School performance among diabetic Children and adolescents

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Summary

Type 1 Diabetes millets it has a direct impact on cognitive functions. For prevent this problem, needs a good glycemic control, which can do by self-measurement blood glucose or need assistant from parents or teachers.

The child's school performance will be best if the blood sugar remains in the acceptable range. Left untreated both high and low blood sugar levels can affect the child's ability to concentrate on schoolwork and participate in school activities.

The cross section study was conducted on 100 diabetic patients aged between 8-18 years from Aldiwaniyah diabetic center, in Aldiwanyia city, from period of 1st March to 1st June, to estimated the effect of glycemic control on school performance, after selected patients, made an interviewed with them &/ parents, asked about demographical information (age, sex, level of education, residence, occupation & education of parents) disease variables (onset, duration, complication hypoglycemia or hyperglycemia, hospitalization, episodes of admission, insulin treatment times doses, blood sugar level, self measure &injection, regular visit to clinic), bad glycemic controls consider by level of HbA1c above 7% or had hyperglycemia for more than 3 times or hypoglycemia more than 2 times in last six months. School characters (failure, absences, skipping, exercise, activity) Poor school performance consider if she/he had absence from school more than 3 days, had school failure, skipping.

The bad school performance was observed in 73%, those with bad glycemic control represented (61%), in (83.7%) of bad glycemic control had poor school performance, in (79.6) patients with longer disease duration had poor school performance, on other hand (83.6%) of Patients with more frequent admission to hospital due to Diabetics complication had poor school performance.

In conclusion bad glycemic control, frequency of admission and disease duration were negatively effect on school performance, level of education patients his mother and self measurement of blood sugar were a determinants of glycemic control.

Recommendation was concentrated on ways of glycemic control by frequent self measurement, education of patients and relatives on nature of Diabetes and enhance compliance and motivation of patients. Frequent supervising by health care provider to schools of patients for reassurance and support of children and teachers.

Introduction

Diabetes mellitus is a group of metabolic diseases in which a person has high blood sugar, either because the body does not produce enough insulin, or because cells do not respond to the insulin that is produce. This high blood sugar produces the classical symptoms polyuria(frequent urination) polydipsia (increased thirst) and polyphagia (increased hunger). There are two main types of diabetes[1].

1-Type 1diabetes: (T1DM) it is characterize by loss of the insulin-producing beta cell in the pancreas leading to insulin deficiency, and presently requires the person to inject insulin. This type of diabetes can be further classifies as immune-mediated or idiopathic. The majority of type 1 diabetes is of the immune-mediated nature, where beta cell loss is a t-cell mediated autoimmune attack [2].

Most affected people are otherwise healthy and of a healthy weight when onset occurs[3]. Sensitivity and responsiveness to insulin are usually normal, especially in the early stages. T1DM could be affected children or adults but was traditionally termed "juvenile diabetes" because it represents a majority of the diabetes cases in children[3].

2-Type 2 diabetes :(T2DM) results from insulin resistance, a condition in which cells fail to use insulin properly, sometimes combined with an absolute insulin deficiency[2].

Management of Diabetes include education, insulin therapy, diet and meal planning and monitoring (HbA1c every 2 or 3 months, home regular blood glucose **measurement)**[1]

Noncommunicable diseases are going to be the major challenge to public health in the Eastern Mediterranean area after the control of infectious diseases and malnutrition[4].

The greatest increase in prevalence of DM is expected to occur in Asia and Africa, where most patients will probably be found by 2030. The increase in incidence of diabetes in developing countries follows the trend of urbanization and lifestyle changes, perhaps most importantly a "Western-style" diet [5]. Access to inexpensive but high energy-dense foods is rising and physical activity is decreasing, since large numbers of people now live in urban areas and are engaged in less physical activity. TIDM

is rapidly increasing in specific regions and shows a trend toward earlier age of onset [2].

In Iraq overall diabetes mellitus prevalence is 21.8/1000 [6]. Rates are

greater in urban than rural areas [6].

The incidence of type 1 diabetes has been increasing by about 3% per year [7].Girls and boys are almost equally affected, there is no apparent correlation with socioeconomic status [2].

T1DM accounts for about 10% of all diabetes, affecting 1.4 million in the United States and about 15 million in the world [2].

T1DM has an impact on the performance of the developmental task, Diabetes may slow the psychological development of the adolescents thus affecting their ability to play, enjoy life and share with others[8].

Studies on children with type 1 diabetes generally report that these children have intelligence within the normal range [9, 10]; however, there are several reports of neuropsychological deficits observed in children with diabetes [11]. Difficulties with verbal intelligence, memory, timed motor tasks, visuospatial abilities, abstract/ visual reasoning, speed of processing, and attention have all been reported [12]. Some studies report that children with diabetes perform academically as well as control groups [10], whereas others note reading and arithmetic deficits [13].

Factors implicated as possible risk factors for neuropsychological difficulties, and therefore achievement problems, include age at onset of diabetes, metabolic control, sex, and psychosocial/ behavior problems [10].

Early onset of diabetes and longer disease duration have been associated

with difficulties in visuospatial ability, motor speed [10].

Studies on diabetes children have suggested that frequent asymptomatic hypoglycemia may be associated with slower response rates[13].

Girls with diabetes had been found to have more difficulty with visuospatial task; boys with diabetes had been found to perform significantly lower on measures of attention and learning. However, other studies have noted no sex differences, and those differences that were obtained may not be related specifically to diabetes [10].

Some studies have found that children with diabetes miss significantly more days, whereas others have not found absenteeism of children with diabetes to differ from that of the general population [10].

Previous study conducted in Bagdad revealed that visit to diabetic clinics and sport activities improve the school achievement among diabetic adolescents [8]. Other study noted the posttraumatic stress disorder (PTSD) had a negative impact on school achievement among

T1DM children and adolescents in Baghdad city [14].

Important goal of diabetes management, besides the attainment and maintenance of good metabolic control, is to ensure that youth develop optimally in all areas of their life: psychologically, socially, academically, and physically [15,16]. Thus, parents, teachers, and health care providers should be aware of possible impact of IDDM in children, and help them to take necessary action to control their blood glucose levels [17], and avoidance of the chronic complications of diabetes [18]. Parent educational involvement may be particularly important for children with T1DM [19, 20]. Mothers with more knowledge have children with better metabolic control; Improvement of mothers' knowledge may improve glycemic control and ultimately decrease acute and chronic complications of diabetes in children [21].

Teachers with more knowledge about T1DM are better able to address students' learning needs and that students demonstrate improved control of blood glucose levels [22,23]. Studies have shown that the majority of school personnel have an inadequate understanding of diabetes [24,25].

Because of increasing in prevalence of T1DM in Iraq[6] and the researches on the level of school performance among diabetic children and adolescents in Iraq are scarce, therefore the study was carried out.

Objectives of study

1-To estimated the school performance of Diabetic patients aged 8-18 years old.

2-To estimated the glycemic control of study sample.

3-To estimated the determinants of glycemic control that effected on school performance.

Patients and method

Study design and setting

This is a cross section study was performed during the period from 1st junary to 1st June 2011. Convenience sample of 100 children and adolescent with T1DM that visited the AL-Diwanyia Diabetics center, Al-Diwanyia teaching hospital.

Selective criteria

1- Type one diabetes mellitus.

2- Age range from 8-18 years.

3- A pupils in Al-Diwanyia city.

4- Duration of Diabetes more than 1year.

Exclusion criteria

1- No other disease like asthma, that effect school performance.

2- No admission from other cause, like accident.

Methods

Children and adolescents were interviewed, and objectives of study were clarified for each participant and /or relative and questionnaire was filled.

The questionnaire contains three parts: Firstly subjective information age, sex, education level (primary school, intermediate school, secondary

school) the classification was converted to years as the educational system in Iraq.

residence (urban and rural), occupation of parent employed or un employed, education level of parents that completed level (primary school, intermediate school and secondary school) and education of years.

Second part contain disease variables information onset of Diabetes (early onset before of 5 years of age and late onset after 5years of age), duration of diabetes (equal or more than 3years and less than 3years), hypoglycemia (blood sugar less than 70 mg/dl with information about time of occurrence, frequency, if lead to admission and period of admission), hyperglycemia(blood sugar more than 180 mg/dl also time of occurrence , frequency if lead to admission and period of admission), other complication such as arthralgia, renal disease, blindness, hypertension if this complication lead to admission. Drugs and insulin doses (dose of insulin measure by international unite) time (at morning, afternoon, at evening and at bed time) injection by themselves or assistant by relatives, if you had glucometer and could do self measurement of blood sugar, in any time and how many, could be interpreted the reading themselves, glycoslyted haemoglobuline HbA1c[26](equal or less than 7% and more than 7%). Admission to hospital classified into two groups those had more than or equal three episodes and those had less than three episodes.

Bad glycemic controls considered by level of HbA1c above 7% or had hyperglycemia for more than 3 times or hypoglycemia more than 2 times in last six months[10].

School information; absences (by number of days absence from school for 3 continuous days, failure in school (years of repeated), exercise (daily activity), snacks and meal.

Poor school performance considered as absence from school > 3 days or had school failure and skipping from school (for rest the year) normal school performance that had absence less 3 days, had no failure or skipping from school[9].

Diabetic center

Children and adolescents were consultant mostly Saturday and Tuesday weekly this regimen effect the sample size in the study.

Each patient had a file contain demographical data in additional to follow up record the clinical aspect of the diabetes, routine blood and urine test were done, HbA1c was applied if possible.

Data collection

The children and adolescents that attending the diabetics center were selected (some the parents refuse to participate in the study only 3 patients), I was visited the Diabetic center three day per week during the period of study, each patient was interviewed and a questionnaire was filled by asking question and write the answer of patients or relatives then measure the weight and height, registry FBS, RBS (in last 6month), HbA1c, then checking with file of patients in office of center. Patients in the ward I depend

on calling from doctor in ward after admission of patients (this represent only 10% of sample).

Measures

weight and height were measured by electronic body scale, then body mass index (BMI) was calculated by dividing the Weight in Kg and the square of the Height in meters, Quetelet formula:(BMI = Wt in kgs / Ht in m^2).The interrupted measure of BMI on WHO percentile chart for children and adolescents for boys and girls (2007), BMI percentile categories:

underweight(<15^{th} percentile), normal (15th–85^{th} percentile), overweight (86th–97^{th} percentile), obese (>97^{th} percentile).

Instrument used for HbA1c in hospital name BIO-RAD, in which first 20 patient in study were reading in hospital lab after this the instrument not work, then depended on reading in outside lab in next visit of patient, the reading categories into two group above 7% and below or equal to 7%.

Ethical approval

Permission to conducted the study was obtains from health authorities.

After clarify the objectives of study for patient/ relatives and take permission for including in this study, confidentiality and privacy was consider and parents decided sharing in the study.

Statistical analysis:

Discrete variables presented as number and percentage, continuous variables presented as mean ±SD (standard deviation). Chi squre and Fischer´s Exact probability test were carried out to examine the association of dependent variable (school performance and glycemic control) with independent variable (age, sex, duration and education level). Student t test was applied to test the difference between glycemic control (good and bad) in the different educational years of patient and his mother. p-value <0.05 was consider significant.

Result

Total of 100 T1DM children and adolescents were included in this study. Their age range was 8-18 years (13.74 ±3.06 years), male to female ratio 0.8:1. The children constituted (35%) and adolescent were (65%).

The mean weight was 42.19 ±1.24kg, the mean height was 146± 18.9 cm, and BMI of diabetics patients there were normal BMI (74%), (2%) under weight, (17%) were overweight and (7%) were obese.

The patient had poor School performance in (73%) of study sample these findings as shown in table1.

The education levels of patients were in mean 7.1±5.3 years. Parent's education of participants for father (6%) has complete secondary school, (74%) complete primary school, (20%) complete intermediate school, for mother (11%) complete secondary school, (25%) had

intermediate school and (64%) had primary school.

Table 1: patients' characteristics.

Variables		No.	%
Age groups	children	35	35%
	adolescents	65	65%
sex	male	45	45%
	female	55	55%
residence	urban	83	83%
	rural	17	17%
School performance	poor	73	73%
	normal	27	27%

Bad glycemic control were seen in (61%), there were (45%) reported history of admission to hospital<3 times. The hyperglycemia found in (91%) and hypoglycemia in (57%). The HbA1c were taken only to 58 patients (56% from 58) above 7%. The onset of disease in 92% was late after 5 year of age and 8% has early onset before 5year of age, the duration of Diabetes were 36 ≤3years, 64% of them >3 years, as shown in table 2.

Table 2: disease variables among study sample.

Variables		No.	%
Glycemic control	Good	39	39%
	Bad	61	61%
Duration of disease	3 years≤	36	36%
	>3 years	64	64%
Age of onset	≤5 years	8	8%
	>5years	92	92%
Admission	<3 times	45	45%
	3 times≥	55	55%
Self measurement of blood sugar	Yes	68	68%
	No	32	32%

There was no association between school performance and sex of patients (χ^2=0.173, df=1, p=0.4), as shown in table 3.

Table 3: Sex of patients in relation to school performance.

		School performance			
		poor		normal	
		No.	%	No.	%
sex	male	32	71.1	13	28.9
	female	41	74.5	14	24.5
	total	73		27	
		χ^2=0.143, df=1, p=0.4			

On other hand there was no statistical association between school performance and age groups classified as children and adolescents (χ^2=1.43, df=1, p=0.19).

Table 4: children and adolescents in relation to school performance.

		School performance			
		Poor		normal	
		No.	%	No.	%
Age groups	children	23	65.7	12	34.3
	adolescents	50	76.9	15	23.1
	total	73		27	
		χ^2=1.43, df=1, p=0.19			

Regarding the glycemic control among sample it was found that (83.7%) of bad control Diabetes had poor school performance, while (43.5%) of good glycemic control had normal school performance, there was statistical association between poor school performance and bad glycemic control,(χ^2=8.95, df=1, p=0.01). as shown in table 5.

Table 5: Effect of glycemic control on school performance.

		School performance			
		Normal		poor	
		No.	%	No.	%
Glycemic control	good	17	43.5	22	56.5
	bad	10	16.3	51	83.7
		27		73	
		χ^2=8.95, df=1, p=0.01			

seventy nine point six percent of Patients with longer disease duration more than 3 years had poor school performance, while those with duration of illness less than or equal 3 years had 61.6% poor

school performance, there was statistically association of longer duration of Diabetes poor school performance (χ^2=4.033, df=1, p=0.03) as shown in table 6.

Table 6: The effect of duration of diabetes on school performance.

		School performance			
		Normal		poor	
		No.	%	No.	%
Duration of Diabetes	>3 years	13	20.4	51	79.6
	≤3 years	14	38.4	22	61.6
		27		73	
		χ^2=4.033, df=1, p=0.03			

Other result showed (83.6%) of poor school performance Patient had more frequent hospital admission, on other hand less frequent admission presented with normal school performance in (40%), there was significant association between frequent hospital admission and poor school performance (χ^2=7.017, df=1, p=0.03) as shown in table 7.

Table 7: hospital admission in relation to school performance

		School performance			
		normal		poor	
		No.	%	No.	%
Admission to hospital	<3 times	18	40	27	60
	3 times≥	9	16.4	46	83.6
		27		73	
		χ^2=7.017, df=1, p=0.03			

Regarding the self measurement of blood sugar there were significantly association with good glycemic control those patients (χ^2=20.669, df=1, p<0.001), (63%) of self measurement had good control, while patient not work self measurement (81.5%) had bad glycemic control as shown in table 8.

Table 8: Self measurement of blood sugar effect on glycemic control.

		Glycemic control			
		Good	%	Bad	%
SMBG	no	10	18.5	44	81.5
	yes	29	63	17	37
		39		61	
		χ^2=20.691, df=1, p=0.001			

Patients with good glycemic control had higher education years (8.8710±3.972) than those with bad control had (6.2653±3.187) there was statistically difference between good and bad glycemic control in education years of patients(t= 3.4, d.f.= 98, p=0.02) as shown in table 9.

Table9: Effect of education level on glycemic control.

Glycemic control	N	Education years
Good	39	8.8710±3.972
Bad	61	6.2653±3.187
	t= 3.4, d.f.=98, p=0.02	

There was significant difference between good and bad glycemic control in educational years of mother of patients, good glycemic control of patients mother had higher years of education(9.456±2.345), than those with bad glycemic control (7.134±4.568), (t= 4.013, d.f.= 98, p=0.01), as shown in table 10.

Table 10: Effect of educational level of mother on glycemic control.

Glycemic control	N	Education years of mother
Good	39	9.456±2.345
Bad	61	7.134±4.568
	t= 4.013, d.f.= 98, p=0.01	

Discussion

School performance in children and adolescents with T1DM mostly had enrolled that metabolic control, onset of DM, and T1DM duration, affect the intellectual ability of children and adolescents [10,27].

The finding that school achievements was not significantly associated with age and sex is consistent with other studies [8,10, 27,28]. Other reports showed that boys with diabetes performing significantly lower on measures of attention and learning than girls with diabetes[16,29]. Girls with diabetes had been found to have more difficulty with visuospatial tasks[30].

The study showed that those with poor school performance had significance bad glycemic control (χ^2=8.95, df=1, p=0.01). This finding is consistent with that of other workers[10,12,13,15,26,31-34]. This finding is due to fact that poor metabolic control leads to difficulty in intellectual ability [35-39]. Factors contribute for poor metabolic controls are:

Inadequate knowledge, negative beliefs about the regimen, poor social support, difficulty of maintaining lifestyle changes, and patient's relationship with the health care team [10, 17, 40].

In Iraq the effect of exposure to wide spread violence had affected the health systems[41]. Several workers showed that exposure to violence affected school performance[14]. Recently the effect of stress of wide spread violence on control of DM was reported[14].

In order to minimize the possible complications, children with DM should be assisted to understand the disease, its complications, and methods of good metabolic control. Thus parents and teachers should be aware of possible impact of DM in children[17].

Primary health care depend on teachers and school administration to play a role in the metabolic control of diabetic students in addition to their role in training the patient for detection of hypoglycemia and hyperglycemia[42,43], workers stated that teachers should be aware of possible impact of DM on children and help them to take necessary action to control their blood glucose levels[17]. Training staff and classmates and allowing students the maximum appropriate flexibility in diabetes care appears beneficial for disease control [21].

Some workers were not sure whether the cognitive effect of poor metabolic control caused by lower achievement or whether the children with better academic skill were also more effective at management their T1DM [9], The latter interpretation seems more likely given the fact that a subset of the children with high HbA1c levels did not differ in achievement from their non diabetic children[9]. Other were attributed bad school performance due to psychosocial burden of DM rather than neurocognitive effect of hypo or hyperglycemia[9,10] , in Iraq the psychosocial burden of the T1DM was demonstrated had bad effect on school performance[44].

Other reported despite some concerns over the effect T1DM that might have on the brain, the condition does not appear to hinder children's school performance, and there was no effect of diabetes on school performance [9,11,45,46].

The study demonstrated that the duration of diabetes affect negatively the school performance (χ^2=4.033, df=1, p=0.03) this finding in accordance with other studies [30,47-51].

Early onset of diabetes and longer disease duration have been associated with difficulties with visuospatial ability, motor speed, eye-hand coordination, memory, attention , and achievement and poor verbal skills[27]. These difficulties may be related to age and associated risk factors, such as hypoglycemic episodes in children with early disease onset and hyperglycemia and social burden for children with later onset of diabetes [52].Two possible etiologies for the association between early disease onset and cognitive difficulties are that central nervous system may be affected by the fluctuations in hormone levels in early years of life, at or before the critical developmental period. Secondly hypoglycemia may affect the

developing brain or that chronic hyperglycemia may affect myelination [27,53]. The mechanism behind the association between diabetes and school performance is probably complex and may include permanent brain damage due to early severe episodes of hypoglycemia [54] or severe ketoacidosis [47] as well as other transient effects on attention, memory, visual–spatial deficits and executive function due to episodes of less severe hypoglycemia[55], The more severe neurocognitive deficits seen in early-onset type 1 diabetes have been attributed both to the sensitivity of the developing brain to hypoglycemia, and to the difficulty in controlling and detecting low blood glucose in very young children[47]. Long-term effects of the disease, as mirrored by correlates of cognitive function deficits with disease duration, may also be associated with visual and verbal memory deficit, as well as reduced motor strength and poor fine motor control [54]. Others have failed to find effects or have found only relatively weak effects of recurrent hypoglycemia on brain structure and function in children with diabetes [11,34,36,38,45,56,57].

School performance was significantly affected by number of admission to hospital (χ^2=7.017, df=1, p=0.03). It is in agreement with other studies[10,49,58,59,60]. Higher admission rate to hospitals due to poor glycemic control could be attributed to the recent spread of violence after 2003. During that deficiency in insulin supply as well as storage of insulin as these shortage in electricity. Several researchers documented the wide spread violence in Iraq effect on health system[41].

Self glucose measurement was significantly associated with low level of HbA1c (χ^2=20.691, df=1, p=0.001), This finding may be attributed to the fact that abnormal glucose level was an impulse for consultation, which in turn lead to good control. Diabetics were trained to hold self glucose measurement which in turn increased their monitoring frequency and lowered their HbA1c levels [61]. Numerous studies support the value of education in the use of SMBG, for example, education focusing on SMBG to improve metabolic control resulting in reductions in HbA1c levels in people with both type1 and type 2 diabetes [62, 63].

Other studies show no significant effect for self glucose measurement on the glycemic control [64].

Other finding in the study noted that higher educational level of patient and his mothers were significantly associated with good glycemic control, (t= 3.4, d.f.= 98, p=0.02) and (t= 4.013, d.f.= 98, p=0.01) respectively, this reflect patient education are important for good procedure for Diabetics control and follow the instruction from health care provider and that the effect of maternal education on health of family[20].

Conclusion

1- Poor school performance highly prevalent among children and adolescents with Diabetes mellitus.

2- There was positive association of poor school performance with bad glycemic control, long duration of Diabetes and frequent hospital admission.

3- Self measurement of blood sugar, education level of patients and mothers were positively associated with good glycemic control, which in turn normal school performance.

Recommendation

1-Enhancing good metabolic control among diabetic children and adolescents by dealing with barriers for DM such as availability of insulin, health education (for patients and relative) and list of foods.
2- Trying to reduce hospitalization (frequency and days) by enhancing secondary prevention in training diabetic for early detection of hypoglycemia and hyperglycemia.

3- Replace missing school days by introduces school classes in hospital.

4- To introduce self measurement of blood glucose, which in turn reduce complications, hospitalization and enhance good school performance.

5- Frequent supervising by health care provider to schools of patients for reassurance and support of children and teachers, to give some instruction and work shop about Diabetes disease it nature and course for teacher and school staffs.

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