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## ASSESSMENT OF INSULIN INJECTION COMPLICATIONS AMONG PATIENTS WITH TYPE 1 DIABETES AND THE SUGGESTED GUIDELINES

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### Abstract:

Increasing the prevalence of DM has emergence of diabetes complications as a cause of early morbidity and mortality. **The aim** of present study was to assess the insulin injection complications among patients with T<sub>1</sub>DM, and suggest the nursing intervention guidelines for patients with T<sub>1</sub>DM. **Research design** used was descriptive exploratory study. **A purposive sample** included 100 patients diagnosed with T<sub>1</sub>DM from both genders. The study was carried out in outpatient clinics at Benha university hospital. **Two tools** were used to collect data; 1) Interview questionnaire sheet; it consisted of three parts A) Patients' demographic data , B) Patients' medical history, C) Patients' lifestyle assessment sheet, 2) Patients' assessment sheet; it consisted of two parts A) Assessment of patients' level of knowledge, B) Assessment of insulin injection complications. **The study results** revealed that more than two third of the studied patients (68%) had mild insulin injection complications and nearly one third (32%) had moderate insulin injection complications, most of patients (75%) had unsatisfied level of knowledge about the disease, complications, and management, and more than half of patients (59%) had unhealthy lifestyle pattern. It can be **concluded** that there was a statistical significant difference between patients' total systematic insulin injection complications in relation to their personal data including age, residency, and level of educations, also there was a statistical significant difference between patients' total systematic insulin injection complications in relation to onset of insulin injection treatment ( $p < 0.05$ ). The studied patients' total local and systematic insulin injection complications correlated negatively with their total lifestyle pattern and total level of knowledge with statistical insignificant differences ( $P > 0.05$ ). **The study recommended** application of guiding educational and cultural programs for patients with DM to improve their knowledge about treatment regimen, correct insulin injection technique, complications, and its preventive and curative management.

**Key words:** Benha, nursing, diabetes mellitus, insulin injection complications, lifestyle.

### Introduction:

Diabetes mellitus (DM) is a complex, chronic illness requiring continuous medical care with multifactorial risk reduction strategies beyond glycemic control. Ongoing patient self-management education and support are critical to preventing acute

complications and reducing the risk of long-term complications (*American Diabetes Association (ADA), 2014*).

The estimated worldwide prevalence of diabetes of all types was 285 million adults in the year 2010, and is projected to rise to 439 million

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in 2030. Specifically, in the United States, the American Diabetes Association estimated the prevalence of diabetes to be 25.8 million (8.3% of the country's population) during 2007 (*Shaw, Sicree, and Zimmet, 2010*).

According to *David, (2011)* DM is classified into four broad categories: T<sub>1</sub>DM, T<sub>2</sub>DM, gestational diabetes, and other specific types. The T<sub>1</sub>DM (Immune-mediated diabetes); this form of diabetes, previously encompassed by the terms insulin-dependent diabetes, or juvenile-onset diabetes, results from a cellular-mediated autoimmune destruction of the  $\beta$ -cells of the pancreas, age of onset usually younger than 30 years and can occur at any age, , and onset is usually abrupt with rapid onset of hyperglycemia, patients often present with acute symptoms of diabetes and markedly elevated blood glucose levels, and some cases are diagnosed with life-threatening ketoacidosis (*Redondo, Jeffrey, Fain, Eisenbarth, and Orban, 2008*).

The T<sub>1</sub>DM is caused by destruction of the insulin-producing pancreatic islet cells, over time, as more and more pancreatic islet cells become damaged, the body's insulin levels begin to drop. Eventually, the body no longer is capable of producing enough insulin to properly manage blood glucose regulation, resulting in hyperglycemia, or elevated levels of glucose in the blood. In some cases, however, patients' experience what is referred to as a "honeymoon period" shortly after T<sub>1</sub>DM is diagnosed, during which the patient's diabetic

symptoms seem to go away for a period of a few months to a year, insulin needs can become minimal during this time, and some patients may indeed find they can maintain normal or near-normal blood glucose levels with little or no insulin administration (*Donna&Linda, 2013*).

The hallmark symptom of T<sub>1</sub>DM is hyperglycemia, which is defined as blood glucose levels >130 mg/dL in the fasting state or >180 mg/dL after meals. However, hyperglycemia is a symptom of both T<sub>1</sub>DM and T<sub>2</sub>DM and therefore cannot be used to aid in the differentiation of these conditions. In addition to hyperglycemia, the most common symptoms of T<sub>1</sub>DM are Polyuria (increased urination), polydipsia (increased thirst) and polyphagia (increased appetite) (*Smith&Cockrell, 2013*).

There is presently no cure for T<sub>1</sub>DM; instead, it is a chronic and lifelong condition that requires patients to adhere to a prescribed diet and therapeutic regimen. With faithful adherence, patients with T<sub>1</sub>DM may live a long life and experience less frequent and less severe diabetes-related complications. This adherence include lifelong commitment of patients to frequent monitoring of blood glucose levels, taking regular doses of insulin, following a diet designed to manage blood sugar levels and participating in an active exercise routine and maintaining hygienic care (*Donna& Linda, 2013*).

According to current ADA recommendations, most people with

T<sub>1</sub>DM should be treated with multidose insulin injections (3 to 4 injections per day of basal and preprandial insulin) or continuous subcutaneous insulin infusions (via insulin pump) to manage blood glucose levels. In addition, people with T<sub>1</sub>DM should be taught how to match preprandial insulin doses to planned carbohydrate intake, premeal blood glucose, and anticipated activity levels to help maintain target blood glucose levels (*Khadori & Griffing, 2013 and ADA, 2013*).

Despite the benefits of insulin therapy, many people with diabetes don't adhere to treatment. Some avoid insulin therapy or refuse to start it. A recent study found more than a third of the roughly 25 million Americans with diabetes don't take insulin as prescribed and 20% intentionally skip some doses, which can lead to serious health risks. Incorrect injection technique can lead to unpredictable absorption, causing hypoglycemia or hyperglycemia. Other potential problems include lipohypertrophy or lipatrophy. It is recommended that as much attention is given to injection technique as to the agent being injected (*Pledger, Hicks, Kirkland, and Down, 2012*).

**Significance of the study:**

The DM has long been considered a disease of minor significance to world health, but is now developing into one of the main public health challenges for the 21st century (*Masur, Thévenod, and Znker, 2008*). The DM remains an incurable disorder which is associated with poor

quality of life, cardiovascular complications, increased mortality and morbidity. The recent statistics shows that the global prevalence of this disorder continues to rise unabated and thus becoming an epidemic (*Diabetes Control and Complications Trial, 2009*)

patients present with uncontrolled hyperglycemia which can be managed only with insulin therapy, besides the existing challenges in the management of uncontrolled diabetes and its related complications, another difficulty which is commonly faced by the nursing staff and the physicians, is the lack of awareness regarding insulin injection techniques; in appropriate insulin injection practices can lead to various clinical complications such as poor glycemic control, pain, bleeding and bruising, breaking and lodging of needle tip beneath the skin, contamination leading to infection, and in accurate dose administration (*Bajwa, Kalra, Baruah, and Bajwa, 2013*).

**Aim of the study:**

The present study was conducted to fulfill the following aim:

- Assess the insulin injection complications among patients with type 1 diabetes.
- Suggest the nursing intervention guidelines for patients with type 1 diabetes.

**Research Question:**

- Is there insulin injection complications among patients with type 1 diabetes?

- Is there a relation between insulin injection complications and patients' demographic data?
- Is there a relation between insulin injection complications and patients' lifestyle?
- Is there a relation between insulin injection complications and patients' knowledge?
- Is there a relation between insulin injection complications and period & doses of insulin injection?

**Subjects and methods:**

**Research design:**

A descriptive exploratory design was utilized in this study.

**Research Setting:**

The study was conducted in outpatient clinics at Benha University Hospital in medical clinic which concerned with caring of medical and diabetic patients.

**Subjects:**

A purposive sample of 100 patients diagnosed with T<sub>1</sub>DM. Subjects were recruited for the study with the following inclusion criteria, adult patients (T<sub>1</sub>DM) treated with insulin therapy (subcutaneous insulin injection) for more than one year, both gender, able to communicate and agree to participate in the study. The exclusion criteria were Patients with diabetes under 18 years old, patients with any skin problem, mentally retarded patients and obese patients.

**Tools for Data Collection:**

Three tools were piloted and used by the researcher to collect data including:

**Tools for data collection:**

Two tools were piloted and used by the researcher to collect data including:

**Tool I: Interview Questionnaire sheet;** which consisted of 3 parts:

**Part 1: Personal Data:**

It was composed of (8) closed ended questions including (age, sex, marital status, residence, level of education, occupation, income, received training programs).

**Part 2: Patients' Medical History:** it consisted of three parts:

**(A) Past Medical History:**

it was composed of (2) questions including (duration of the disease, onset of insulin injection treatment).

**(B) Family history:**

it was composed of (2) questions including (family history of diabetes, degree of relatively).

**(C) Present history:**

it was composed of (10) questions including (complications of diabetes, type of complications, other medication taken with insulin injection, allergy to any drug, number of follow up in outpatient clinic, rate of testing blood glucose level, way to test blood glucose level, insulin self injection, who teach correct technique, who inject insulin if not self injection).

**Part 3: Patients' lifestyle assessment sheet:**

it was composed of six domains including (27) questions about patients' lifestyle pattern including; diet (4 questions), exercise (5 questions), medication (6 questions),

smoking (3 questions), stress (4 questions), and hygiene (5 questions).

**Tool II: Patients' assessment sheet;** it consisted of two parts:

**Part 1: Patients' knowledge questionnaire sheet:**

It consisted of (32) questions about patients' knowledge about insulin injection complications, and the nursing intervention assessment. It was formed of multiple choice questions.

**Part 2: Assessment the insulin injection complications:**

It developed by the researcher, constructed and reviewed utilizing the most recent and relevant literature Which includes complications of insulin injection that the patients suffering from. It includes two main domains; local complications (10 items) and systematic complications (8 items).

**Pilot study:**

A pilot study was conducted on group 10 patients with DM in order to test the clarity and applicability of the study tools. Required modifications were done in the form of adding or omission of some questions.

**Administrative design:**

An official permission to carry out the study was obtained by submission of official letters from the dean of

faculty of nursing Benha University to the director of Benha University Hospital, head of nursing, and head nurse of outpatient clinics.

**Ethical consideration:**

Ethical approval was obtained from the Scientific Ethical Committee of Benha University. The purpose of the study was explained to the patients and oral consent was obtained from them to participate in this study. They were given an opportunity to withdraw from the study without given a reason and they were assured that anonymity and confidentiality of information was protected. Ethics, values, culture, and beliefs were respected.

**Statistical analysis:**

The obtained data were organized, categorized, analyzed through a personal computer using the statistics package for social sciences(SPSS).Data were presented using descriptive statistics in the form of frequencies and percentages. Statistical significance was considered at  $P \leq 0.05$ , highly significance  $P < 0.001$  and insignificant was considered at  $P > 0.05$ . Also cronbach's alpha test was used to test the reliability of the tool.

**Result:**

**Table (1):** Frequency and percentage distribution of personal characteristics of the studied patients (n=100).

<b>Sociodemographic Characteristics</b>	<b>Frequency</b>	<b>%</b>
<b>Age groups (in years)</b>		
18 - <30	11	11.0
30- <40	11	11.0
40-<50	16	16.0
≥50	62	62.0
	11.69±SD	49.75±Mean
<b>Gender</b>		
Male	41	41.0
Female	59	59.0
<b>Residence</b>		
Urban	14	14.0
Rural	86	86.0
<b>Marital status</b>		
Single	5	5.0
Married	82	82.0
Divorced	3	3.0
Widowed	10	10.0
<b>Level of education</b>		
Illiterate	42	42.0
Read & write	14	14.0
Secondary education	35	35.0
University education	9	9.0
<b>Occupation</b>		
Not working	17	17.0
Retired	9	9.0
Housewife	40	40.0
Written work	18	18.0
Professional work	16	16.0
<b>Monthly Income</b>		
Enough	45	45.0
Not enough	55	55.0
<b>Received training programs of insulin injection</b>		
Yes	4	4.0
No	96	96.0
<b>Type of received training programs</b>		
		n=4
Lecture of protection from diabetes complications	2	50.0
Lecture on diabetes	2	50.0

The characteristics of the study sample are described in table (1): illustrates that more than two third (47%) of studied subjects were in age

group from 55 years to 65 years, with mean  $56.6 \pm 10.5$ , and (41.0%) of them were illiterate, respectively.

**Table (2):** Frequency and percentage distribution of studied patients in relation to their past and family history (n=100).

Past and family history	Frequency	%
<b>Duration of diabetes mellitus</b>		
1<3Y	6	6.0
3<5Y	7	7.0
>5Y	87	87.0
<b>Onset of insulin injection treatment</b>		
1<3y	6	6.0
3<5y	7	7.0
≥5y	87	87.0
<b>Family history of diabetes</b>		
Yes	76	76.0
No	24	24.0
<b>Degree of relatively</b>		
	n=76	
First degree	42	55.3
Second degree	34	44.7

This table showed that, most of diabetic patients (87%) had diabetes and treated with insulin injection for more than five years, and also(76%)

of them had family history of diabetes with more than one third of them(55.3%) had first degree of relatively.

**Table (3):** Frequency and percentage distribution of studied patients according to their level of knowledge (n=100).

Total knowledge Score	Unsatisfactory		Satisfactory	
	No	%	No	%
Total level of knowledge of the studied patients	75	75.0	25	25.0

Table (3): shows the levels of knowledge of the studied subjects. This table showed that three quarters of the studied patients (75%) had

unsatisfactory level of knowledge, and only one quarter of them (25%) had satisfactory level of knowledge.

**Table (4):** Frequency and percentage distribution of diabetic patients according to their total lifestyle items (n= 100).

Total lifestyle Items	Healthy lifestyle		Unhealthy lifestyle	
	N	%	N	%
Diet	84	84.0	16	16.0
Exercise	9	9.0	91	91.0
Medication	51	51.0	49	49.0
Smoking	97	97.0	3	3.0
Stress	46	46.0	54	54.0
Hygiene	81	81.0	19	19.0
Total lifestyle	41	41.0	59	59.0

This table showed that more than one third of the studied patients (41%) had healthy lifestyle pattern.

**Table (5):** Frequency and percentage distribution of the studied patients according to their insulin injection complications (n=100).

Complications Items	Occurred		Not occurred	
	N	%	N	%
<b>Local insulin injections complications</b>				
Lipoatrophy	45	45.0	55	55.0
Lipohypertrophy	92	92.0	8	8.0
Bleeding and bruising	15	15.0	85	85.0
Leakage of insulin	19	19.0	81	81.0
Inflammation of injection site	32	32.0	68	68.0
Infection of injection site	4	4.0	96	96.0
Low sensitivity to injection pain	35	35.0	65	65.0
Pain of injection rotated site	77	77.0	23	23.0
Peripheral edema	31	31.0	69	69.0
Local allergic reaction	28	28.0	72	72.0
<b>Systematic insulin injections complications</b>				
Hypoglycemia	63	63.0	37	37.0
Somogyi effect	36	36.0	64	64.0
Dawen phenomenon	22	22.0	78	78.0
Hyperglycemia	94	94.0	6	6.0
DKA	45	45.0	55	55.0
HHNK syndrome	0	0	100	100.0
Drug interaction	2	2.0	98	98.0
Insulin resistant	17	17.0	83	83.0
<b>Total insulin injection complications</b>	<b>Total insulin injection complications</b>			
	<b>N</b>	<b>%</b>	<b>Mean ± SD</b>	
No insulin injection complications	0	0.0		
Mild insulin injection complications	68	68.0	30.6 ± 1.3	
Moderate insulin injection complications	32	32.0	26.9 ± 1.5	
Sever insulin injection complications	0	0.0		



This table showed that more than two third of the studied patients (68%) had mild insulin injection complications and nearly one third (32%) had moderate insulin injection complications.

**Table (6) :** Association between the studied patients' total local and systematic insulin injection complications and their personal characteristics (n=100).

Sociodemographic Characteristics	Total insulin injection complications	Test of significance	Total systematic insulin injection complications	Test of significance
	Mean ± SD		Mean ± SD	
<b>Age groups (in years)</b>				
18 - <30	16.4±0.9	One Way Anova F= 0.50 P= 0.68	12.8±1.5	One Way Anova F= 3 P= 0.033*
30- <40	16.4±1.2		14±1.3	
40-<50	16.3±1.2		13.5±1.1	
≥50	16±1.3		13±1.2	
<b>Gender</b>				
Male	16.1±1.2	t= -0.03 P= 0.97	13.1±1.3	t=-0.49 P= 0.620
Female	16.2±1.2		13.3±1.4	
<b>Residence</b>				
Urban	16.1±1.1	t= -0.17 P= 0.85	12.6±1.6	t= 1.74 P= 0.054*
Rural	16.2±1.3		13.2±1.2	
<b>Marital status</b>				
Single	16.8±1.09	One Way Anova F= 0.87 P= 0.45	13.6±2	One Way Anova F= 0.77 P= 0.50
Married	16.1±1.2		13.2±1.2	
Divorced	17±1		13.6±0.5	
Widowed	16.3±1.8		12.7±1.7	
<b>Level of education</b>				
Illiterate	16.1±1.3	One Way Anova F=0.97 P=0.406	12.9±1.1	One Way Anova F= 2.6 P= 0.054*
Read & write	16±1.5		13.4±1.3	
Secondary education	16.1±1		13.1±1.2	
University education	16.8±1.1		14.2±1.4	
<b>Occupation</b>				
Not working	16.2±1.2	One Way Anova F=0.16 P=0.95	13.1±1.1	One Way Anova F= 1.9 P= 0.10
Retired	16±1.4		12.4±1.2	
Housewife	16.2±1.3		13.1±1.2	
Written work	16±1.2		13.8±1.2	
Professional work	16.3±1.1		13±1.4	
<b>Monthly Income</b>				
Enough	16±1.4	t= -0.78 P=0.43	13±1.5	t= -1.2 P=0.21
Not enough	16.2±1.1		13.3±1.1	
<b>Received training programs</b>				
Yes	16±0.81	P= 0.75	12.2±1.5	t= -1.4
No	16.2±1.2	t= -0.31	13.2±1.2	P= 0.13

\* Significant (S)  $p \leq 0.05$

Insignificant (S)  $p > 0.05$

This table showed that there was statistical significant difference between the studied patients' total systematic insulin injection complications in relation to their age, residency, and level of education ( $p \leq 0.05$ ).

**Table (7)** Association between the studied patients' total local and systematic insulin injection complications and onset of insulin injection treatment, and number of insulin injections per day (n=100).

Items	Total insulin injection complications	Total local insulin injection complications	Test of significance	Total systematic insulin injection complications	Test of significance
		Mean ± SD			
<b>Onset of insulin injection treatment</b>					
1<3y		16.3±1.5	One Way Anova F= 1.3 P= 0.27	13.7±1.4	One Way Anova F= 3.4 P= <b>0.037*</b>
3<5y		16.6±1.1		13.8±1	
≥5y		16.1±1.2		13±1.2	
<b>Number of insulin injections per day</b>					
One dose		16.5±1.4	One Way Anova F= 1.1 P= 0.33	13.2±1.4	One Way Anova F= 0.55 P= 0.57
Two doses		16.1±1.2		13.2±1.2	
Three doses		15.8±1.1		12.6±1.8	

\* Significant (S)  $p \leq 0.05$

Insignificant (S)  $p > 0.05$

This table showed that there was statistical significant difference between the patients' total systematic insulin injection complications in relation to onset of insulin injection treatment ( $p < 0.05$ ).

**Discussion:-**

The findings of the present study revealed that, more than half of the studied patient ages were more than 50 years old with mean (standard deviation) was 49.75 (11.69) this is in accordance with **Clark et al (2011)** who reported that mean age of his studied subjects was 39 years (range 20–55 years), also **Hirsch(2012)**who reported that age of his studied subjects ranged from 19 to 74 years (mean 55.6 years), also this is in accordance with(**Butalia, et al,2013**) who reported that mean (standard deviation) age in his studies was 40.0 (15.8) years,

As regard to gender, the results of the present study showed that, female

patients represent more than half of the study sample; this finding was in agreement with many studies in which the higher incidence of T<sub>1</sub>DM was among females **Selim (2000), Abu-Samara (2005), Abd El-Aziz (2007), Hassan (2007), and Nafee and Awad (2008)**. Also **Munib,(2009),Moustafa, (2011), Abd El-monem, (2012) and Hirsch (2012)** all reported that more than half of their studies patients were female, also **Riaz, (2014)**reported that the majority of his studied patients were female.

Regarding residence, the results of this study revealed that more than three quarters of the study sample were from rural area, this finding in agreement with findings of **Abdel Hamid, (2005), Abu-Samara, (2005), Abd El-Aziz, (2007), and Galal, (2012)**who reported that, more than half of their subjects were from rural areas.

In relation to marital status, the study findings showed that, more than

three quarters of patients were married, this finding is agreement with **Hassan (2007)** and **Galal (2012)** who mentioned that the majority of their studied patients were married, and this finding might be due to same age groups of the studied sample.

Concerning educational level of the studied sample, the result of current study showed that the minority of patients had completed university degree and more than one third of them were illiterate. This in accordance with **Abdel Hamid (2005)** who reported that most of his studied sample were illiterate, and **Galal (2012)** who reported that one half of his studied sample could just read and write while the minority of them had completed university degree. Also this finding in accordance with **Riaz, (2014)** who reported that about half of his studied subjects had primary education as the highest level of education attained.

In relation to patients' occupation, the study finding showed that nearly two third of the studied patient were not working (not work& retired& housewife) this finding in accordance with **Galal (2012)** who reported that more than one half of his studied patients were not working. These may be related to gender or complications occurred.

Regarding income, the study finding showed that more than half of study sample had not enough monthly income. This finding is in agreement with **Wong et al (2003)** who found adolescents who lived in shared home more exposed to disease because they

have not enough money for treatment and care and **Galal (2009)** who reported that more than half of his patients had not enough monthly income.

Regarding receiving training programs, the study finding showed that the majority of the studied patient hadn't receiving any training programs, this finding in agreement with **Attia, (2012)** who reported that more than half of caregivers of school children with T<sub>1</sub>DM haven't receiving any training programs.

As regard to duration of diabetes, the present study revealed that most of studied patients had diabetes and treated with insulin injection for more than five years, this finding in agreement with **Munib(2009), Moustafa (2011), Attia (2012)and Galal (2012)**who reported that their studied subjects had disease for duration ranged from one up to ten years, this finding supported by **Abd El-Ghaffar(2003)** and **Abd El-Aziz (2007)**who reported that duration of diabetes among diabetic adolescents ranged from 1 to 12 years.

As regard to family history of diabetes, the present study revealed that three quarters of studied patients were having positive family history of diabetes, and more than half of them having first degree relativity, this finding is in agreement with **Ratzan (2000), Cho (2003), and Abdel Hamid (2005)** who reported that diabetes should be suspected with a strong family history of diabetes. Also this finding is in agreement with **Abd El-Aziz (2007)** who reported that

diabetic adolescents had a positive family history of the disease, and **Rewers et al(2010)** who reported that, diabetes mellitus should be suspected in children with a strong family history of diabetes.

The current study revealed that more than one third of the studied patients had followed healthy lifestyle pattern, this finding in accordance with **Shobana, (1999)** who reported that only one third of his study respondents were following dietary prescriptions regularly. Additionally this finding in agreement with several studied done by **Hammed (2001), Moustafa (2011), Attia (2012), and Galal (2012)** all reported that there was significantly improvement in the reported dietary management among the studied subjects after implementing the self care programs.

Regarding the studied patients level of knowledge the current study revealed that three quarters of studied patients had unsatisfactory level of knowledge, and only one quarters had satisfactory level of knowledge, this finding in agreement with **Attia (2012)**who reported that more than half of his studied subjects had average knowledge, and minority revealed good knowledge this finding in agreement with **Galal (2012)**who reported that there was a highly statistically significant difference in total knowledge scores of diabetic patients with an extremely significant difference in mean knowledge scores after applying the education program.

Concerning insulin injection complications; more than two third of

the studied patients had mild insulin injection complications and nearly one third had moderate insulin injection complications; this finding is in accordance with several studies reported that hypertrophy was the most common cutaneous complications of insulin therapy; **Chowdhury and Escudier( 2003), Richardson and Kerr (2003), Villiers(2006), Vardar and Kizilci (2007), Munib(2009), and Cunningham (2013).** who reported that over time, areas of lipohypertrophy and lipoatrophy, bruising, bleeding can develop as complications for insulin injection.

Concerning relation between patients' total local and systematic insulin injection complications in relation to their personal characteristics the present study revealed that there was a statistical significant difference between patients' total systematic insulin injection complications in relation to their age, residency, and level of education this finding was supported by **Torrance, (2008)** who reported that international guidelines identified the following points as important factors when considering insulin injection technique: injection sites, needle length, age of patient, gender of patient, BMI and pinch up, **Dunning, (1998)** who reported that number of factors complicated the diagnosis and management of possible insulin allergy: were patient's psychological history, and the long duration of insulin treatment before any localized reaction was reported. Also **Riaz, (2014)**who reported that some of the sociodemographic and service related

factors are influencing the patient compliance, factors found to be significantly associated with non adherence of diabetic patients were cost of insulin, occupation of respondent's mother, family history of diabetes, poor understanding of prescription, irregularity of follow up, and fear of insulin.

A statistical significant difference was observed between patients' total systematic insulin injection complications in relation to onset of insulin injection treatment, this finding was supported by **Conrad and Ferry (2014)** who reported that short term overdosing of insulin causes short term insulin resistance, it has been hypothesized that chronic high dosing contributes to more permanent insulin resistance, if insulin resistance exists, more insulin are needs. If this compensatory increase does not occur, blood glucose concentrations increase. Also **(AACE)2013** reported that the A<sub>1c</sub> target must be individualized based on numerous factors such as duration of diabetes,

#### **Conclusion**

The current study concluded that, more than two third of the studied patients had mild insulin injection complications and nearly one third had moderate insulin injection complications. There was statistical significant difference between patients' total systematic insulin injection complications in relation to their personal characteristics including age, residency, and level of education, and onset of insulin injection treatment ( $P < 0.05$ ).

#### **Recommendations:**

**According to results of the current study, the following suggestions are recommended:**

- (1) Periodic health teaching programs for diabetic patients and family including diabetes self management, education of correct insulin injection technique and insulin injection complications and its preventive and curative management, and clinical management to improve their management of the disease.
- (2) Prospective follow up studies are needed to develop and refine intervention to improve compliance of diabetic patients and prevention of short and long term complications.
- (3) Emphasizing the importance of more prospective studies to shed light on the factors that hinder the glycemic control of diabetic patients and their adherence with insulin therapy and how to overcome them to ensure their compliance.
- (4) Further studies on insulin injection complications to evaluate the important of including the suggested nursing management guidelines on the patient's care including complications.

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