

KNOWLEDGE, AWARENESS AND PRACTICE ON FLEXPEN TECHNIQUE AMONG DIABETIC PATIENTS IN HOSPITAL USM

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Abstract. Diabetes Mellitus (DM) is a common chronic disease and needs adequate glycemic control to prevent complications of uncontrolled diabetes. Insulin injection is one of diabetic management to maintain optimum blood glucose level with a condition that correct injection techniques are applied. Thus, the aim of this study is to identify the knowledge, awareness, and practice on FlexPen insulin injection technique among diabetic patients in Hospital Universiti Sains Malaysia (USM). This was a cross-sectional study conducted among diabetic patients in the Hospital USM diabetic centre. A total of 97 respondents were recruited using a simple random sampling method. Data on socio-demographic characteristics, knowledge, awareness, and practice on FlexPen insulin injection technique among diabetic patients were obtained through a self-administered questionnaire. Data were analyzed using Statistical Package for Social Science (SPSS) version 24 for Window. The mean age of the respondents was 46.69 ± 11.73 years old. Majority of the respondents had a high level of knowledge (57.7%), awareness (83.5%), and practice (89.7%). Adequate level of knowledge, awareness, and practice is important for a correct technique on self-administration of insulin. Hence, related interventions were needed for better glycemic control.

Keywords: *knowledge, awareness, practice, insulin injection technique*

Introduction

DM is a common chronic disease in which people suffered this disease will have high blood glucose. Adequate glycemic control is needed to prevent complications of uncontrolled diabetes. A proper technique for an insulin injection, which is one of the diabetic management, will lead to an optimum blood glucose level maintenance. Improper insulin injection technique will lead to injection-related complications such as hyperglycemia, hypoglycemia, infection, and bleeding (Tan, 2017). Therefore, it is important to have adequate knowledge, awareness, and practice for the diabetic patients to improve their insulin injection technique in order for the insulin effect matched with the glucose load in the body (Soylar et al., 2017) and to reduce the risk of complications of an incorrect insulin injection technique (Mandava et al., 2019).

FlexPen insulin is widely used by diabetic patients in Hospital USM. However, from the observation of the staff nurses and nursing students in Hospital USM, most of the diabetic patients who are using FlexPen insulin have low knowledge, awareness and practice on the proper technique of insulin injection. According to Diabetic Centre Hospital USM (2019), elderly diabetic patients received a more in-depth education on insulin injection technique compared to the new patients. This shows that the level of knowledge and awareness is still very low and poor injection practice is still being practiced among diabetic patients. There is limited study on the knowledge, awareness, and practice on FlexPen insulin injection technique among diabetic patients in

Malaysia. Hence, this study aims to identify the knowledge, awareness, and practice on FlexPen insulin injection technique among diabetic patients in Hospital USM, Kelantan. In Malaysia, Kelantan state recorded the highest number of diabetic patients compared to the other states (Remali et al., 2017).

Materials and Methods

A cross-sectional study was carried out between February until March 2020. The subjects were directly recruited at the diabetic center in Hospital USM through a simple random sampling method. The calculated sample size required for this study was 97 respondents. A few parameters were used to calculate the sample size and the highest estimated sample size was chosen to create a significant result. Referring to Montoya et al. (2019), a Single Proportion Formula: $n = \left(\frac{z}{\Delta}\right)^2 p(1-p)$ was used in the sample size calculation with the desired confidence level (z) = 1.96, precision (Δ) = 0.05, and anticipated population proportion (p) = 0.056. A 20% dropout was considered in the sample size calculation.

Data was collected using a self-administered questionnaire, which comprises of four sections. The questionnaire had been tested for validity and reliability through a pilot study in 15 respondents that met the inclusion criteria. The Cronbach's alpha value obtained using SPSS was 0.916. Section A of the questionnaire consists of 10 items related to socio-demographic data. Section B consists of 10 items to identify the level of knowledge of diabetic patients on FlexPen insulin injection. Section C consists of 10 items to identify the level of awareness of diabetic patients on FlexPen insulin injection whereas Section D consists of 15 items to identify the practice on FlexPen insulin injection among the diabetic patients in Hospital USM. A "Yes" or "No" answer was applied in Section B, C, and D. A "Yes" answer will be scored as "1" while a "0" for a "No" answer. For Section B and C, the respondents would need to use a scoring system from 0-10 after assessing their knowledge and awareness. The knowledge and awareness section scores were categorized as good (8-10), moderate (4-7), and poor (0-3). In Section D, a scoring system from 0-15 was applied to assess their practice on FlexPen insulin injection technique in which the practice scores were categorized as good (11-15), moderate (5-10), and poor (0-4).

The study was approved by the Human Research Ethics Committee (HREC), USM. Approval from the Director of Hospital USM was obtained in order to gain access to diabetic patients. It was ensured that the study was conducted without any conflict of interest. Respondents who fulfill the inclusion criteria were given consent to participate in this study. The consent forms containing the personal details of the respondents and the data collected from this study will be kept confidential and will only be used for academic and research purposes. The involvement of the respondents in this study is also voluntary and the respondents may withdraw at any time.

The data were analyzed using SPSS and descriptive statistics were performed to identify the level of knowledge, awareness, and practice on insulin injection technique among diabetic patients in Hospital USM.

Results and Discussion

Socio-demographic characteristics

Table 1 summarizes the socio-demographic characteristics of a total of 97 respondents in this study. The mean age of the respondents was 46.69 ± 11.73 years old. The majorities were Malay ethnicity (58.8%), employed (51.5%), female (50.5%), educated (95.9%), monthly household income more than RM1500 (48.5%), and suffered Type II DM (99.0%). The mean duration of DM was 8.19 years with a standard deviation of 9.16. A total of 39 respondents (40.2%) injected themselves twice daily with insulin, 29 respondents (29.9%) injected once daily, 16 respondents (16.5%) injected three times daily while 13 respondents (13.4%) injected four times daily. 48 respondents (49.5%) injected 1-20 IU per day followed by 28 respondents (28.8%) injected 21-40 IU per day, 12 respondents (12.4%) injected 41-60 IU per day, 6 respondents (6.2%) injected 61-80 IU per day, and only 3 respondents (3.1%) injected 81-100 IU per day.

Table 1

Table 1. Socio-demographic characteristics of the respondents (N=97).

Variable	Frequency (N)	Percentage (%)	Min	Max	Mean	Standard Deviation
Age						
20-29	2	2.1				
30-39	28	28.8				
40-49	35	36.1				
50-59	15	15.5				
60-69	13	13.4				
70-79	4	4.1				
Occupation						
Employed	50	51.5				
Self-employed	19	19.6				
Housewife	10	10.3				
Pensioner	18	18.6				
Gender						
Male	48	49.5				
Female	49	50.5	25	74	46.69	11.726
Ethnic						
Malay	57	58.8				
Chinese	34	35.0				
Indian	6	6.2				
Education level						
Educated	93	95.9				
None	4	4.1				
Income						
Less than RM1000	29	29.9				
RM1000-RM1500	21	21.6				
More than RM1500	47	48.5				
Types of Diabetes Mellitus						

Type I	1	1.0				
Type II	96	99				
Duration of Diabetes Mellitus (years)						
1-10	73	75.2	1	36	8.19	9.160
11-20	13	13.4				
21-30	8	8.2				
31-40	3	3.1				
Frequency of insulin injection per day (times)						
1	29	29.9	1	4	2.13	0.996
2	39	40.2				
3	16	16.5				
4	13	13.4				
Total of insulin dose per day (IU)						
1-20	48	49.5				
21-40	28	28.8	6	96	1.85	1.064
41-60	12	12.4				
61-80	6	6.2				
81-100	3	3.1				

Level of knowledge on Flexpen insulin injection technique among diabetic patients in Hospital USM

Table 2 shows the level of knowledge on FlexPen insulin injection technique among diabetic patients in Hospital USM. Table 3 summarizes the responses of the respondents on each question of knowledge on FlexPen insulin injection technique. Out of 97 respondents, only 56 respondents (57.7%) had a high level of knowledge whereas only 33 respondents (34%) had a moderate level of knowledge, and 8 respondents (8.3%) had a low level of knowledge. The mean and standard deviation of the level of knowledge were 7.48 and 2.18, respectively.

Table 2. Level of knowledge on FlexPen insulin injection technique among diabetic patients in Hospital USM (N=97).

Knowledge level	Frequency (N)	Percentage (%)	Mean (SD)
High	56	57.7	
Moderate	33	34.0	7.38 (2.180)
Low	8	8.3	

Table 3. Demographic data, comorbidities and ocular features of CMV retinitis patients.

No.	Items	Yes N (%)	No N (%)
1.	Needle length that needs to be used should be 4-8mm.	63 (64.9)	34 (35.1)
2.	The needle should only be used only once.	40 (41.2)	57 (58.8)
3.	Insulin should not be injected in swelling or scar site.	94 (96.9)	3 (3.1)
4.	The angle of injection should be 45° angle (for longer needle or at a 90° angle (for shorter needle).	60 (61.9)	37 (38.1)

5.	Insulin can be injected at the abdomen area.	95 (97.9)	2 (2.1)
6.	Insulin can be injected at the buttock area.	73 (75.3)	24 (24.7)
7.	Insulin can be injected at the thigh.	70 (72.2)	27 (27.8)
8.	Insulin can be injected at the arm.	78 (80.4)	19 (19.6)
9.	Change of the site of inkection is needed.	94 (96.9)	3 (3.1)
10.	The needle should be disposed into sharp containers after injection.	59 (60.8)	38 (39.2)

Knowledge of FlexPen insulin injection technique is vital to achieve a better diabetic control (Orlova et al., 2019). A study by Pawar et al. (2018) showed that higher level of knowledge on FlexPen insulin injection technique had helped in providing better health and economic outcomes for the diabetic patients. According to the findings, more than half of the respondents (57.7%) was found to have a high level of knowledge, 34.0% had a moderate level of knowledge whereas only 8.3% of the respondents had a low level of knowledge on FlexPen insulin injection technique. The result, however, contradicts with another finding by Shrestha et al. (2018). The study concluded that the diabetic patients attending diabetic clinics in Eastern Nepal lacked the knowledge on proper self-administration of insulin injection technique. Another report by Vijay (2018) reflected that more than half of the diabetic patients in India were found to have inadequate knowledge of the self-administration and disposal of the insulin. One of the possible reasons this study shows a high level of knowledge in diabetic patients in Hospital USM could be due to 95.9% of the respondents were educated. This is contrary to the study by Shrestha et al. (2018) whereby only 14.0% of the respondents were educated. Another possibility could be due to the differences in the income of the diabetic patients with higher earning diabetic patients will have the appropriate knowledge on the proper FlexPen insulin injection technique (Mehmood et al., 2019). This statement is in line with the finding in this study whereby 48.5% of the respondents had a monthly income of more than RM1500, hence a higher level of knowledge. Even though the statistics showed a satisfying level of knowledge on insulin injection technique, healthcare professionals should continue imparting insulin self-administration education at each follow-up visit (Yosef, 2019). This is to strengthen the information on the issue of insulin self-administration.

Furthermore, the findings from this study showed that 58.8% of the respondents disagreed on the single use of the needles. This is in line with the result of the study conducted by Frid et al. (2016) in which the diabetic patients reused the needles for convenience and cost-saving. According to a study performed by Tandon et al. (2017), 80% of the respondents reused the needles 3 times or more. Few complications have been reported on reusing the needles including distortion and loss of moisture of the skin, which could lacerate the skin and cause pain during injection (Tosun et al., 2019). Hence, general nurses, diabetes nurses or diabetes educators should frequent injection training session with the diabetic patients to reduce the incident of reusing the needles (Frid et al., 2016).

In regard to needle disposal, 60.8% of the respondents agreed that the needle should be disposed into sharps containers after injection. However, the level of awareness on this issue was still lacking. In India, a higher statistic was recorded with 82% of the study population had inadequate knowledge in disposing of the needle after used and this could cause injuries to the public (Vijay, 2018). Moreover, the finding in this study contradicts with a study from Basazn Mekuria et al. (2016) in Gondar Town, Ethiopia in which only 21% of the respondents had good knowledge on the proper needle disposal.

These differences might due to the inadequate education on the proper needle disposal. In the interview session with the respondents in Hospital USM, the diabetic patients claimed that the diabetic educators had explained the proper technique for needles disposal. The differences between Malaysia, India and Ethiopia on the knowledge of needle disposal is ought to be examined further.

Level of awareness on Flexpen insulin injection technique among diabetic patients in Hospital USM

Table 4 shows the level of awareness on FlexPen insulin injection technique among diabetic patients in Hospital USM. Table 5 summarizes the responses of the respondents on each question of awareness on FlexPen insulin injection technique. 81 respondents (83.5%) showed a high level of awareness followed by 10 respondents (10.3%) had a moderate level of awareness, and 6 respondents (6.2%) had a low level of awareness. The mean and standard deviation of awareness level was 8.51 and 2.001, respectively.

Table 4. Level of awareness on FlexPen insulin injection technique among diabetic patients in Hospital USM (N=97).

Awareness level	Frequency (N)	Percentage (%)	Mean (SD)
High	81	83.5	8.51 (2.001)
Moderate	10	10.3	
Low	6	6.2	

Table 5. Awareness on FlexPen insulin injection technique (N=97).

No.	Items	Yes N (%)	No N (%)
1.	Do you think injection of insulin on-time is important.	67 (69.1)	30 (30.9)
2.	Do you think pressing the injection site after injection can prevent bleeding?	81 (83.5)	16 (16.5)
3.	Do you think washing hands before injection can prevent infection?	86 (88.7)	11 (11.3)
4.	Do you think correct dose of insulin injected can present hypoglycemia (too little glucose)?	82 (84.5)	15 (15.5)
5.	Do you think correct dose of insulin can prevent hyperglycemia (too much glucose)?	84 (86.6)	13 (13.4)
6.	Do you think an unopen FlexPen insulin need to be stored in the refrigerator before begin to use it?	90 (92.8)	7 (7.2)
7.	Do you think the used FlexPen insulin needs to be stored at room temperature after opened?	96 (99.0)	1 (1.0)
8.	Do you think it is important to follow-up the treatment in hospital?	96 (99.0)	1 (1.0)
9.	Do you think following the dietary recommendations given by the doctor necessary?	73 (75.3)	24 (24.7)
10.	Do you think regular exercise important to maintain optimal blood glucose level?	70 (72.2)	27 (27.8)

The findings from this study showed a high level of awareness on FlexPen insulin injection technique in the majority of the respondents in Hospital USM, which was in line with the study by Getachew and Solomon (2019). In the previous study, majority of

the respondents favor towards self-insulin administration. The similarity might due to most of the respondents in both of the studies were literate, having enough self-insulin injection education facilities, and good access to media about the awareness of FlexPen insulin injection technique. Hence, they would have a higher understanding of the importance of correct FlexPen insulin injection technique. It was suggested that the facilities and information should be improved and updated so that the awareness level increased.

In this study, 99.0% of the respondents had the awareness that the used FlexPen insulin should be stored at room temperature whereas 92.8% of the respondents aware that unopened insulin should be stored in the refrigerator. This is consistent with the findings obtained by Patil et al. (2017) in which three-quarter of the respondents in the study properly stored the used and the unopen insulin. These suggest that the diabetic patients were concerned on the correct technique to store the insulin to prevent the insulin from being spoiled and ineffective. However, the study by Shetty et al. (2017) reported that although 71.4% of the respondents stored the unopened insulin correctly, still a large number of the respondents (54.8%) improperly stored the used insulin. Hence, the study suggested that lifelong monitoring and modification are needed to achieve the maximum benefits of insulin therapy. Even though the awareness level in this study is high, it was suggested that further diabetic education is needed such as by giving a booklet with pictorial illustrations that contains information on proper storage of used and unused insulin (Shanmugam and Roy, 2017). This booklet could be given to the diabetic patients in almost every visit to the clinic to help strengthen their understanding and have a better knowledge of insulin storage.

Level of practice on Flexpen insulin injection technique among diabetic patients in Hospital USM

Table 6 shows the level of practice on FlexPen insulin injection technique among diabetic patients in Hospital USM. Table 7 summarizes the responses of the respondents on each question of practice on FlexPen insulin injection technique. Among the 97 respondents, 87 respondents (89.7%) had a good practice on FlexPen insulin injection technique. This is followed by 7 respondents (7.2%) with a poor practice on FlexPen insulin injection technique and 3 respondents (3.1%) had a moderate practice on FlexPen insulin injection technique. The mean of the level of practice on FlexPen insulin injection technique was 12.56 whereas the standard deviation was 3.024.

Table 6. Level of practice on FlexPen insulin injection technique among diabetic patients in Hospital USM (N=97).

Practice level	Frequency (N)	Percentage (%)	Mean (SD)
Good	87	89.7	12.56 (3.024)
Moderate	3	3.1	
Poor	7	7.2	

Table 7. Practice on FlexPen insulin injection technique (N=97).

No.	Steps	Perform	
		Yes N (%)	No N (%)
1.	Check the expiry date of the insulin.	56 (57.7)	41 (42.3)

2.	Wash the hands before injection.	76 (78.4)	21 (21.6)
3.	Choose a site for injection (at least 1 cm from previous injection site).	92 (94.8)	5 (5.2)
4.	Make sure no air bubbles before selecting the required insulin dose.	79 (81.4)	18 (18.6)
5.	Make sure that the dosage selector is at '0'.	97 (100.0)	0 (0.0)
6.	Select the required dose as prescribed by the doctors.	87 (89.7)	10 (10.3)
7.	Wipe the injection site with an alcohol swab or other disinfectants.	54 (55.7)	43 (44.3)
8.	Pinch the skin before inserting the needle.	92 (94.8)	5 (5.2)
9.	Insert needle smoothly into skin and press plunger until the button stop moving.	94 (96.9)	3 (3.1)
10.	Insert the needle according to the angle recommended by the doctors.	90 (92.8)	7 (7.2)
11.	Wait for 5-10 seconds before removing the needle from skin.	86 (88.7)	11 (11.3)
12.	Check to make sure you see a '0' in the dose window to confirm you receive the complete dose.	94 (96.9)	3 (3.1)
13.	Remove the needle from the skin at the same angle it is inserted into the skin.	90 (92.8)	7 (7.2)
14.	Press the injection site for a few seconds after injection.	88 (90.7)	9 (9.3)
15.	Dispose the needle into the sharp bin after injection.	43 (44.3)	54 (55.7)

Majority of the respondents practice a good level of FlexPen insulin injection technique. This was in line with the finding from Ahmad et al. (2016) whereby 86.8% of the respondents had appropriate insulin injection practice. However, the study also revealed that some of the diabetic patients prone to practice their own insulin injection technique that is different from the standard techniques. In comparison, a study by Khalid et al. (2018) in Muzaffarabad, Pakistan showed only 18% of their respondents practiced correct insulin injection technique. The differences might due to the inadequate teaching and guidance provided by the healthcare professionals in Muzaffarabad, Pakistan as stated in the study. Therefore, it is crucial for healthcare providers to identify the incorrect injection technique in every follow-up visit to help to improve glycemic control among diabetic patients.

More than half of the respondents in this study wiped the injection site with an alcohol swab or other disinfectants. The finding in this study contradicts with a finding from Tandon et al. (2017) whereby 72.42% of their respondents did not clean the injection site before the insulin injection. The injection site should be thoroughly cleaned starting from the center in a circular motion with an alcohol swab or other disinfectants. Even though 57.7% of the respondents in this study practiced wiping the injection site with an alcohol swab or other disinfectants, however, the frequency is not satisfactory. Hence, advice and recommendations should be given to diabetic patients to prevent injection site infection. According to Sangwan et al. (2019), the best site for insulin injection was the abdomen as it is easily reachable, and the insulin can be quickly absorbed.

Conclusion

Insulin injection is one of DM management that can help to maintain blood glucose level. Hence, it is very important for diabetic patients to have a proper technique to

inject the insulin so that unnecessary complications can be avoided. Diabetic patients who have improper insulin injection technique are caused by lack of related knowledge, awareness, and practice. Thus, this study provides an insight into the knowledge, awareness, and practice on FlexPen insulin injection technique and the association with socio-demographic characteristics among diabetic patients. In conclusion, the findings show that an adequate level of knowledge, awareness and practice is needed in order for the diabetic patients to self-administer insulin injection correctly. Therefore, continuous diabetic education such as through seminar or demonstration is important to ensure that the diabetic patients are updated and have proper FlexPen insulin injection technique. The nurses also play a vital role in giving health education and health promotion to improve glycemic control of diabetic patients. Future research shall explore the contribution of the nurses or other healthcare providers on the types of interventions that influence the knowledge, awareness, and practice on FlexPen insulin injection technique among diabetic patients. This is important to help to maintain useful interventions and modifying the ineffective interventions that are being used.

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Conflict of interest

Authors declare that the information provided above is correct and the manuscript submitted is original. We have no conflict of interest to declare and certify that no funding has been received in conducting this study and preparation of this manuscript.

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