in your school?	178 (23.9)	506 (68.0)	60 (8.1)
Is there any trained person in dealing with diabetic emergencies in your school?	119 (16.0)	558 (75.0)	67 (9.0)
Does your school have a training program for dealing with diabetic students?	302 (40.6)	398 (53.5)	44 (5.9)

presence of a trained personnel for checking blood sugar and giving insulin in the school.

Regarding snacks and school lunches for diabetic children, 656 (88.2%) mentioned no snacks or special school lunches presented to diabetic children and 44 (5.9%) were not sure about that. Only 302 (40.6%) of the participants knew that their

school have a training program in how to deal with diabetic children in their schools (Table3).

Attitude indicators about diabetes at the school setting (Table 4): 587 (78.9%) of the teachers knew that tremors and sweating means hypoglycemia in diabetic student and 627 (84.3%) mentioned that the diabetic child with hypoglycemia

should take sweet juice. Only 475 (63.8%) answered that in case of coma, small amount of jam or honey should be put on the mouth of the diabetic child. 154 (20.7%) of the respondents agreed that somebody should be appointed to look after the diabetic children- including the presence of a dedicated school nurse (665; 89.4%).

Effect of gender on the study outcomes:

The gender effect on different domains of our study was significantly different comparing male scores vs. females regarding knowledge and training indicators only. The scores regarding general and specific knowledge, symptoms of the disease, emergency responses, practice and training needs was equally

Table 4: Diabetes mellitus attitude indicators among the studied population of teachers concerning children diabetes at the school setting.

Questions	Answers		
	Yes n (%)	No n (%)	Unsure
Are you willing to have diabetic children in your class?	617 (82.9)	86 (11.6)	41 (5.5)
In case of hypoglycaemia, should the diabetic student take sweet juice?	627 (84.3)	41 (5.5)	76 (10.2)
In case of coma, can small amount of jam or honey be put into the mouth of the diabetic student?	475 (63.8)	90 (12.1)	79 (24.1)
Would you like to join training program for dealing with diabetic students?	693 (93.1)	41 (5.5)	10 (1.3)
Do you support presence of school nurse?	665 (89.4)	67 (9.0)	12 (1.6)

Table 5: Effect of gender on the scores in different domains of study regarding diabetes.

Variable	Gender	n	Mean \pm SDM	P<
General knowledge	Male	282	2.28 \pm 0.304	0.535
	Female	462	2.27 \pm 0.315	
Symptomatology	Male	282	2.57 \pm 0.360	0.009*
	Female	462	2.50 \pm 0.360	
Emergency Response	Male	282	2.62 \pm 0.398	0.484
	Female	462	2.64 \pm 0.378	
Practice guidelines	Male	282	1.42 \pm 0.591	0.800
	Female	462	1.41 \pm 0.559	
Training needs	Male	282	2.44 \pm 0.413	0.000**
	Female	462	2.56 \pm 0.411	

*Significant using independent samples "t"-Test and assuming equal variance.

**Significant using independent samples "t"-Test but not assuming equal variance.

distributed between male and female (Table 5). Effect of type of school on the study outcome: Cross-tabulating the effect of nature of school (primary vs. intermediate) on different domains of our study, scores regarding general and specific knowledge, symptoms of the disease, emergency responses, practice and training needs showed significant gender differences. Scores regarding knowledge and training indicators were equally distributed in both primary and intermediate schools (Table 6).

DISCUSSION:

The mission of the College of Medicine, Aljouf University is community serving and citizenship development. This is why

Table 6: Effect of the type of schools on the scores in different domains of study regarding diabetes.

	School	n	Mean	P<
General knowledge	Primary	432	2.25 ± 0.323	0.005*
	Middle	312	2.31 ± 0.290	
Symptomatology	Primary	432	2.54 ± 0.349	0.284*
	Middle	312	2.51 ± 0.378	
Emergency Response	Primary	432	2.65 ± 0.353	0.061
	Middle	312	2.60 ± 0.425	
Practice guidelines	Primary	432	1.33 ± 0.496	0.001**
	Middle	312	1.53 ± 0.643	
Training needs	Primary	432	2.47 ± 0.385	0.001**
	Middle	312	2.59 ± 0.445	

**Significant using independent samples "t"-Test but not assuming equal variance.

*Significant using independent samples "t"-Test and assuming equal variance.

the college adopted the community-oriented education system. The college plan for the establishment of the Diabetes Research Center was to promote diabetes research and improve preventive and clinical community services. To guarantee the safety and well-being of the child with diabetes at the school setting, partnership between health and education services is indispensable.

Assessing the level of school staffs, administrators and teachers' awareness of diabetes is supportive for health educators to plan for future enhancement programs. Students with diabetes and their parents report inadequate knowledge, preparation, or support from the school teachers and a lack of education for substitute teachers, bus drivers, coaches, and other ancillary school personnel¹⁴.

Poor diabetic control for young people is linked to increased heart complications, peripheral nerve function, and other serious complications^{15, 16}. Providing training to the school personnels significantly improves the diabetic child's glycemic control, and furnishes a more supportive school environment¹⁷⁻¹⁹. Upon proper support of the students with T1DM not only their academic and social but also

their medical outcomes improve²⁰.

We planned the present 3-steps investigation to help establishing guidelines for Managing Diabetes at School in Al-Jouf region. Firstly, questionnaires assessed the extent to which primary and intermediate school teachers are knowledgeable about children diabetes mellitus at school setting. Secondly, we tested how school staffs, administrators and teachers reacted to diabetes needs. Thirdly, we highlighted deficiencies in information and training programs that could improve health care for diabetic children at school setting. We observed adequate general knowledge about diabetes among school personnels in Al-Jouf regions. This is attributable to the level of education of participants and the high prevalence of the disease in Saudi Arabia²¹. However, the study also noticed the lack of enthusiasm of teachers to have diabetic child in their class and unawareness about the management of diabetic emergencies among school personnels in Al-Jouf region. In fact, a diabetic emergency as hypoglycemia is life threatening and occurring more frequently in children with DM.

Awareness about complications of DM

was found to be similarly low in countries of the region like Bahrain and Turkey^{22, 23}. T1DM treatment with insulin needs help from school nurses and teachers. However, the study recorded that only a few schools have school nurses and trained personnels. Consequently, the responsibility of children's health is shouldered by parents. Regarding the information sources about DM among the participants, 40.6% of them reported acquiring their information as a part of their general education. School nurses were reported to be the major source of information for chronic diseases, and are required to obtain concise disease-specific information²⁴. Regarding activity and exercise within the school environment, most of the participants answered that diabetic children could attend the physical activity sessions. However, they were not aware about the measures that should be taken before, during or after any activity - such as blood glucose monitoring before and after any activity, consuming additional carbohydrates, and if using an insulin pump, decisions related to whether the pump should be disconnected or temporary basal rates set²⁵.

Only one fifth of the participants of our study knew that their schools appoint somebody to look after the diabetic students and/or was trained for checking blood sugar and giving insulin. Less than one fifth of school personnels received training on how to recognize and respond to diabetic emergencies. The study showed that there is deficiency in training programs regarding diabetes at school and the overwhelming majority liked to join such training program. 76.5% of the participating personnels showed willingness to pay the required support to diabetic children at school. This means that majority of personnels would attend and gets benefit from such training programs. Therefore, a positive impact on

academic and health performance of diabetic children would be the gain. A comprehensive review of the published literature that examined publications concerned with care of children with diabetes at school and ways of improving it showed areas of deficiencies to be; communication, after-school support, education of staff and peers, school nurse availability, and lunch choices²⁶.

CONCLUSION:

This is the first report to check the knowledge about diabetes at school among Saudi teachers in Al-Jouf region. Our data shows that primary and intermediate school teachers in Al-Jouf region have enough general knowledge on diabetes regarding symptoms. However, they were deficient regarding diabetes complications and management. Furthermore, the majority of teachers did not receive training programs on diabetes at school, although majority of them expressed willingness to pay the required support to diabetic children and attend such programs. Therefore, our study suggests that more efforts should be paid to improve knowledge, practice and attitude of diabetes at school setting and its associated complications among primary and intermediate school teachers.

We suggest three stages of training as following: 1) Basic understanding targeting all school staffs through training on how to recognize and respond to the signs and symptoms diabetic emergencies and who to make urgent contacts in case of an emergency, 2) Specific personnels with the responsibility of taking care of diabetic students should receive additional training on managing diabetes, its complications and emergencies, and, 3) Advanced training for a few school staffs should be an in-depth training about diabetes, its routine care and emergencies in support for each student with diabetes.

ETHICAL CLEARANCE:

Ethical approval was obtained from the Ethics and Research Committees of the College of Medicine, Aljouf University and Directorate of Education of Al-Jouf region.

COMPETING INTERESTS:

The authors declare that they have no competing interests.

FUNDING:

None.

AUTHORS' CONTRIBUTIONS:

Both authors contributed in planning the study, collecting data and wrote and read the final version of the manuscript.

ACKNOWLEDGMENTS:

We wish to thank all study participants and the schools where this research was undertaken.

REFERENCES:

1. International Society of Pediatric and Adolescent Diabetes (ISPAD 2000). Consensus Guidelines for the management of type 1 diabetes mellitus in children and adolescents.
2. Craig ME, Hattersley A, Donaghue K. Definition, Epidemiology and Classification. Global IDF/ISPAD Guideline for Diabetes in Childhood and Adolescence, 2011:8-16. ISPAD; 2011.
3. Nguyen T, Mason K, Sanders C, Yazdani P, Heptulla RA. Targeting blood glucose management in school improves glycemic control in children with poorly controlled type 1 diabetes mellitus. *J Pediatr.* 2008; 153(4):575-578.
4. Jackson CC, Albanese-O'Neill A, Butler KL, Chiang JL, Deeb LC, Hathaway K, Kraus E, Weissberg-Benchell J, Yatvin AL, Siminerio LM. Diabetes care in the school setting: a position statement of the American Diabetes Association. *Diabetes Care,* 2015; 38(10):1958-63.
5. American Diabetes Association. Diabetes care in the school and day care setting. *Diabetes Care,* 2010;33Suppl 1:S70-4.
6. Marks A, Wilson V, Crisp J. The management of type 1 diabetes in primary school: review of the literature. *Issues ComprPediatrNurs,* 2013;36(1-2):98-119.
7. Akesen E, Turan S, Guran T, Atay Z, Save D, Bereket A. Prevalence of type 1 diabetes mellitus in 6-18-yr-old school children living in Istanbul, Turkey. *Pediatr Diabetes.* 2011; 12:567-571.
8. American Diabetes Association. Diabetes care in the school and day care setting. *Diabetes Care* 2003; 26:S131-5.
9. Strowig SM, Raskin P. Intensive management of type 1 diabetes mellitus. In: Porte D, Sherwin RS, Barron A, eds. *Ellenberg& Rifkin's Diabetes Mellitus.* 6th Ed. New York: McGraw-Hill; 2003: 501-514.
10. American Diabetes Association. Diabetes care in the school and day care setting. *Diabetes Care.* 2011; 34(1) (suppl):S70-S74.
11. Levitsky LL, et al. Complications and screening in children and adolescents with type 1 diabetes mellitus. <http://www.uptodate.com/home>.
12. Chmiel-Perzynska I, Derkacz M, Grywalska E, Kowal A, Schabowski J, Nowakowski A: The knowledge about hypoglycaemia among primary school teachers in the Lubelskie province in Poland. *Exp Clin Diabetology* 2008, 8(4):157-158.
12. American Association of Diabetes Educators. Management of children with diabetes in the school setting. *Diabetes Educ.,* 2014; 40(1):116-21.
13. Hayes-Bohn R, Neumark-Sztainer D, Mellin A, Patterson J. Adolescent and parent assessments of diabetes mellitus management at school. *J Sch Health.* 2004; 74(5):166-169.
14. Centers for Disease Control and Prevention. National diabetes fact sheet: general information and national estimates on diabetes in the United States, 2011. Atlanta, Ga. US Department of Health and Human Services, Centers for Disease Control and Prevention. Available at: http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf (Last accessed on October 1, 2016).
15. Siminerio LM, Albanese-O'Neill A, Chiang JL, Hathaway K, Jackson CC, Weissberg-Benchell J, Wright JL, Yatvin AL, Deeb LC; American Diabetes Association. Care of young children with diabetes in the child care setting: a position statement of the American Diabetes Association. *Diabetes Care,* 2014; 37(10):2834-42.
16. Siminerio ML, Koerbel G. A diabetes education program for school personnel. *PracDiab Int.* 2000; 17(6): 174-177.

17. Wagner J, James A. A pilot study of school counselor's preparedness to serve students with diabetes: relationship to self-reported diabetes training. *J Sch Health*. 2006; 76(7):387-392.
18. Mandali SL, Gordon TA. Management of type 1 diabetes in schools: whose responsibility? *J Sch Health*. 2009 Dec; 79(12):599-601.
19. Lange K, Jackson C, Deeb L. Diabetes care in schools--the disturbing facts. *Pediatr Diabetes*, 2009; 10Suppl 13:28-36.
20. AL wakeel JS, Al-Suwaida A, Isnani AC, Al-Harbi A, Alam A (2009). Concomitant macro and micro-vascular complications in Diabetic nephropathy. *Saudi J. Kidney Dis. Transpl.*, 20: 402-409.
21. LatifAlnasir F: Assessment of knowledge of diabetes mellitus among Bahraini school teachers. *Bahrain Med Bulletin* 2003, 25(4):172-176.
22. Aycan Z, Önder A, Çetinkaya s, et al. Assessment of the knowledge of diabetes mellitus among school teachers within the scope of the managing diabetes at school program. *J Clin Res PediatrEndocrinol* 2012; 4:199-203.
23. Husband A, Pacaud D, Grebenc K, McKiel E: The effectiveness of a CD Rom in educating teachers who have a student with diabetes. *Can J Diab Care* 2001, 25(4):286-290.
24. MacMillan F, Kirk A, Mutrie N, et al. (2013) a systematic review of physical activity and sedentary behavior intervention studies in youth with type 1 diabetes: Study characteristics, intervention design, and efficacy. *Pediatric Diabetes* DOI: 10.1111/pedi.12060.
25. Tolbert R. Managing type 1 diabetes at school: An integrative review. *J SchNurs.*, 2009; 25(1):55-61.