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Review Article

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A Study of Insulin Injection Practices in Al Ahsa's Diabetic Population

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ABSTRACT

Background: Diabetes Mellitus (DM) is a global health problem. Saudi Arabia is one of the leading ten countries worldwide with a high prevalence rate close to 24%. Improper insulin injection technique is a common phenomenon.

Aim: The purpose of this study was to explore how participants were performing insulin injections and the factors associated with those practices.

Methods: A cross-sectional study using a questionnaire-based survey was carried out at two locations in Al Ahsa, Saudi Arabia. These locations included: (1) primary healthcare centers, (2) the Diabetic Center at King Fahd Hospital. The inclusion criteria included nonpregnant patients aged 18 years or older with type 1 or type 2 diabetes injecting insulin using an insulin pen or insulin syringes.

Results: Four hundred and fourteen diabetic patients participated in the study. Age was subcategorized into three age groups, and the most prevalent age group was between 18 and 28 years 192 (46.4%). In terms of gender, 293 (70.8%) of patients were female. A total of 219 (52.9%) had a college education. As for diabetics, 250 (60.4%) had type 1 diabetes. In terms of how long they have used insulin injections as a diabetes treatment, 159 (38.5%) have used it for less than five years. In terms of how many injections they use per day, 139 (33.6%) reported that they use three injections or more. In regards to keeping insulin in the refrigerator, 39 (9.4%) answered never, while 89 (21.5%) answered sometimes. In regards to performing hand hygiene before injection, 64 (15.5%) answered never, while 175 (42.3%) answered sometimes. In terms of checking the expiration date of insulin bottles, 44 (10.6%) never do so, whereas 175 (42.3%) check it on occasion. The number of participants with good practices was around one-third 149 (36%), while the number of participants with bad practices was 265 (64%).

Conclusion: There was a low proportion of participants who frequently practiced insulin injections appropriately in this study. Patients should still be educated about the crucial injecting practices. There were unsafe insulin injection practices involving insulin pens and insulin syringes. It is important to pay more attention to the patient's unsafe practices.

Keywords: Diabetic Patients, Healthcare Workers, Insulin Injection, Medical Waste Disposal, Patient Education, Practice, Safety

Introduction

Diabetes Mellitus (DM) is a global health problem [1]. Currently, 537 million adults aged 20-79 years have diabetes mellitus (DM) worldwide. It has become one of the fastest-growing health challenges of the 21st century, with a disproportionate burden on low and middle-income countries [2]. It is one of the rapidly evolving disorders globally, and some countries have reached epidemic levels [3].

It is a common chronic and metabolic disorder characterized by high blood glucose levels due to either insulin hormone resistance or deficiency that can chronically affect the whole body [4]. Between 2000 and 2019, there was a 3% increase in diabetes mortality rates by age [1]. The global diabetes prevalence in 2019 is estimated to be 9.3%, rising to 10.2% by 2030 and 10.9% (700 million) by 2045 [5]. Specifically, Saudi Arabia is one of the leading ten countries worldwide with a high prevalence rate close to 24% [6]. In Saudi Arabia, a recently published systematic review by Alanazi et al. depicted poor public awareness about DM and its risk factors as well as complications [7].

The management mostly takes place by self-administration of insulin at home. Various kinds of medical instruments, like insulin pens, needles, and syringes, as parts of self-care, are used [8].

Improper insulin injection technique is a common phenomenon. It can lead to glycemic variability and subsequently compromised short- and long-term complications [9].

Diabetes mellitus (DM) affects 415 million people worldwide with an estimated prevalence of 9.1% in 2015 and is predicted to increase to 10% by 2040 [10]. The World Health Organization

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(WHO) has reported that Saudi Arabia ranks the second highest in the Middle East, and is seventh in the world for the rate of diabetes. It is estimated that around 7 million of the population are diabetic and almost around 3 million have pre-diabetes [11]. According to WHO reports in 2016, among the Saudi population, the prevalence of diabetes was 14.4% (13.8% among females and 14.7% among males). It was considered that is the cause of 5% of overall deaths in Saudi Arabia [1]. According to local studies, a cross-sectional study of the Alkharj region's population revealed a diabetes prevalence of 3.8% for females and 9.2% for males [12].

Aim

The purpose of this study was to explore how participants were performing insulin injections and the factors associated with those practices.

Objectives

1. To Recognize safe and unsafe practices for insulin injection.
2. To recognize the factors that affect safe practices in diabetic patients.

Materials and Methods

Study Design and Population

A cross-sectional study using a questionnaire-based survey was carried out at two locations in Al Ahsa, Saudi Arabia. These locations included: (1) primary healthcare centers, (2) the Diabetic Center at King Fahd Hospital. The inclusion criteria included nonpregnant patients aged 18 years or older with type 1 or type 2 diabetes injecting insulin using an insulin pen or insulin syringes.

The research protocol was approved by the Ethics Committee at IRB of King Faisal University, KFU-REC-2022-FEB-EA000461, and IRB of King Fahd Hofuf Hospital KFHH No. (H-05-HS-065), IRB Log No: 70-EP-2022. The study was conducted from March 2022 to January 2023.

The questionnaire was built after reviewing the same articles and studies. The questionnaire of study was prepared based on previous literature with modifications [13-15]. The questionnaire was first written in English and translated to local language (Arabic) which is then translated back to English in order to ensure that the translated version gives the proper meaning. The questionnaire was pretested on 22 participants prior to the gross data collection, which were not included in the final analysis, and relevant modifications were instituted prior to commencement of actual data collection.

The questionnaire was conducted in an interview-based setting. There were two parts of the questionnaire with a total of 19 questions. The first part of the questionnaire included questions about demographics, such as age, gender, educational level, and the number of injections per day. The second part of the questionnaire included 13 questions relating specifically to practices of insulin injection, and insulin injection techniques.

For analyzing the 13 questions about technical practices of insulin injection among the surveyed patients, each question that was answered correctly was given one point (a maximum score of thirteen points). The mean score gives an impression about the practices. A mean of 13 questions regarding practices was calculated. And those above the mean score were categorized as 'good' acceptable practice, and those below were categorized as 'poor' non-acceptable practice.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS, IBM Corp., Armonk, New York). Data were presented as numbers and frequencies. Two-tailed one-way analysis of variance (ANOVA) test was used to compare the average score of insulin injection techniques according to various sociodemographic and clinical variables. A p value less than 0.05 was regarded statistically significant.

Results

Four hundred and fourteen diabetic patients participated in the study. Table (1) illustrates the participants' characteristics. Age was subcategorized into three age groups, and the most prevalent age group was between 18 and 28 years 192 (46.4%). In terms of gender, 293 (70.8%) of patients were female. A total of 219 (52.9%) had a college education. As for diabetics, 250 (60.4%) had type 1 diabetes. In terms of how long they have used insulin injections as a diabetes treatment, 159 (38.5%) have used it for less than five years. In terms of how many injections they use per day, 139 (33.6%) reported that they use three injections or more.

Table 1: Participants' Characters

Item	Frequency	Percent
Knowledge		
Age		
18-28 years	192	46.4
28-38 years	46	11.1
38+ years	176	42.5
Gender		
Female	293	70.8
Male	121	29.2
Educational level		
Illiterate	52	12.6
Primary school level	36	8.7
Elementary level	32	7.7
High school level	75	18.1
College level	219	52.9
Diabetic type?		
Diabetes type 1	250	60.4
Diabetes type 2	164	39.6
Years of treatment by insulin therapy		
1-5 years	159	38.4
5-10 years	79	19.1
10-15 years	63	15.2
15+ years	113	27.3
Insulin injection/day		
1 injection	138	33.3
2 injections	137	33.1
3+ injections	139	33.6

In Table (2), insulin injection practices are illustrated. In regards to keeping insulin in the refrigerator, 39 (9.4%) answered never, while 89 (21.5%) answered sometimes. In regards to performing hand hygiene before injection, 64 (15.5%) answered never, while 175 (42.3%) answered sometimes. In terms of checking the expiration date of insulin bottles, 44 (10.6%) never do so, whereas 175 (42.3%) check it on occasion. There are 14 (3.4% of respondents) who never check the dose's accuracy, while 42 (11% of respondents) check it sometimes. In terms of reading the safety instructions on the insulin package, 139 (33.6%) never do, while 119 (28.7%) do it occasionally. As for eating before taking the insulin dose, 89 (21.5%) answered never, while 169 (40.8%) answered sometimes. The angle at which the needle is inserted was never checked by 18 (4.3%), while 141 (34.1%) checked it occasionally. When it comes to holding the needle between the thumb and forefinger correctly, 13 (3.1% of respondents) never care about it, while 96 (23.2%) sometimes do. Reusing the insulin needle after falling down is reported to occur sometimes by 149 respondents (36%), but it is reported to occur most often by 32 respondents (7.7%). In terms of injecting insulin slowly and gradually, 29 (7%) reported never using this technique, while 145 (35%) reported using it sometimes. On the question of changing the injection site periodically, 15 (3.6%) reported they did not care, while 159 (38.4%) cared sometimes to do so. When asked if they disposed of injection syringes and needles in sharp containers, 121 (29.2%) responded that they never did. In contrast, 89 (21.5%) reported that they sometimes care about disposing of it in a sharp container. In terms of reusing the syringe, 211 (51%) reported never reusing the syringe, while 134 (32.4%) stated doing so occasionally.

Table 2: Participants' practices regarding insulin injections

Item	Frequency	Percent
Do you keep the insulin inside a refrigerator after using it?		
Never	39	9.4
Sometimes	89	21.5
Usually	286	69.1
Do you perform hand hygiene before injecting?		
Never	64	15.5
Sometimes	175	42.3
Usually	175	42.3
Do you check the expiration date of the insulin bottle?		
Never	44	10.6
Sometimes	79	19.1
Usually	291	70.3
Do you check the accuracy of the does?		
Never	14	3.4
Sometimes	42	10.1
Usually	358	86.5
Do you read the safety instructions that are included in the insulin injections package?		
Never	139	33.6
Sometimes	119	28.7
Usually	156	37.7
Do you eat before taking the insulin dose?		
Never	89	21.5
Sometimes	169	40.8
Usually	156	37.7
Do you insert the needle at 45 or 90 degree angle?		
Never	18	4.3
Sometimes	141	34.1
Usually	255	61.6
Do you correctly hold the needle between the thumb and forefinger?		
Never	13	3.1
Sometimes	96	23.2
Usually	305	73.7
Has ever the injector ever fallen down, then you reuse it?		
Never	233	56.3
Sometimes	149	36.0
Usually	32	7.7
When you inject the needle, do you inject it in a slow and graduate manner?		
Never	29	7.0
Sometimes	145	35.0
Usually	240	58.0
Do you change the injection site periodically?		
Never	15	3.6
Sometimes	159	38.4
Usually	240	58.0
Do you dispose of the injection in a sharp container?		
Never	121	29.2
Sometimes	89	21.5
Usually	204	49.3
Do you ever reuse the needle?		
Never	211	51.0
Sometimes	134	32.4
Usually	69	16.7
Mean	**6.24 ± 2.81**	

A mean score provides an overview of the practices. Based on 13 questions regarding practices, a mean was calculated. Those above the mean score were categorized as 'good' acceptable practices, while those below were categorized as 'poor' non-acceptable practices. The number of participants with good practices was around one-third 149 (36%), while the number of participants with bad practices was 265 (64%).

Table 3: The practice total score

Score	Frequency	Percent
Good (6.24 or more)	149	36.0
Bad (less than 6.24)	265	64.0
Total	414	100.0

This table shows the correlation between the practice score and the demographic characteristics of the participants. It was found that there was a significant positive relationship between the practices and age, which means that with age, the practices are more acceptable. The table also revealed that there were no significant correlations between the practice score and gender, diabetic type, years of the disease, years of insulin treatment, or insulin injections per day.

Table 4: correlation between the mean score and demographic data of the participants

Age	Pearson Correlation	.192**
	Sig. (2-tailed)	0.000
Gender	Pearson Correlation	0.015
	Sig. (2-tailed)	0.763
Educational level	Pearson Correlation	0.066
	Sig. (2-tailed)	0.181
Diabetes type	Pearson Correlation	-0.009
	Sig. (2-tailed)	0.849
How many years do you treat by insulin therapy?	Pearson Correlation	-0.027
	Sig. (2-tailed)	0.588
Currently, how many insulin injection do you use in a day?	Pearson Correlation	-0.011
	Sig. (2-tailed)	0.819

Discussion

Correct insulin injection technique is crucial for better glycemic control. Diabetic patients who don't know proper injection techniques may administer insulin incorrectly, leading to poor glycemic control and adverse outcomes [16]. Our study aimed to explore how participants were performing insulin injections and the factors associated with those practices.

The present study revealed that the number of participants with good practices was around one-third (36%), while the number of participants with bad practices was (64%). In the same line, other studies in Nepal showed significant gaps between insulin delivery recommendations and insulin injection practice in Nepalese patients with diabetes. The majority of patients were storing their insulin pens (insulin cartridge inside) either at room temperature or in the refrigerator. The insulin pen in use (insulin cartridge inside) can be stored at room temperature (15-25°C) for 30 days [14,17]. In the same line the study of Alhazmi GA, in Makkah, the study showed that the practices toward insulin use among the surveyed DM patients in Makkah region were not satisfactory. The study showed that a large proportion of the surveyed patients had unsatisfactory knowledge about insulin injection practices [13]. In Italy Pozzuoli et al. demonstrated suboptimal insulin injection technique among 352 Italian patients with DM [18].

Another study in china published by Ji J, Lou Q. 2010, revealed that, the insulin injection skill of patients with diabetes in mainland China was poor [19].

This result was not in the same line with study of Alshawwa S, in saudi arabia, which found that the majority of patients had good knowledge and practice explained with values 73.6% of total papulation [20]. The authors revealed that there were substantial gaps concerning proper insulin injection practice.

Conclusion

There was a low proportion of participants who frequently practiced insulin injections appropriately in this study. Patients should still be educated about the crucial injecting practices. There were unsafe insulin injection practices involving insulin pens and insulin syringes. It is important to pay more attention to the patient's unsafe practices. The knowledge and practice of diabetic patients were low regarding safe insulin injection practices in the study area. The study revealed that the knowledge and practice of diabetic patients toward safe insulin injection practices had a strong association with the age of patients.

Conflict of Interest

The authors declare that they have no conflict of interest.

Data Availability

The data utilized to support the results of the research are accessible to the corresponding author upon request.

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