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ASSESSMENT OF PATIENTS'AWARENESS ABOUT DIABETES MELLITUS DISEASE AND INSULIN UTILIZATION IN EASTERN REGION OF SAUDI ARABIA

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ABSTRACT

Background: Diabetes Mellitus (DM) is a chronic metabolic disorder that characterized by long-term hyperglycemia which lead to different complications. Diabetes Mellitus Type I is an autoimmune disorder characterized by destroying of insulin-producing pancreatic β cells. One of the most prescribed medications in the hospital is insulin, which can be a harmful medication if not used appropriately. There were 3.4 million cases of Diabetes in Saudi Arabia in 2015, in which 109.5 per 100,000 were diagnosed as Type I Diabetes Mellitus. **Objective:** to assess Type I Diabetic patient's awareness about Diabetes Mellitus disease and the insulin utilization. **Method:** A cross section study was conducted among 65 diabetic patients from 19 Jan 2016 to 5 May 2016. The questionnaire design based on the recent literature and updated American Diabetes Association (ADA) guidelines 2016. It consisted of 48 questions and distributed using different social media programs, also to community pharmacies or as oral interview in Eastern Region of Saudi Arabia. **Results:** Total of 65 patients filled the questionnaire, the majority were males 46 (75.38%) aged between 25 to 34 years 16 (24. 61%). The percentage of their awareness about the proper use of insulin and its common side effects was (71.06%) which indicated a high level of their awareness and (76.92%) aware about hypoglycemia symptoms and its treatment but they were unaware of the hyperglycemia symptoms and its treatment (20%). In addition, they were moderately aware about the blood glucose monitoring parameters (36.92%) and only (36.69%) of them aware about their recommended diet .There were only (29.74%) aware about the type and duration of exercise. Also, they were a moderately aware about diabetes mellitus disease

complications (45.89%). Their awareness about the recommend vaccination for diabetic patients was (31.75%), which reflect a moderate level of awareness. **Conclusion:** This study showed that Type I diabetic patients in eastern region of Saudi Arabia had a high level of awareness about insulin utilization and its side effects but they were moderately aware about diabetes mellitus complication and monitoring.

KEYWORDS: Type I, Diabetic mellitus, Patients, Awareness, Insulin.

1. INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder that characterized by long term hyperglycemia which lead to different complications such as retinopathy, nephropathy and neuropathy, as well as macrovascular complications such as cardiovascular diseases including atherosclerosis and hypertension. It can developed at any age even in the 8th and 9th decades of life but usually diagnosed in children and young adults.[1,2] Diabetes Mellitus I is an autoimmune disorder characterized by the destruction of insulin-producing pancreatic β cells, in which the body begins to kill its own insulin producing cells known as islet cells. A combination of genetic and environmental factors eventually leads to the loss of functional β cell mass.[3] This destruction begins years before the clinical manifestations of the disease become apparent. In newly diagnosed type 1 diabetic patients, the natural course of the disease is often characterized by transient restoration of beta cell function following initiation of insulin therapy. This period, often referred to as the "Honeymoon Period".[4]

Type 1 diabetic patients treated by insulin. One of the most common prescribed medications in the hospital is insulin. It can be a harmful if not used appropriately. It is a one of five high alert medications.[5] Insufficient awareness about insulin use can result in preventable complications, adverse patient outcome, poor adherence to therapy and invariably poor glycemic control.[6]

Poor control of fast blood glucose (FBG), random blood glucose(RBG) and H1Ac parameters for patient received insulin was shown in different clinics will lead to urgent hospital admissions for either diabetic ketoacidosis (DKA) or hyperglycemia event.[7]

This study was conducted to assess type I diabetic patients' awareness about Diabetes Mellitus disease and insulin utilization.

The rational of our study was the high percentage of DM disease in Saudi Arabia. Saudi Arabia is one of the 19 countries of the Middle East and North Africa region (MENA). 415 million people have diabetes in the world and more than 35.4 million people in the MENA Region; by 2040 this will rise to 72.1 million. There were 3.4 million cases of diabetes in Saudi Arabia in 2015, in which 109.5 per 100000 were type I.[8]

The uncontrolled blood glucose level by using insulin improperly which lead to the urgent hospital admissions and death (23,420 patients).[10]

The hypothesis for our study was the awareness of type I diabetic patients about diabetes mellitus disease and insulin utilization.

2. METHOD

A cross sectional study was conducted among 65 diabetic patients over 5 months period from 19 Jan 2016 to 5 May 2016. The questionnaire was designed based on the recent literature and updated American Diabetes Association (ADA) guidelines. It consisted of 48 questions either opened, closed end, or multiple choices questions to assess different parts of patient awareness like complications induced by DM, the recognition of hyperglycemia or hypoglycemia level and the patients action in both situations, insulin administration and its common side effects, and patient adherence. In addition, it included some questions regarding life style modification.

This questionnaire was distributed by different social media programs and in community pharmacies as an oral interview with diabetic patients after verbal consent was obtained. Patients were excluded if they had to leave before the questionnaire was completed. Adult patients (18 years of age or older) with conformed diagnosis of Type I diabetes mellitus and treated with insulin were eligible for this study.

Data were collected from the filled questionnaires and entered to Microsoft Excel 2011 for analysis. Study results were presented using percentages and frequencies.

3. RESULTS

Patients' characteristics and demographic data was shown in **(table 1).** Total of 65 patients filled the questionnaires, most of them were males 46 (75.38%) aged between 25 to 34 years 16 (24.61%) with a family history of diabetes mellitus disease 62 (95.4%). The DM disease

duration for most of the patients was more than 15 years 40 (61.53%). Most of responders suffered from hyperglycemia 46 (70.8%) followed by retinopathy 27 (41.5%).

Table (1): Demographic Data		
Demographic Data	**number**	**Percentage**
Age:		
18-24	**13**	20%
25-34	**16**	24.61%
35-44	**11**	16.92%
45-54	**10**	15.38%
55-64	**9**	13.84%
65 and more	**6**	9.23%
Educated level :		
Uneducated	**8**	12.30%
Primary school	**16**	24.61%
intermediate school	**8**	12.30%
High school	**14**	21.53%
Bachelor degree	**19**	29.23%
Gender :		
Male	**49**	75.38%
Female	**16**	24.61%
Occupational status :		
Without job	**39**	3.07%
Companies	**8**	12.30%
Security	**2**	3.07%
Teacher	**8**	12.30%
Engineer	**3**	4.61%
Administrative	**3**	4.61%
Officer	**1**	1.53%
Carpenter	**1**	1.53%
Type of DM disease:		
Type 1	**65**	48.1%
DM disease Duration :		
5 years or less	**2**	3.07%
5-10 years	**12**	18.46%
10-15 years	**11**	16.92%
More than 15 years	**40**	61.53%
Family history of DM disease:		
Yes	**62**	95.4%
No	**3**	4.6%
Number of members in family with DM disease:		
1	**17**	28.3%
2	**19**	31.7%
3	**15**	25%
4	**5**	8.3%
More than 4	**4**	6.7%
Diabetes Mellitus Complications		
Neuropathy	**20**	30.8%
Nephropathy	**4**	6.2%
Retinopathy	**27**	41.5%
Cardiovascular disease	**13**	20%
Hypoglycemia	**17**	26.2%
Diabetic ketoacidosis	**10**	15.4%

3.1 Insulin Utilization and Side Effects

The most frequent site of insulin injection was thigh 59 (90.76%) and forearm 40 (61.53%). the majority of patients were administered insulin by themselves 37(56.92%) and other responders needed a help from their sibling 26(40%). The most experienced side effect is hypoglycemia 42 (61.64%) followed by weight gain 28 (43.07%) **(table 2).**

Table(2):The Insulin Utilization and Side Effects

Insulin type	**Number**	**Percentage**
Long acting(glargine)	6	9.2%
Short acting with meal(aspart)	31	46.7%
Mixed insulin	28	43.07%
Insulin frequency per day		
Three times per day with each meal and at bedtime	37	24.02%
Twice per day at morning and night	27	41.53%
Other	1	1.54%
Insulin adherence		
Yes	57	87.69%
No	8	12.3%
Insulin side effects		
Hypoglycemia	42	64.61%
Increase weight	28	43.07%
Tissue atrophy	8	12.3%
Other	1	1.53%
Awareness about insulin administration		
Yes	62	95.38%
No	3	4.61%
Insulin injection site		
Thigh	59	90.77%*
Abdominal	36	55.38%*
Shoulder	40	61.53%*
Awareness level		**68.56%**
The angle of insulin injection		
45 C º	20	30.76%
90 C º	45	69.23%
Other	0	0%
Needle shape		
Insulin vial	16	24.61%
Insulin Pen	49	75.38%
The persons who help DM patient for insulin administration		
Siblings	26	40%
Parents	6	9.23%
By patient himself	37	56.92%
Insulin storage		

In refrigerator		
In room temperature(25-30 C º)	62	95.38% *
In room temperature regardless to actual temperature	2	3.07%
cabinet	0	0%
Other	1	1.53%
In refrigerator	0	0%
Strategy to prevent Skin atrophy		
Injection in different places	32	49.23% *
Separation of doses	0	0%
I don't know	32	49.23%
Change type of insulin	0	0%
Other	1	1.53%
***Total level of awareness**	**71.06%**	

3.2 Hypoglycemia Incidence in Type I Diabetic Patients

The number of patients were admitted to the hospital due to hypoglycemia event were once or twice per years 37(56.92%). The most common Hypoglycemic symptoms that were experienced by Type 1 diabetic patients were Drowsiness 44(67.69%), Blurred vision 17(26.15%), Sweating 39(60%) or Palpitation 29 (44.61%). The patient had different strategies to manage their hypoglycemic symptoms either by drinking juice 53(81.53%), eat candy 47 (72.30 %), or went to emergency department 22(33.84%), but no one has been received a glucagon kit. Those results were shown in **(table 3)**.

Table(3): Hypoglycemia Incidence

	Number	**Percentage**
Incidence of hypoglycemia events		
Yes	52	80%
No	13	20%
Number of hospital admission due to hypoglycemia per year		
1-2	37	56.92%
3-4	7	10.76%
>5	4	6.15%
Hypoglycemia symptom		
Drowsy	44	67.69%
Blurred vision	17	26.15%
Shiver	18	27.69%
Palpitation	29	44.61%
Syncope	13	30.76%
Warred and Tension	14	21.53%
Sweating	39	60%
Other	3	4.61%
Patient action during Hypoglycemia episode		
Drink juice	53	81.53%*****
Eat candy	47	72.30%*
Glycogen kit	0	0%
Went to ER	22	33.84%
***Total level of awareness**	**76.92%**	

3.3 Hyperglycemia Incidence in Type I Diabetic Patients

On other hand the number of patients were admitted to the hospital due to hyperglycemia event were once or twice per years 53(81.53%). The most sensible hyperglycemic symptoms were thirsty 35 (53.84%), frequent urination 48(73.84%), dry skin 30(46.15%), or fatigue 28(43.07%). The patient had different strategies to manage their hyperglycemia symptom either by taking two unit of insulin 23(35.38%), taking insulin according to blood glucose level 13(20%), or went to emergency department 34(52.30%). Those results were shown in **(table 4).**

Table(4) : Hyperglycemia Incidence

Incidence of hyperglycemia events	**Number**	**Percentage**
Yes	48	73.84%
No	17	26.15%
Number of hospital admission due to Hyperglycemia		
1-2	53	81.53%
3-4	7	10.76%
>5	3	4.61%
Hyperglycemia symptoms		
Dry skin	30	46.15%
Thirsty	35	53.84%
Frequent urination	48	73.84%
Blurred vision	20	30.76%
Fatigue	28	43.07%
Weight loss	8	12.30%
The smell of acetone	3	4.61%
Other	4	6.15%
Treatment of Hyperglycemia		
Taking two units of insulin	23	35.38%
Taking insulin according to blood glucose level	13	20%*****
went to ER	34	52.30%
***Total level of awareness**	**20%**	

3.4 Diabetes Mellitus Monitoring

The majority of responders were measured their blood glucose level at home 46(70.76%), where only 36(55.38%) patients were measure their blood glucose level in nearest health care center. Also, 23(35.38%) patients measure their blood glucose level three time per day. the number of patients who visited the clinic every three months were 47(72.30%). the majority of diabetic patients 44(67.69%) measure the random blood glucose for diseases monitoring. Only, 40(61.53%) patients had a knowledge about target random blood glucose level and only 18(27.69%) had a knowledge about target Hb1Ac.Those results were shown in **(table 5).**

Table (5): Diabetes Mellitus monitoring		
Clinical monitoring location	**Number**	**Percentage**
Health care Center	36	55.38%
Outpatients clinics	18	27.69%
At home	46	70.76%
No. of blood glucose reading in home		
1	3	4.61%
2	10	15.3%
3	23	35.38%*
More than 3	5	7.69%*
Awareness level	**21.53%**	
Follow up with physician		
Yes	60	92.30%
No	5	7.69%
The number of clinic visits per year		
Every month	6	9.23%
Every two month	5	7.69%
Every three month	47	72.30%
Every six month	5	7.69%
Not been following	1	1.53%
other	1	1.53%
Measuring parameters for diseases monitoring		
Fast blood glucose after 8 hour starvation	30	46.15%*
Random blood glucose before each meal	44	67.69%*
HbA1c	13	20%*
Awareness level	**44.61%**	
Awareness about glycemic control targets		
Random < 180 mg/dl	40	61.53%
FBG < 130 mg/dl	29	44.61%
HbA1c <7 %	18	27.69%
Awareness level	**44.61%**	
***Total level of awareness**	**36.92%**	

3.5 Diabetes Mellitus and Lifestyle Modification

Regarding diabetic patient awareness about recommended exercise, the majority of the patients 48(73.84%) prefer walking exercise. The duration of exercise is 15-30 minutes per day 19(29.23%). The diabetic patients who did not take insulin doses at all either before or after exercise 36(55.38%). Those results were shown in**(table 6).**

Table (6) : Exercise types and duration		
Commitment to exercise	**Number**	**Percentage**
Yes	28	43.07%
No	37	56.92%
Type of exercise		
Walking	48	73.84%*****
Trot	3	4.61%
Swimming	1	1.53%
Muscle strength and stretching	4	6.15%
Other	10	15.38%
Awareness level	**73.84%**	
Duration of exercise per day		
1-15 min	15	12.07%
15-30 min	19	29.23%
30-45 min	8	12.3%*
More than 45 min	0	0%
Awareness level	**12.3%**	
Strategy of take insulin with exercise		
Same dose of insulin before exercise with Measuring BG level	15	23.07%
Same dose of insulin after exercise with Measuring BG level	10	15.38%
Didn't take insulin doses at all	36	55.38%
Decrease dose of insulin before exercise with Measuring BG level	2	3.07%
Decrease dose of insulin after exercise with Measuring BG level	2	3.07%*****
Awareness level	**3.07%**	
***Total level of awareness**	**29.74%**	

Regarding diabetic patients awareness about their diet, only 24(36.92%) were aware that the recommended diet for diabetic patients must contain a low fat and carbohydrate contents but rich in vegetables with restricted type of fruits (mango, dates, figs and dried fruits). Only 31(47.69%) diabetic patients were aware about the proper action after taking a heavy meal (containing high amount of fat and carbohydrate) in which they must measure blood glucose level two hours after meal and change insulin dose based on the readings. Those results were shown in **(table 7)**.

Table (7): Mediterranean Diet Adherence		
Commitment to Mediterranean diet	**Number**	**Percentage**
• Yes	27	41.53%
• No	38	58.46154
Forbidden fruit		
• Grapes	37	56.92%*
• Figs	11	16.92%*
• Mango	40	61.53%*
• Peaches	5	7.69%*
• Dried fruit	19	29.23%*
• I do not know	13	20%
Awareness level	**34.45%**	
Awareness about balanced diet		
• It contains a high amount of fat, fruit, meat, vegetables and carbohydrate.	6	9.23%
• It contains a small amount of fat, fruit, meat, vegetables and carbohydrate.	21	32.30%
• It contains a high amount of fruits and vegetables a small amount of fat and carbohydrates	14	21.53%
• It contains a specific type of fruit is rich in vegetables and low in fat and carbohydrates	24	36.92%*
Awareness level	**36.92%**	
Patient action after taking meal containing high amount of fat and carbohydrates		
• Measuring the blood glucose level before a meal with change insulin dose	9	13.84%
• Measuring the blood glucose level after a 2 hours meal with change insulin dose	31	47.69%*
• Did not take insulin doses at all	24	36.92%
• Reduce the dose of insulin before the meal with Measuring the blood glucose level	0	0%
• Reduce the dose of insulin after the meal with Measuring the blood glucose level	1	1.53%
Awareness level	**47.69%**	
***Total level of awareness**	**39.69%**	

3.6 Diabetes Mellitus Complications

The diabetic patients were moderately aware about the most common diabetic mellitus complications such as renal failure 32 (49.23%), retinal hemorrhage 28(43.07%), cardiovascular disease 43 (66.15%), nerve damage 38 (58.46%), and blood clot in the brain 27(41.53%) but they unaware about deep vein thrombosis (DVT) as complication induce by diabetic mellitus disease. Those results were shown in **(table 8)**.

Table (8): The Assessment of Patient Awareness About DM complications

	Number	Percentage
• Renal failure	32	49.23%*
• Retinal hemorrhage	28	43.07%*
• Cardiovasculardisease	43	66.15%*
• Nerve damage	38	58.46%*
• stroke	27	41.53%*
• DVT	11	16.92%*
• Other	3	4.61%*
***Total level of awareness**	**45.89%**	

3.7 Vaccinations

Regarding the recommend vaccinations for diabetic patients, only 46(70.76%) were aware about necessary indicated influenza vaccine annually for diabetic mellitus patients but they were unaware at all about other recommended vaccination like hepatitis 7 (10.76%) and pneumococcal vaccine 9(13.84%). Those results were shown in **(table 9).**

Table (9): Patients Awareness about the Recommend Vaccination

Recommend Vaccination	**Number**	**Percentage**
Influenza	46	70.76%
Hepatitis	7	10.76%
Pneumococcal vaccine	9	13.84%
Other (no knowledge)	19	29.23%
The last time of influenza vaccination administrate		
1-30 days	1	1.54%
1-3 month	13	20%
3-6 month	12	18.46
More than 6 month	8	12.3%

3.8 Awareness Aspects

Regarding type I diabetic mellitus patients awareness aspects, the percentage of their awareness about a proper using of insulin and its common side effects (71.06%) and the hypoglycemia symptoms and treatment (76.92%) was high. The majority of patients were unaware about hyperglycemia symptoms and treatment (20%) and the type and duration of exercise (29.74%).

Most of them were moderate aware about monitoring parameters for diabetic mellitus disease (36.92%), the recommended diabetes diet (36.69%), Diabetes complications (45.89%) and recommended vaccinations (31.75%). The results were shown in **(table 10)**.

Table (10): The Awareness Aspects

	Percentage	**Level**
Proper insulin utilization and awareness about its	71.06%	High
Hypoglycemia symptom and treatment	76.92%	High
Hyperglycemia symptom and treatment	20%	Unawareness
Monitoring parameters of diabetic mellitusdisease	36.92%	Moderate
Exercisetypes and duration	29.74%	Unawareness
Mediterranean diet Adherence	39.69%	Moderate
Assessment of patient awareness about DM complications	45.89%	Moderate
Recommend Vaccinations	31.78%	Moderate
Total level of type I diabetic patients awareness	**44%**	**Moderate**

4. DISCUSSION

The knowledge about diabetic mellitus disease is the first way to protect the patients from the incidence and the progression of diabetic mellitus complications. In our study, the results showed a moderate awareness of diabetic patients about the diabetes mellitus disease and the proper use of insulin. In comparable study was performed in Saudi Arabia (Alkharj) that assessed the awareness level of diabetic patients in which more than half of them (51.9%) were males[11] and in our study most of them were male (75.38%). Only (46.1%) of diabetic patients aware about their recommended diet[11] while only (36.92%) of patients in our study aware about it.

Regarding physical activity, only (15.3%) of diabetic patients in comparable study were aware about it[11] but in our study only (29.74%) were aware. Only (48.9%) of diabetic patients were aware about the diabetes mellitus complications in comparable study[11] but only (45.89%) in our study were aware about the diabetes mellitus complications. Also, the awareness about home self-monitoring for blood glucose level in our study was (36.92%) but in comparable study performed in Eastern Saudi Arabia was (44.8%).[12]

In our study (76.92%) patients were aware about hypoglycemia symptoms and treatment while in other related study was performed in Makkah showed (35%) of diabetic patients had a good knowledge about hypoglycemia symptoms and treatment.[13]

The limitations of our study were a low sample size, performed in a limited region (Eastern), also some of distributed questionnaire were based on electronic survey and the majority of our responders were male.

The strength points for our study were the proper designing of the questionnaire to assess the most important aspects related to diabetes mellitus disease and the insulin utilization and it considered as the first study performed in Saudi Arabia to assess Type I diabetic patients awareness about diabetics mellitus disease and the insulin utilization.

5. CONCLUSION

This study showed that the type I diabetic patients had a high level of awareness about insulin utilization and it is side effects but a moderate level awareness about diabetes mellitus disease complication and monitoring.

Our recommendations for health care providers are to increase the knowledge of diabetic patients by implementing workshops, brochures and counseling them during the follow up clinical visits about the proper using of hypoglycemic agents and their common side effects and about the life style modifications. In addition, the implementation of educational centers for diabetic patients or education programs in a social media or in television channels will increase our community awareness about diabetes mellitus and its treatment.

For further researches, we recommend to design a similar study for different regions in Saudi Arabia to assess type II diabetic patients' awareness about diabetes mellitus disease and its treatment.

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