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Fear of Self-Injecting and Self-Testing and the Related Risk Factors in Adolescents with Type 1 Diabetes: A Cross-Sectional Study

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ABSTRACT

Introduction: This study was conducted to investigate the fear of self-injecting and self-testing and its related risk factors among adolescents with type 1 diabetes mellitus (T1DM).

Methods: From December 2015 to April 2016, a cross-sectional study was performed at the Diabetes Treatment Center, Prince Sultan Military Medical City, Riyadh, Saudi Arabia on 142 registered T1DM patients between 13 and 19 years of age. Selection of the respondents was done deliberately and carefully, and the suitable patients were given specific identification numbers. A trained interviewer administered the short Diabetes Fear of Injecting and Self-testing Questionnaire to each patient. It included two subscales estimating the fear of self-injection (FSI) and fear of self-testing (FST). Each patient's age, gender, weight, height, adjusted body mass index (BMI), duration of the diabetic condition, treatment modality, insulin dosage, and glycosylated hemoglobin (HbA1c) were recorded.

Results: The study found that the overall mean score of FSI was 2.44 ± 0.96, whereas that of FST was 2.25 ± 1.04. Adolescents above 16 years of age, treated with multiple daily insulin (MDI), on higher insulin doses, having poor glycemic control, and fewer finger pricks were observed to show significant risk factors for fear of self-injection of insulin, whereas in those patients having a long duration of T1DM, MDI treated, on higher insulin doses, with poor glycemic control, and fewer finger pricks showed significant risk factors for fear of self-testing of blood glucose. From the regression analysis it was evident that the variables of higher age, MDI treatment, and fewer finger pricks were independent risk factors for fear of self-injection of the insulin, whereas a fewer number of finger pricks was an independent risk factor for fear of self-testing the blood glucose.

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Conclusion: Fear of self-injecting and fear of self-testing are common among adolescents with T1DM. Therefore, it is essential to ensure comprehensive multidisciplinary diabetes education to lower the risk factor of fear of injections.

Keywords: Fear of self-injecting; Fear of self-testing; Type 1 diabetes

INTRODUCTION

The World Health Organization (WHO) has stated that Saudi Arabia ranks the second highest in the Middle East, and is seventh in the world for the rate of diabetes. Type 2 diabetes mellitus (T2DM) predominates, while type 1 diabetes mellitus (T1DM) continues to pose a significant public health problem in Saudi Arabia [1]. Over the past three decades, the incidence and prevalence of T1DM have been increasing in Saudi Arabia and currently the prevalence of T1DM in Saudi Arabian children and adolescents is 109.5 per 100,000 people [1].

For adolescent T1DM patients, disease management includes frequent blood sugar monitoring and multiple daily injections (MDI) of insulin necessitating a minimum of four injections each day or a continuous subcutaneous insulin infusion (CSII) via an insulin pump which needs the infusion site to be changed every 2 to 3 days [2]. For both the newly diagnosed patient and the long-term ones, the process of injecting and blood glucose testing cause high levels of distress [3]. More than in any other chronic childhood disease, children with T1DM have to accept needles as a part of their daily lives [4].

Most diabetic patients simply accept injections and blood glucose testing as an unavoidable part of life. Children or adolescents with T1DM, who must maintain desirable glycemic control, may be negatively bound by the fear of needles and try to avoid blood sugar monitoring, insulin injections, and/or CSII site changes [4]. However, for several others, both newly diagnosed and those managing the condition over a long term, the injection process itself can cause great distress. The striking characteristic of needle phobia is the evident anxiety at the very concept of injections or blood glucose testing, resulting in the attempt to resist them. Despite the fact that insulin treatment is the central component of diabetes management for both type 1 and type 2 diabetes accompanied by secondary pancreatic insufficiency or uncontrolled glycemia, poor compliance to the self-administration of insulin injections has been noted mostly because of factors like the fear of insulin or fear of needles [5]. Fear of needles and its relationship with pain stands out as one of the most significant factors. This fear negatively impacts the treatment of diabetic patients [5].

Intense fear of self-injecting insulin (injection phobia) remains the most plausible reason for compromising glycemic control and precipitating psychological distress [5, 6]. Similarly, the fear of self-monitoring the blood glucose (SMBG) or pricking the finger can trigger distress and seriously hamper self-management. Evidence also suggests that the fear of blood and injury is linked to less frequent self-testing and poor glycemic control. However, there is very limited research work available on the etiology, prevalence, and treatment of the fear of self-injecting (FSI) and fear of self-testing (FST) in patients with type 1 diabetes [7, 8]. The Diabetes Fear of Injecting and Self-testing Questionnaire (D-FISQ) was therefore developed as a means of quantifying

the degree of fear of self-injecting insulin and self-testing of blood glucose in insulin-treated diabetic patients [9]. The objective of the current study was to assess the fear of self-injecting and self-testing and its associated risk factors in adolescents with type 1 diabetes in Saudi Arabia.

METHODS

Study Design, Setting, and Sampling

A cross-sectional type of study was performed between December 2015 and April 2016, involving 142 T1DM patients between 13 and 19 years of age, registered in the Diabetes Treatment Center, Prince Sultan Military Medical City (PSMMC), Riyadh, Saudi Arabia. Selection of the respondents was done deliberately and carefully, and the suitable patients were given specific identification numbers.

Inclusion and Exclusion Criteria

Patients with T1DM, 13–19 years of age, undergoing treatment with MDI or insulin pump (IP) therapy for over 1 year at PSMMC were selected for the study; those with a history of psychopathology and cognitive impairment were excluded. Informed consent, both verbally and in written form, was obtained from the patients after clearly explaining the purpose and research methodology before the completion of the study measurement.

Diabetes Fear of Injecting and Self-testing Questionnaire (D-FISQ)

A trained interviewer administered (via interview) the short version of D-FISQ to each patient. D-FISQ is a 15-item self-report questionnaire composed of two subscales that measure the fear of self-injecting (six-item subscale) and fear of self-testing (nine-item subscale), the latter quantifying the fear of blood glucose testing. A four-point Likert scale was used to score the items, ranging from one (almost never) to four (almost always) [6].

Compliance with Ethics Guidelines

This study was conducted in accordance with the 1975 Declaration of Helsinki, as revised in 2000, and the protocol of this study was approved by the research ethics committee of Prince Sultan Military Medical City, Riyadh, Saudi Arabia.

Statistical Analysis

Data analysis was done with Microsoft Excel 2010, Microsoft Corporation, Seattle, WA, USA and the Statistical Package for Social Sciences version 16 SPSS Inc., Chicago, IL, USA. Equal variances across the groups were performed employing the Kolmogorov–Smirnov test. Besides the descriptive analysis, t test and multiple linear regression analysis were done to identify the differences among the groups. A p value of less than 0.05 was accepted as statistically significant.

RESULTS

Table 1 lists the demographic variables of the study population. The mean age of the study cohort was 15.4 ± 2.72 (mean $\pm$ SD) years. Of the 142 patients surveyed, 76 were male (53.5%) and 66 were female (46.5%). The mean duration of diagnosis of T1DM was 7.13 ± 4.7 (mean $\pm$ SD) and most of the study population (58.5%) were in the 13- to 16-year age group.

Table 1 Demographic variables of the study population

Variable (s)	Frequencies (n)	Percentage
Gender		
Male	76	53.5
Female	66	46.5
Age (years)		
13–16 years	83	58.5
17–19 years	59	41.5
Body mass index		
Underweight	18	12.7
Normal	94	66.1
Overweight	16	11.3
Obese	14	9.9
Duration of diabetes mellitus (years)		
≤5 years	50	35.2
>5 years	92	64.8
Treatment modality		
Multiple daily insulin	103	72.5
Insulin pump	39	27.5
HbA1c (%)		
≤7	38	26.8
>7	104	73.2
Dose of insulin (units per kg)		
≤0.7	19	13.4
>0.7	123	86.6

Variables related to the fear of injection and self-testing are shown in Table 2. The study found that the overall mean (SD) score of FSI was 2.44 ± 0.96, whereas that of FST was 2.25 ± 1.04. On comparison with the 13- to 16-year age group (2.02 ± 1.01), a considerably higher degree of fear of self-injection of insulin (2.58 ± 1, $p < 0.05$) was reported among the 17- to 19-year age group. Compared with the adolescents who suffered with diabetes for 5 years or less, those who suffered for more than 5 years revealed a greater degree of fear of needles in self-testing the blood glucose levels ($p < 0.05$). Similarly, compared with those using the IP, adolescents treated with MDI revealed significantly greater fear of self-injection of insulin and self-testing of blood glucose ($p < 0.05$). Fear of self-injection of insulin was observed to decrease significantly among those patients with good glycemic control of 7% or less compared with those having more than 7%. Identical results were observed for those adolescents on a daily insulin dose of at most 0.7 units/kg compared with those on a daily insulin dose of more than 0.07 units/kg. Interestingly, the fear of insulin injections dropped among those adolescents who pricked their fingers four or five times per day compared with those who pricked themselves only once or twice daily.

All the statistically significant variables in the t test were submitted for regression analysis. Regression analysis indicated that the variables including older age, MDI treatment, and fewer finger pricks were independent risk factors for fear of self-injection of insulin (Table 3), whereas a fewer number of finger pricks was an independent risk factor for fear of self-testing of blood glucose (Table 4).

DISCUSSION

Children with T1DM commonly exhibit fear of needles [4], which is frequently overlooked. The current study has shown significant impact of fear of needles among young patients with type 1 diabetes. Research shows that extreme FSI of insulin (injection phobia) will probably be another factor that compromises glycemic control. The strength of the phobic symptoms and anxiety-depression can negatively impact

Table 2 Variables associated with diabetes fear of injecting and self-testing

Variable (s)	Fear of self-injection of insulin	Fear of self-testing of blood glucose
Gender		
Male	2.21 ± 1.1	2.33 ± 1.01
Female	2.29 ± 0.991	2.53 ± 0.916
Age (years)		
13–16	2.02 ± 1.01	2.31 ± 1.04
17–19	$2.58 \pm 1^*$	2.61 ± 0.81
BMI		
Underweight	2.18 ± 0.96	2.19 ± 0.84
Normal	2.42 ± 0.98	2.08 ± 0.98
Overweight	2.61 ± 0.87	2.25 ± 1.23
Obese	2.50 ± 1.24	2.54 ± 1.13
Duration of diabetes mellitus (years)		
≤ 5	2.04 ± 0.96	2.04 ± 1
>5	2.37 ± 1.06	$2.65 \pm 00.87^*$
Treatment modality		
Multiple daily insulin	$2.62 \pm 0.96^*$	$2.69 \pm 0.99^*$
Insulin pump	1.28 ± 0.45	1.77 ± 0.42
HbA1c (%)		
≤ 7	1.55 ± 0.555	1.26 ± 0.50
>7	$2.76 \pm 0.876^*$	$2.62 \pm 0.948^*$
Dose of insulin (units per kg)		
≤ 0.7	1.32 ± 0.582	1.53 ± 0.612
>0.7	$2.40 \pm 1.02^*$	$2.58 \pm 0.932^*$
Average number of finger pricks per day		
1	2.72 ± 1.22	3.11 ± 1.32
2	$3.12 \pm 0.633^*$	$2.79 \pm 0.645^*$
3	$2.12 \pm 0.844^{*\#}$	$2.76 \pm 0.78^*$
4	$1.52 \pm 0.667^{*\#f}$	$1.76 \pm 0.614^{*\#f}$

Table 2 continued

Variable (s)	Fear of self-injection of insulin	Fear of self-testing of blood glucose
5	$1.20 \pm 0.414^{*\#f}$	$1.40 \pm 0.507^{*\#f}$

Groups compared by t test and one-way analysis of variance

Average number of finger pricks comparisons: * 1 vs 2, 3, 4, 5; # 2 vs 3, 4, 5; f 3 vs 4, 5

the metabolic control. On the contrary, studies reported that metabolic control may be improved by reducing the fear of injection [7]. Further, compared to patients in a Western setting, the Asian patients with diabetes revealed a greater degree of fear of injections and a higher perception of difficulty in using insulin [5, 10, 11]. The objective of the current study therefore was to assess the level of fear of needles and the risk factors related to it among the Saudi patients with T1DM.

Insulin users consistently indicate several factors that cause insulin injection-related anxiety and non-adherence, injection-related distress continuing to be a significant contributor. In fact, 57% of American insulin users reported deliberately avoiding administering the insulin "they knew they should take" [12]. Among the newly diagnosed pediatric patients, 40% reportedly showed moderate to severe levels of fear for insulin injection, and the prevalence of fear touched 75% in children younger than 9 years of age [13]. One research program that studied children with T1DM between 2 and 21 years of age ($n = 113$) showed 27% to be affected by needle phobia [14]. The current study on comparing the 13- to 16-year age group (2.02 ± 1.01) found significantly higher degree of fear of insulin self-injection (2.58 ± 1, $p < 0.05$) in the 17- to 19-year age group which

Table 3 Results of multiple linear regression analysis (fear of self-injection of insulin)

Variable	Fear of self-injection of insulin				
	β coefficients	95% confidence interval		t value	p value
		Lower	Upper		
Age	0.348	0.149	0.547	3.46	0.001
Treatment modality	−0.667	−0.923	−0.412	−5.17	0.001
Average number of finger pricks	−0.506	−0.609	−0.402	−9.67	0.001
Hemoglobin A1c (%)	0.213	−0.083	0.508	1.42	0.157
Dose of insulin (units/kg)	−0.220	−0.554	0.115	−1.30	0.197

Table 4 Results of multiple linear regression analysis (fear of self-testing of blood glucose)

Variable	Fear of self-testing of blood glucose				
	β coefficients	95% confidence interval		t value	p value
		Lower	Upper		
Diabetes duration	0.197	−0.028	0.421	1.7	0.85
Treatment modality	−0.155	−0.429	0.118	−1.1	0.263
Average number of finger pricks	−0.507	−0.621	−0.393	−8.8	0.00
Hemoglobin A1c (%)	0.224	−0.093	0.540	1.4	0.164
Dose of insulin (units/kg)	1.13	−0.361	0.360	−231	0.998

is contrary to the prior finding that young children rather than the older patients show a higher degree of fear and report pain with injections and fingersticks [13]. Compared with the last decade, although the needles used today for SMBG are much more fine, anxieties regarding using needles and fear of pain may continue to occur, resulting in the reduced adherence to SMBG [15, 16]. On comparing patients suffering with diabetes for at most 5 years with adolescents who suffered for more than 5 years, this study showed that the latter revealed greater fear of needles to self-test the blood glucose.

On comparing the adolescents treated with IP with adolescents treated with MDI, the current study showed that the latter had significantly more fear of self-injection of insulin and self-testing of blood glucose ($p < 0.05$). This could be because the automatic injection device, which is a loaded syringe, is put in the device, locked into place, and automatically pushed into the skin by a spring-loaded system. The advantage of this device is that the needle is not visible and is very quickly jabbed through the skin [17]. Studies also reveal that compared with those using the IP, adolescents treated with MDI show much greater fear of self-injection of insulin and self-testing of blood glucose, in particular those on CSII [4, 18]. Further, after regression analysis, the results of the present study indicated that MDI treatment was an independent risk factor for fear of self-injection of insulin.

Studies reported that adolescents miss or sometimes even completely cease taking their

insulin injections because of fear of needles, which is confirmed by the present findings [15, 16]. A similar observation was noted in a study performed in Saudi Arabia in which 79% of the patients were non-compliant with their insulin regimen [19]. A low degree of compliance was seen in commencing and continuing with their needle-based therapies like insulin administration [7]. Fear of self-injection of insulin was found to considerably drop among patients with A1c values below 7%, which is confirmed by the present study [7].

Patients who control their glycemic level at 7% or less were seen to express a lesser degree of fear of self-injection of insulin and self-testing of blood glucose compared with those with HbA1c values higher than 7%. Research has revealed that insulin administration is frequently needed in diabetes mellitus management to maintain optimal glycemic control. In spite of this, however, several patients hesitate to begin insulin treatment [4]. In the general population, several factors leading to this reluctance have been identified, one of the most frequent being the fear of needles. Such barriers are also evident in multi-ethnic populations. One study recently reported that patients with a higher degree of fear of needles reveal higher HbA1c levels and more infrequent blood sugar monitoring [4]. In another study, patients having positive scores for fear of injections reportedly showed significantly higher HbA1c levels than those lacking this fear [20].

In the current study, regression analysis showed that a fewer number of finger pricks was a negative independent risk factor for self-testing of blood glucose. Children with type 1 diabetes generally begin with two insulin injections per day using two different types of insulin and normally continue on to three or four insulin injections per day using different types of insulin [21]. The types of insulin used varied with the levels of blood glucose. According to some research three or four insulin injections per day provides the best blood glucose control and can avert or defer diabetes-induced microvascular complications. In many instances, however, children would avoid injecting the insulin injection out of fear of needles [22, 23]. In this study, an interesting fact discovered was that the fear of insulin injection and fear of self-testing of blood glucose were less among those adolescents who pricked four to five times per day compared with those who pricked only once or twice a day. This implies that a regular habit of injection may reduce the fear of needles. Research has revealed that SMBG is effective in enhancing the degree of self-care in patients with diabetes. SMBG heightens the empowerment of patients with diabetes, helping them to accurately estimate the effects of alterations in lifestyle and medications on their blood glucose levels. However, some research showed that fingertip pricking was painful for certain patients, who therefore avoided practicing SMBG quite often, even in developed countries. In the USA and Italy, only a limited minority of patients with diabetes and injecting insulin practiced at least daily SMBG (26% and 13.9%, respectively), despite the monitoring devices being provided at no cost in Italy [24, 25]. The studies also reported that this could be a result of older age, lower levels of diabetes education, lesser comorbidities, fear of testing and pain [26].

The major limitations of this study include its cross-sectional nature, the small sample size, and the fact that it was performed at a single center. More studies on a larger scale are needed to address the limitations indicated in the study. Despite the limitations, the study

delivers valuable data about the insulin pump treatment and satisfaction among adolescents with T1DM.

CONCLUSION

It is quite common among children with T1DM to have a fear of needles. However, although this is frequently missed, the current study has revealed the remarkable impact the fear of needles exerts on type 1 diabetes. This study identified some significant risk factors for fear of needles: age, duration of diabetes and treatment modality, besides glycemic control, insulin dosage, and number of finger pricks on average. Although the needles used today for SMBG and insulin injections are much finer than those of earlier times, the fear of using needles and pain may continue to be encountered and thus lead to a lower compliance with SMBG and self-injection of insulin. Healthcare providers, diabetes educators in particular, need to carefully consider these factors when discussing SMBG with children diagnosed with diabetes and their caregivers. The diabetes educationist should be trained to employ techniques to reduce the pain during finger prick, for example, by pricking the lateral aspect of the finger, avoiding pricking the thumbs and index fingers, or pricking to shallower needle depths; besides, they could be advised to utilize alternative testing sites, like the arm, abdomen, and thigh to rest the fingers for some length of time.

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