International Anatolia Academic Online Journal

Evaluation of the Awareness of Teachers Living in Istanbul towards Type-1 Diabetes Mellitus Before and After Giving Education to Teachers: A Community-based, Prospective Cohort Study

Eda Sunnetci Silistre[1]*, Halil Ugur Hatipoglu[1]

[1]MD, University of Health Sciences Istanbul Training and Research Hospital, Department of Pediatrics, Istanbul, Turkey

Subtitle: Awareness of school teacher about Type 1 DM in Istanbul

Abstract

Type-1 Diabetes Mellitus (T1DM) is the most frequent endocrinological disease that has very serious complications and in recent prevalence studies it has been reported that the frequency of the disease has been increasing. There is a need to increase awareness of the disease in children diagnosed with T1DM and their families and teachers with whom they spend most of their times. The aim of this study was to investigate the effects of T1DM education on awareness of the teachers towards the disease. 203 primary-secondary and high schools in different regions of Istanbul were reviewed for the year 2009 and a total of 1006 teachers and 114 students diagnosed with Type-1 DM were included in the first part of study. The participants were asked to fill in a form that included several questions to assess the awareness about the disease. Afterwards the teachers were included in a training program conducted by two pediatricians. In the second part of the study the same teachers and different 67 students diagnosed with type-1 DM from the same schools were asked to fill in the same form in 2013. It was observed that educating the teachers about DM reduced the risk of comatose situations caused by the disease and the rates of insulin injections in class, eating snacks at school and self-monitoring of blood glucose at school and home were affected significantly positively. In addition, the number of children using carbohydrate counting and

* Corresponding author: E-mail address: edasunnetci@gmail.com; Phone: +90 212 498 61 61; Fax: +90 212 416 98 14
Conflict of Interest: There is no conflict of interests
Founding: The study was not founded.

the frequency of giving permission for micturition during lessons also significantly increased after the education. The present study shows that educating teachers at primary-secondary and high schools about Type-1 DM might affect the progression of the disease in a positive manner.

Key words: Diabetes mellitus, Teacher education, School

İstanbul'da Yaşayan Öğretmen ve Okul Çağındaki Çocukların Öğretmenlere Eğitim Verilmesinden Önce ve Sonra Tip-1 Diyabetes Mellitus'a Yönelik Farkındalığının Değerlendirilmesi: Toplum temelli bir Prospektif Kohort Çalışması

Özet

Tip-1 Diyabetes Mellitus (T1DM) ciddi komplikasyonları olan, en sık görülen endokrinolojik hastalıktır. Son prevalans çalışmalarında hastalığın sıklığının artmakta olduğu bildirilmektedir. Hastaların zamanlarının çoğunu birlikte geçirdikleri aileleri ve öğretmenlerinin T1DM farkındalığının artırılması gereklidir. Bu çalışmanın amacı, T1DM eğitiminin, öğretmenlerin hastalık konusundaki farkındalıkları üzerindeki etkilerini araştırmaktır. İstanbul'un farklı bölgelerinde bulunan 203 ilkokul, ortaokul ve lise 2009 yılı için gözden geçirilmiş ve söz konusu okullarda görev yapan 1006 öğretmen ile T1DM tanısı alan 114 öğrencileri çalışmanın ilk bölümüne dâhil edilmiştir. Katılımcılardan hastalıkla ilgili farkındalıklarını değerlendirmek amacıyla T1DM ile ilgili soruların yer aldığı bir form doldurmaları istenmiştir. Daha sonra katılımcı öğretmenler iki çocuk doktoru tarafından yürütülen bir eğitim programına dâhil edilmiştir. Araştırmanın ikinci bölümünde katılımcı öğretmenlerin ve aynı okullardan T1DM tanısı alan farklı 67 öğrencilerinin 2013 yılında aynı formu doldurmaları istenmiştir. Öğretmenlerin DM konusunda eğitilmesinin, hastalığın neden olduğu komatöz durumların görülme riskini azalttığı ayrıca sınıfta insülin enjeksiyonu yapılması oranlarını, okulda atıştırmalık tüketilmesini ve hem okulda hem de evde kan şekeri ölçülmesini önemli ölçüde olumlu etkilediği gözlenmiştir. Ek olarak, karbonhidrat sayımı yapan çocukların sayısı ve dersler sırasında hasta öğrencilerin miksiyon için tuvalete gitmelerine izin verme sıklığı da eğitimden sonra önemli ölçüde artmıştır. Bu çalışma, ilkokul

ortaokul ve liselerde görev yapan öğretmenlere T1DM ile ilgili eğitim verilmesinin hastalığın seyrini olumlu yönde etkileyebileceğini göstermektedir.

Anahtar Sözcükler: Diabetes mellitus, Öğretmen eğitimi, Okul

Introduction

Type-1 Diabetes Mellitus (T1DM) is the most frequent endocrinological disease that has very serious complications. In recent prevalence studies it has been reported that the frequency of the disease has been increasing **(1).** Fasting plasma glucose being over 125 mg/dl twice or glycated hemoglobin (HbA1C) level being over 6,5% make the physician diagnose the disease **(2)**. Life-threatening situations like hypoglycemia and diabetic ketoacidosis are among the most frequent complications of T1DM and may be fatal **(3)**. The prevalence of the disease varies among communities depending on the genetic and environmental factors. In a previous study which was conducted in 2011, we determined the prevalence of this disease as 0.67/1000 in Istanbul, Turkey **(4)**. In the EURODIAB study, which was conducted in 2005, it was reported that the number of new cases in Europe was around 15000 each year **(5).**

For the reasons mentioned above there is a need to increase awareness of the disease in children diagnosed with T1DM and their families and teachers with whom they spend most of their times. Various studies were conducted in different countries throughout the world, and some training programs were organized. Although the awareness levels vary among countries, it is especially low in underdeveloped or developing countries **(6,7)**. In a recent study conducted in Germany it was reported that providing training for T1DM patients at school age and for their teachers had positive effects on the disease **(8)**. In a study conducted by Kanungo in 2015, it was reported that adequate awareness was not detected in the society even in health professionals about T1DM **(9).** Abdel Gawwad has highlighted the need of diabetes education training courses especially designed to promote adequate care and management of diabetic emergencies (**10).** In a review about teachers perspectives of supporting pupils with long-term health conditions, it was reported that communication between families, school and health and social care services appears to be poor and it was suggested that educational programs delivered by healthcare professionals seem to have the potential to increase

teachers' knowledge and confidence on managing diabetic emergencies and giving appropriate care to the pupils **(11).**

The purpose of this study was to assess the knowledge and awareness of a group of school teachers towards T1DM before and after they were given an education and to evaluate how this education program affects the patients' compliance in insulin injection, snack consumption and self-monitoring of blood glucose.

Methodology

The present study was approved by the Ministry of Health and the Local Ethical committee. 203 children previously diagnosed, according to the criteria of the World Health Organization, with T1DM by at least a secondary level institution of healthcare and studying in the primary-secondary or high schools in different regions of Anatolian and European sides of Istanbul were included to the study **(12)**. In Turkey, children start mandatory education (12-year duration) at the age of 66 months, including elementary school (4 years) and intermediate school (4 years) high school (4 years). Thus, the study population included pupils from the 1st grade of elementary school to the 4th grade of high school (12th grade) spanning an age range of 6-18 years. Firstly, the socio-demographical data of 114 students who were determined to fit the inclusion criteria through 12 weeks in 2009 (May-July) like age, height, weight, Body Mass Index (BMI) and gender were recorded. 29 of the children were from Primary School while 36 of them from Secondary School and other 49 from High School. In addition, the general definitive data of the patients -like the birth weights, duration of diagnosis, duration of breastfeeding (months), Vitamin D intake, the clinic in which they were diagnosed and at which frequency they were followed up- also recorded. Furthermore, the latest HbA1C level of these children, whether the T1DM was diagnosed after a complication such as ketoacidosis or from outpatient clinics, the frequency of blood glucose measurement, the dose and frequency of the insulin injection, where the patient checked his/her blood glucose at school, where the patient applied insulin, whether the patient counts carbohydrate at school, whether the patients had snacks (if yes, where does the patient obtain the snacks from?), hypoglycemia symptoms and frequency, what patients do to avoid hypoglycemia were recorded. In addition, 1006 teachers were asked to fill in a questionnaire to evaluate the awareness of teachers and school administrators on T1DM. Questions on the

following items were included in the questionnaire; the definition of the disease, knowledge on frequent complications of the disease like hypoglycemia and polyuria, whether during lessons they gave permission to the students who had DM for micturition, whether they took adequate precautions for complications like hypo/hyperglycemia and to sustain the continuance of the medical treatments of children. The education that included information on the definition of T1DM and the treatment, complications and the treatment of these complications was provided for the teachers and administrators in the same school in 2010 once in every semester by 2 pediatricians and school counsellors. After this education, the same data were collected from the same 1006 teachers or administrators and their 67 students (10 students from primary schools, 28 students from secondary schools and 29 students from high schools) diagnosed with T1DM through 12 weeks in 2013 (March-May).

114 of the participant children were from 2009 (1st Group), and 67 were from 2013 (2nd Group), which made a total of 181 T1DM patients who were at school age. 110 of them were male (60.7%) and 71 were female (39.3%). The mean age of the children in the 1st Group was 13.2 years and that of those in the 2nd Group was 13.9 years. The children in the 1st Group were being followed-up for 4.2 years with the diagnosis of T1DM, and those in the 2nd Group were being followed-up for 5.6 years. 70 of the 170 patients were diagnosed with T1DM at university hospitals, 38 were diagnosed in other research hospitals, and 62 were diagnosed at state hospitals. Almost all of the children were followed up regularly, and the average of regular follow up period was 3.4 months (Table 1).

Table 1: Some socio-demographical characteristic of the participants

		1st Group n=114		2nd Group n=67		
		n	**%**	**n**	**%**	**p**
Sex	**Female**	45	39.5	26	39	0,15
	Male	69	60.5	41	61	
		Mean	**SD**	**Mean**	**SD**	**p**
Age (year)		13.2	4.2	13.9	3.9	0,084
BMI (kg/m^2)		23.2	4.4	24.1	4.6	0.861
Duration of follow-up (years)		4.2	4	5,6	5	0.010

BMİ: Body mass index, SD: Standard deviation.

Statistical Analysis

The "SPSS (Statistical Package for Social Sciences) 15,0 for Windows" program was used in the evaluation of the findings obtained in the study. The Chi-Square Test was applied in comparing the qualitative data. The Normality Test (Kolmogorov Simirnov Test) was applied before the computation of the quantitative data. The "Mann Whitney U", "Kruskal-Wallis" test, which is one of the Nonparametric tests; and the "student t-test" and "One-Way Variance Analysis" (ANOVA) Test, which are among the parametric tests, were used in the analyses of the study data. The results are given as average ± standard deviation for numerical values; and as ***n*** and % for qualitative values. The $p<0.05$ value was taken to be statistically significant.

Results

There were no statistically significant differences between the groups in terms of gender (p=0.15). There was no statistically significant difference between the groups in terms of age, the grade distribution of the children and BMI (p=0.084, p=0.182 and p=0.861, respectively). There were no significant differences between the groups in terms of being followed-up with the diagnosis of T1DM (p=0.010). The Chi-Square Test showed that providing training to teachers reduced the rates of diagnosing diabetic ketoacidosis (DKA) (p=0.01). No significant differences were detected between the HbA1C levels that were checked in the past 3 months (p=0.93) **(Table 2)**. While the rate of checking the blood glucose levels at school were nearly 43% before the training it rose up to 70% after the training (p=0.002). In addition, the frequency of self-monitoring of blood glucose at both home and school became better after the education for the teachers (p=0.001 and p=0.003, respectively). Before the education program while 39% of the students were injecting insulin at school, this rate increased to 72% after the program (p=0.001). The rates of having snacks at school were better at a statistically significant level after the training (p=0.001). While 60% of the children brought their snacks from homes, 40% bought from their schools (school canteen or school administration). The carbohydrate count rates were significantly higher in the 2nd group (p=0.021) **(Figure 1)**. However, no significant differences were detected between the groups in the terms of weekly numbers of hypoglycemia symptoms and serious hypoglycemia attacks in one year (p=0.554 and p=0.317, respectively). The great majority of these children with 86% brought sweet foods (like fruit juice and candy) with them as a traditional hypoglycemic treatment, 2% of

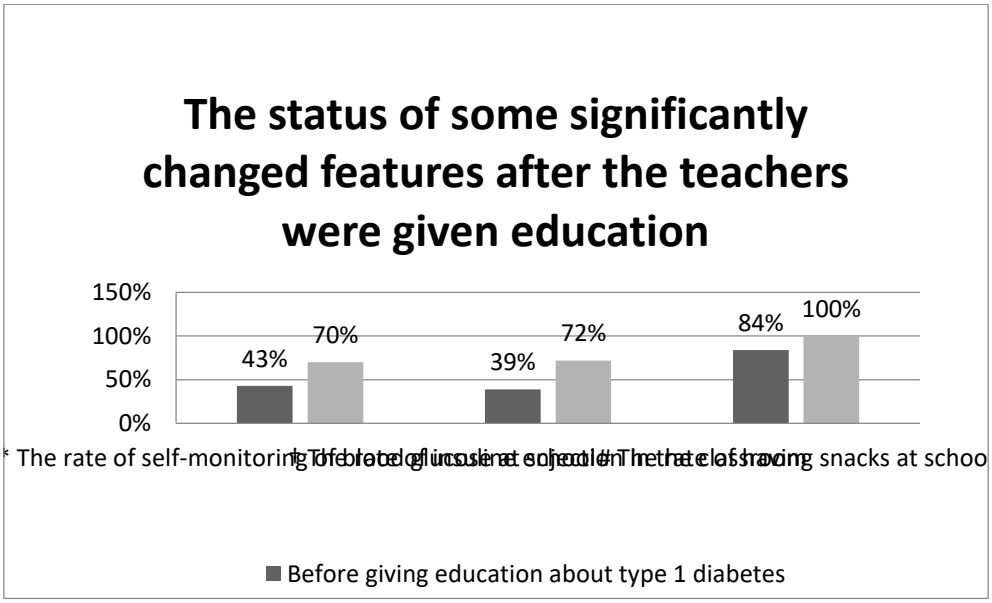
them had Glucagon with them, and interestingly a significant rate of the children (12%) did not bring anything with them as hypoglycemia precaution. It was determined that there were no significant differences between the status before and after the training (p=0.13). While the rate of giving permission for toilet during classes before the training was 89%, it rose up to 97% after the training. Although this change was not statistically significant, it was very close to the significance level (p=0.058).

Table 2: The status of some features before and after the teacher were given education about T1DM

	Children in 2009	Children in 2013	p
Diagnosis with DKA (Y/N)	93/18	67/0	**0,01**
Average HbA1c	8,11	8,14	0,93
Frequency of self-monitoring of BG at School	0,65	1,10	**0,003**
Frequency of self-monitoring of BG at Home	3,38	5,18	**0,001**
Snacking at school (Y/N)	96/18	67/0	**0,001**
Carbohydrate Counting (Y/N)	43/69	37/30	**0,021**

Y: Yes, N: No, BG: Blood Glucose, HbA1c: Glycated hemoglobin

Figure 1



*p=0,002, † p=0.001, # p=0.001

Discussion and Recommendations

Children at school age spend most of their times at schools and it is almost possible to claim that they nearly spend the same amount of time at home and at their schools. Hence, it is clear that the parents and teachers of patients who have a serious disease should have a certain level of knowledge about the disease. Based on this idea, in this society-based prospective study, we assessed the knowledge and awareness of the teachers having students who were diagnosed with T1DM towards the disease and its complications before and after an education program and it was assessed how this education program affected the patients' compliance in their therapy. To the best of our knowledge, this is the first study in our country evaluating the awareness of the children diagnosed with T1DM and their teachers before and after DM training provided for educators. There are limited numbers of studies in the literature that are not up-to-date with the same characteristics, and we believe that our study is important in this respect.

It was reported in many studies conducted in various countries that the teachers of children aged 6-18 years, and even the school nurses did not have adequate knowledge on T1DM. In a society-based questionnaire study that was conducted in our country in 2012, 1054 teachers participated, and it was determined that 47.6% had medium-level knowledge on DM, and 32.4% did not have adequate knowledge **(13)**. Similar findings were reported in many studies from different countries **(14-16)**. In studies conducted in other countries with similar purposes with our study, it was reported that informing teachers on DM brought with it significant improvements in laboratory and clinical findings of the disease such as HbA1C levels in particular.

Gesteland et al. conducted a study in 1986 on 244 teachers and reported that neither of the 2 different training methods on T1DM (1. videos, pamphlets, and a question and-answer method; 2. online training system) had superiority to each other but however, significant increases were detected in the awareness levels of the teachers who received training when compared with those who did not receive any training **(17).** Similarly, Smith et al. reported that different training methods on DM increased the awareness levels of school staff at a significant level and with similar rates **(18)**. Unlike this study, in these studies the Type-1 DM Basic Awareness Questionnaire, which consisted of 16 questions, was applied as a quantitative method. However, in this study, instead of such a questionnaire we used the

direct indicators such as whether the teachers give permission to the patients for checking blood glucose and injecting insulin in classrooms or going to the toilet for micturition and we observed that these indicators were significantly better after the training. In addition, we also supported these findings by considering the frequency of having snacks, the rate of carbohydrate counting and the frequency of DKA, although these are not direct indicators of awareness, because of providing us important clues for the evaluations. However, there were almost 4 times more participant teachers in our study when compared with the other studies. Although it is not true to suggest that the only determinant on these findings is this education program it cannot be denied that educating families and other people in patients' social environment has positive effects.

Jarret et al. conducted a study in the USA in 1993, and provided a two-hour-training on how to train others to 49 volunteer families who had children diagnosed with DM. Then, these families provided basic training seminars on DM to the teachers working at their children's schools. It was determined that the awareness of the teachers towards T1DM improved after this seminars. They claimed that providing training for families who have children with T1DM will increase the awareness of their children's teachers in an indirect manner **(19)**. Vanelli et al. conducted a study in Italy and initially investigated the incidence of DKA in newly diagnosed school-age children 8 years after an information program on DKA was introduced to teachers, parents, students, and pediatricians in 177 primary and secondary public schools. They compared the clinical and laboratory features of 24 young diabetic patients who were given information on DKA (group 1) with those of 30 patients coming from nearby areas in which no campaign for the prevention of DKA had been carried out (group 2). They diagnosed DKA in 3 children from group 1 and in 25 children from group 2. As a result, they reported that after this prevention program cumulative frequency of DKA in new-onset T1DM decreased significantly **(20)**. Similarly, in this study, we determined that after the education program the number of children diagnosed with DKA decreased significantly.

Not to apply a questionnaire, as a quantitative method, was the limitation of this study. Instead, we evaluated the data mentioned above, which are other indicators of awareness.

In conclusion, it is clear that providing training on T1DM to teachers whom the children diagnosed with diabetes spend most of their times together, will increase the awareness

towards to disease. Hence, we suggest that the number of training programs to be increased for teachers and other school staffs who are in direct contact with children in order to reduce the complications due to T1DM. Training for school personnel may be as follows: level 1 training for all school staffs, that includes a basic overview of diabetes, typical needs of a student with diabetes, recognition of hypoglycemia and hyperglycemia, and who to contact for help; level 2 training for school staffs such as teachers who have liabilities for a student or students with diabetes, which includes all content from level 1 plus recognition and treatment of hypoglycemia and hyperglycemia and required accommodations for those students; and level 3 training for a small group of school staff members who will perform student-specific routine and emergency care tasks such as blood glucose monitoring, insulin administration, and glucagon administration when a school nurse is not available to perform these tasks and which includes level 1 and 2 training as well **(21)**.

References:

1. Fox DA, Islam N, Sutherland J, Reimer K, Amed S. Type 1 diabetes incidence and prevalence trends in a cohort of Canadian children and youth. Pediatr Diabetes. 2017. Epub 2017/09/01.
2. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2009;32 Suppl 1:S62-7. Epub 2009/01/06.
3. Hsieh A, Twigg SM. The enigma of the dead-in-bed syndrome: challenges in predicting and preventing this devastating complication of type 1 diabetes. J Diabetes Complications. 2014;28(5):585-7. Epub 2014/06/29.
4. 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(6):567-71. Epub 2011/03/23.
5. Patterson CC, Dahlquist GG, Gyurus E, Green A, Soltesz G. Incidence trends for childhood type 1 diabetes in Europe during 1989-2003 and predicted new cases 2005-20: a multicentre prospective registration study. Lancet. 2009;373(9680):2027-33. Epub 2009/06/02.

6. Kumar KM, Saboo B, Rao PV, Sarda A, Viswanathan V, Kalra S, et al. Type 1 diabetes: Awareness, management and challenges: Current scenario in India. Indian J Endocrinol Metab. 2015;19(Suppl 1):S6-8. Epub 2015/05/06.
7. Alotaibi M, Alibrahim L, Alharbi N. Challenges associated with treating children with diabetes in Saudi Arabia. Diabetes Res Clin Pract. 2016;120:235-40. Epub 2016/09/14.
8. Berger B, Sethe D, Hilgard D, Martin D, Heusser P. Design of a Self-Management Program for Children Aged 6-12 Years with Type 1 Diabetes Mellitus at the Community Hospital Herdecke, Germany. Complement Med Res. 2017;24(4):255-63. Epub 2017/08/30.
9. Kanungo A. Myths about type 1 diabetes: Awareness and education. Indian J Endocrinol Metab. 2015;19(Suppl 1):S24-5. Epub 2015/05/06.
10. Abdel Gawwad ES. Teacher's Knowledge, Attitudes and Management Practices about Diabetes Care in Riyadh's Schools. J Egypt Public Health Assoc. 2008;83(3-4):205-22. Epub 2008/01/01.
11. Hinton D, Kirk S. Teachers' perspectives of supporting pupils with long-term health conditions in mainstream schools: a narrative review of the literature. Health Soc Care Community. 2015;23(2):107-20. Epub 2014/03/29.
12. American Diabetes Association Clinical Practice Recommendations 2001. Diabetes Care. 2001;24 Suppl 1:S1-133. Epub 2001/06/14.
13. Aycan Z, Onder A, Cetinkaya S, Bilgili H, Yildirim N, Bas VN, 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 Pediatr Endocrinol. 2012;4(4):199-203. Epub 2012/10/04.
14. Nichols PJ, Norris SL. A systematic literature review of the effectiveness of diabetes education of school personnel. Diabetes Educ. 2002;28(3):405-14. Epub 2002/06/19.
15. Gormanous M, Hunt A, Pope J, Gerald B. Lack of knowledge of diabetes among Arkansas public elementary teachers: implications for dietitians. J Am Diet Assoc. 2002;102(8):1136-8. Epub 2002/08/13.
16. Nabors L, Lehmkuhl H, Christos N, Andreone TL. Children with diabetes: perceptions of supports for self-management at school. J Sch Health. 2003;73(6):216-21. Epub 2003/08/06.

17. Gesteland HM, Sims S, Lindsay RN. Evaluation of two approaches to educating elementary schoolteachers about insulin-dependent diabetes mellitus. Diabetes Educ. 1989;15(6):510-3. Epub 1989/11/01.
18. Smith CT, Chen AM, Plake KS, Nash CL. Evaluation of the impact of a diabetes education curriculum for school personnel on disease knowledge and confidence in caring for students. J Sch Health. 2012;82(10):449-56. Epub 2012/09/08.
19. Jarret L, Hillam K, Bartsch C, Lindsay R. The Effectiveness of Parents Teaching Elementary School Teachers About Diabetes Mellitus.Diabetes educ. 1993;19:193-197
20. Vanelli M, Chiari G, Ghizzoni L, Costi G, Giacalone T, Chiarelli F. Effectiveness of a prevention program for diabetic ketoacidosis in children. An 8-year study in schools and private practices. Diabetes Care. 1999;22(1):7-9. Epub 1999/05/20.
21. American Diabetes Association. Diabetes care in the school and day care setting. Diabetes Care. 2010;33 Suppl 1(Suppl 1):S70-4.