Adherence of Patients with Insulin Dependent Diabetes to Therapeutic Regimen

Hanan Elsayed Ali Abdu EL- Aal*, Mervet Abdelfatah Mohamed, Amna Yehia Saad
Department of Medical Surgical Nursing, Faculty of Nursing, Alexandria University
*Corresponding author: Hanan Elsayed Ali Abdu EL- Aal, Mobile: (+20) 01001737446,
E-Mail: hanan.mehanaa@yahoo.com

ABSTRACT
Background: Diabetes mellitus is a metabolic disorder with varied etiologies characterized by chronic hyperglycemia and carbohydrate, fat and protein metabolism disorders caused by insulin secretion defect, insulin action or both. People with diabetes also have an increased risk of other diseases, including heart, peripheral, arterial and cerebrovascular disease.
Objective: This study aimed to identify adherence of patients with insulin-dependent diabetes to therapeutic regimen.
Patients and methods: A descriptive research design was used to accomplish the aim of the present study. A convenience sample of 150 adult patients who were admitted to the study. The study was conducted at the Diabetic-Outpatient Clinic at Shark El Madina Hospital in Alexandria. Outpatient clinic was working 6 days per week from Saturday to Thursday from 9 am to 1 pm.
Results: There was a highly statistical significant relation between patient's age, sex, level of education, monthly income and overall adherence to therapeutic regimen ($p < 0.05$). The highest percentage of the studied patients who had good adherence to therapeutic regimen were aged 40 -50 years old, female patients, university educated and had enough income (63.9%, 52.7%, 62.1%, and 75% respectively). Overall adherence barriers were moderate in the patient's age group of 50-60, male, manual occupation, divorced, secondary educated and who hadn't have enough income (65.4%, 55.9%, 71.1%, 71.4%, 70% and 63% respectively).
Conclusion: Based on the study findings, it can be concluded that, more than half of the studied patients were fair adherent to diabetic diet, and more than two thirds of them were good adherent to medication.
Keywords: Adherence of Patients, Diabetes mellitus, Insulin, Congestive heart disease.

INTRODUCTION

Diabetes may be categorized as Type 1, Type 2, gestational diabetes and specific types of diabetes due to other causes, e.g. monogenic diabetic syndromes [such as neonatal diabetes and maturity-onset diabetes of the young (MODY)], exocrine pancreatic diseases (such as cystic fibrosis) and drug- induced or chemical-induced diabetes [such as glucocorticoid use, for HIV / AIDS treatment, after surgery or after transplantation of the organ (stress diabetes)] [1].

Burnier and Vrijen [2] defined adherence to the therapy as the extent to which an individual's behavior in taking medication, following a diet, and/or undertaking lifestyle changes, compatibles with accepted recommendations from a healthcare provider. Also **Ganiyu et al.** [3] added that adherence is described as the patient's active, voluntary, and collaborative involvement in a mutually satisfying course of behavior to achieve a therapeutic outcome.

Patients typically follow a self-management regimen that includes frequent self-monitoring of blood glucose (SMBG), dietary modifications, physical activity, education, medication administration, and foot care to maintain adequate glycemic control. Collaboration and negotiation with health care providers, family members, and others are important to ensure that such behavioral changes are optimally supported and encouraged the numerous lifestyle modifications that are of vital importance in the management of diabetes

[4]. Variables that have been considered to be correlates of various adherence behaviors in diabetes can be organized into four clusters: treatment and disease characteristics; intra-personal factors; inter-personal factors; and environmental factors [5].

Ejeta et al. [6] stated that non-adherence to the patients typically follow a self- therapeutic regimen leading to inadequate metabolic function, contributing to acute and long term complications. There are four main acute complications of diabetes involved with short-term imbalances in blood glucose levels, which include hypoglycemia, diabetic ketoacidosis (DKA), hyperglycemic nonketotic coma or hyperglycemic hyperosmolar syndrome (HHNS) and metformin associated lactic acidosis (MALT).

Long-term diabetes complications can influence nearly all body systems. The general categories of chronic diabetic complications are macrovascular and microvascular diseases. Chronic micro vascular includes nephropathy, retinopathy and neuropathy. Diabetes ' macro-vascular diseases include congestive heart disease (CHD), peripheral vascular disease and stroke. To improve the quality of diabetic treatment, including better metabolic control and diab etic selfmanagement, it is necessary to determine barr iers to diabetic management [7].

The goal of management is to control hyperglycemia, to maintain general health, psychological and emotional satisfaction, and to prevent acute and chronic complications. The aspect of management

should include self-care behaviors involved in achieving adequate metabolic regulation and preventing long-term complications such as home glucose monitoring (in blood or urine), modification of food intake, especially of carbohydrates, to meet daily needs and match available insulin, drug administration (insulin or oral hypoglycemic agents), regular physical activity; foot care, regular medical monitoring visits and other behaviors (i.e. dental care, proper clothing, etc.) may vary based on the type of diabetes [8].

Caraceni *et al.* [9] added that evidence suggests that improved adherence to medication and lifestyle as part of self-management improves metabolic control and reduces complications, increases life expectancy and reduces morbidity in people living with diabetes. Healthcare providers can play an important role in assessing the risk of non-adherence and providing intervention to optimize adherence [9].

AIM OF THE STUDY
Identify adherence of patients with insulin-dependent diabetes to therapeutic regimen.

MATERIALS AND METHOD

Materials:
Research design: A descriptive research design was used to accomplish the aim of the present study.
Setting: The study was conducted at the Diabetic-Outpatient Clinic at Shark El madina hospital in Alexandria. Outpatient clinic was working 6 days per week from Saturday to Thursday from 9 am to 1 pm. The clinic is composed of one room that contains one bed for patients' examination.
Subjects:
A convenience sample of 150 adult patients were admitted to the above mentioned settings were comprised the study subjects. The study sample was calculated based on Epi info program using the following parameters.
1. Population size: 900 (the number of patients who repeatedly visit the diabetic-outpatient clinic from the outpatient clinic records.
2. Expected frequency: 50%
3. Acceptable error: 10%
4. Confidence coefficient: 95%
5. Minimum sample size: 140

Subjects were considered eligible to participate in the study if they met the following criteria:
▪ Adult patients diagnosed with IDDM aged from 20 to 60 years.
▪ Adult patients diagnosed with IDDM for at least 6 months.
▪ Able to communicate verbally.
▪ Willing to participate in the study.

Tool:
One tool was used for data collection in the current study.
"Adherence of patients with insulin-dependent diabetes mellitus to therapeutic regimen structured interview schedule". This tool was developed by the researcher based on a thorough review of recent related literature [15]. It aimed to identify the adherence of patients with IDDM to therapeutic regimen. It consisted of two parts:
Part I: included items related to socio-demographic and clinical data:
a) Patients' Socio-demographic data included; the patient's personal data such as: patient's age, sex, marital status, educational status, residence, occupation, and monthly income.
b) Clinical data included; the patient's diagnosis, duration of diabetes, duration of treatment, presence of other chronic diseases of DM, type of insulin, and number of daily injections, clinic attendance, current symptoms, time of asking for medical help for the first time and time of starting insulin injection, history of complications and family history.
Part II: included assessment of "adherence of patients with insulin-dependent diabetes to therapeutic regimen structured interview schedule". This part was used to assess the adherence of patients with insulin-dependent diabetes to therapeutic regimen. It consisted of seven sub items namely: diet, medication, exercise, blood sugar testing, foot care, smoking and adherence barriers.

Method:
The study was accomplished as follows:
Ethical approval:
Official approval to carry out the study was obtained from the Ethical Committee of the Faculty of Nursing, Alexandria University and also from the hospital responsible authorities at the previously mentioned research settings to obtain their permission to collect necessary data. An official permission was obtained from the directors and head of the outpatients of the selected hospital setting after explaining the aim of the study.
Developing the study tool: The tool was developed by the researcher based on the review of the relevant recent literature and was translated into Arabic language.

Data collection:
• After securing the administrative approval and the final draft of the developed tool was used to collect data in order to achieve the objective of this study.
• The data were collected by researcher for each patient once using individualized interview.
• The interview ranged from 30-45 minutes on individual session.

- Data were collected in the morning shift.
- The data collection was started, and continued for a period of 6 months from June 2018 and to October 2018.

Ethical considerations:
- Informed oral consent was obtained from each study subject after explanation of the aim of the study.
- The anonymity and confidentiality of patients' responses were assured.
- The participants were informed that their participation was not obligatory and they had the right to refuse the participation in the study.
- The patients were informed that they have the right to take out from the study at any time.

Statistical analysis of the data:
- After data were collected, they were coded and transmitted into specially designed formats, to be suitable for computer feeding.
- Verification processes were carried out to avoid any errors during data entry.
- Data were fed to the computer and analyzed by using IBM SPSS software package version 20.0.
- Qualitative data were described by using number and percent.
- Quantitative data were described using range (minimum and maximum), mean and standard deviation.
- Comparison between different groups regarding categorical variables were tested by Chi-square test.
- When more than 20% of the cells have expected count less than 5, adjustment for chi-square was conducted using Fisher's Exact test or Monte Carlo correction.
- For normally distributed data, comparison between two independent populations was done using independent t-test while more than two populations were analyzed using F-test (ANOVA) to be used.
- Correlations between two quantitative continuous variables were assessed using Pearson coefficient(r).
- For abnormally distributed data, comparison between two independent populations were done using Mann Whitney test.
- Correlations between two quantitative ranked variables were assessed using Spearman coefficient (rs).

  Significance of the obtained results was judged at the 0.05 level.

RESULTS
Table (1) showed frequency distribution of the studied patients according to their socio-demographic characteristics. **In relation to age**, it was noticed that more than half (54%) of the studied patients were within the age group 50 -60 years old, while only 9.3% were in the age group 20 <30 years. **Concerning sex,**

it was found that about more than half of the studied patients (60.7%) were females. **As regards area of residence** the table revealed that all studied patients lived in urban area and more than half (58.7%) of them were married, while 9.3% of them were divorced. **According to the educational level,** it was evident that read and write patients as well as secondary education formed 26.7% of the studied patients, while 10.7% of them had basic education. **In relation to occupation**, it was found that 40% of the studied patients were housewives, while 9.3% of them had manual work. Moreover, it was found that the majority of the studied patients (92 %) had not sufficient monthly income to fulfill the daily requirements from patient's point of view.

Table (1): Frequency distribution of the studied patients according to their socio-demographic data (n = 150)

Socio-demographic data	No.	%
Age in years		
20 -	14	9.3
30 -	19	12.7
40-	36	24.0
50-60	81	54.0
Sex		
Male	59	39.3
Female	91	60.7
Area of residence		
Urban	0	0.0
Rural	150	100.0
Marital status		
Single	16	10.7
Married	88	58.7
Divorced	14	9.3
Widow	32	21.3
Level of education:		
Illiterate	25	16.7
Read and write	40	26.7
Basic education	16	10.6
Secondary	40	26.7
University	29	19.3
Occupation		
Office work	25	16.7
Manual	14	9.3
Professional	35	23.3
Housewife	60	40.0
Retired /Not work	16	10.7
Monthly income		
Enough	12	8.0
not enough	138	92.0

Table (2) illustrated the frequency distribution of the studied patients according to levels of adherence of patients with insulin- dependent diabetes to therapeutic regimen. **In relation to adherence to diet,**

the findings indicated that more than half of the studied patients (58%) were fair adhered to diabetic diet, and more than two third (67.3 %) of them were good adherent to medication. **In regard to adherence to exercise,** the results revealed that about three quarters (75.3%, 76%) of the studied patients were poor adhering to both exercise and blood sugar testing. **Regarding adherence to foot care,** the results revealed that the studied patients who were fair and good adhering to foot care had the same percentage (38.7%), while 22.6 % were poor adhering. **In relation to overall adherence to therapeutic regimen**, it was found that more than half of the studied patients (52%) were fair adhering, while 10.7% were poor adhering.

Table (2): Frequency distribution of the studied patients according to levels of adherence of patients with insulin-dependent diabetes to therapeutic regimen

Adherence of Patients with Insulin- dependent Diabetes to Therapeutic Regimen	Poor (<50%)		Fair 50% - <65%)		Good (≥65%)	
	No.	%	No.	%	No.	%
Diet	44	29.3	87	58.0	19	12.7
Medication	10	6.7	39	26.0	101	67.3
Exercise	113	75.3	25	16.7	12	8.0
Blood Sugar Testing	114	76.0	35	23.3	1	0.7
Foot Care	34	22.6	58	38.7	58	38.7
Overall	**56**	**37.3**	**78**	**52.0**	**16**	**10.7**

Table (3) showed the descriptive analysis of the studied patients according to total and percent score of adherence of patients with insulin-dependent diabetes to therapeutic regimen. **In relation to adherence of patients with insulin-dependent diabetes to therapeutic regimen,** the study findings revealed that the mean and standard deviation of adherence to diet, medication, exercise, blood sugar testing and foot care were 54.30 ± 11.55, 54.30 ± 11.55, 24.28 ± 27.0, 33.0 ± 15.49 and 60.07 ± 16.86 respectively, while the mean and standard deviation to overall adherence was 52.25 ± 9.47.

Table (3): Descriptive analysis of the studied patients according to total and percent score of adherence of patients with insulin- dependent diabetes to therapeutic regimen

Adherence of patients with insulin-dependent diabetes to therapeutic regimen	Total score adherence of patients with insulin- dependent diabetes to therapeutic regimen	% score adherence of patients with insulin-dependent diabetes to therapeutic regimen
Diet Mean ± SD.	12.61 ± 54.30	54.30 ± 11.55
Medication Mean ± SD.	11.35 ± 2.45	54.30 ± 11.55
Exercise Mean ± SD.	2.91 ± 3.24	24.28 ± 27.0
Blood Sugar Testing Mean ± SD.	2.64 ± 1.24	33.0 ± 15.49
Foot Care Mean ± SD.	10.81 ± 3.04	60.07 ± 16.86
Overall Mean ± SD.	41.59 ± 13.74	52.25 ± 9.47

Table (4) showed the relation between overall adherence to therapeutic regimen and socio-demographic data of the studied patients. There was a highly statistical significant relation between patient's age, sex, level of education, monthly income and overall adherence to therapeutic regimen as p values were < 0.003, $= 0.016$, < 0.001 and $= 0.014$ respectively. The result of the study revealed that the highest value of adherence was in the age group $40<50$, female patients, university educated patient and patients who had enough monthly income. Also, there was a highly statistically mean and standard deviation, which were 56.04 ± 8.55, 53.75 ± 9.40, 59.03 ± 8.76 and 58.68 ± 8.49 respectively.

Table (4): Relation between overall assessment of adherence of patients with insulin- dependent diabetes to therapeutic regimen and A. socio-demographic data (n = 150)

Socio-demographic data	Overall Adherence of Patients with Insulin- dependent Diabetes to Therapeutic Regimen Mean ± SD.	Test of sig.	P
Age in years 20 - 30 - 40- 50 – 60	47.51 ± 8.09 47.58 ± 8.51 56.04 ± 8.55 52.42 ± 9.61	F= 4.919*	<0.003*
Sex Male Female	49.94 ± 9.19 53.75 ± 9.40	t= 2.445*	0.016*
Occupation Office work Manual Professional Housewife Retired /Not work	53.07 ± 11.73 51.27 ± 9.03 49.60 ± 9.37 53.16 ± 8.29 54.21 ± 10.23	F= 1.079	0.369
Marital status Single Married Divorced Widow	51.53 ± 10.30 53.25 ± 9.76 51.16 ± 6.69 50.35 ± 9.28	F= 0.844	0.472
Level of education: Illiterate Read and write Basic education Secondary University	48.51 ± 8.01 52.61 ± 9.35 52.17 ± 9.21 49.34 ± 8.72 59.03 ± 8.76	F= 6.478*	<0.001*
Monthly income Enough Not enough	58.68 ± 8.49 51.69 ± 9.37	t= 2.493*	0.014*

t: Student t-test   **F**: **F for ANOVA test**
p: p value for associated between different categories
*: Statistically significant at $p \leq 0.05$

Table (5) demonstrated the relation between socio-demographic data and overall assessment of adherence of patients with insulin-dependent diabetes to therapeutic regimen.
It was noticed that the highest percentage of the studied patients who had good adherence to therapeutic regimen were aged $40<50$ years, female patients, university educated and had enough income (63.9%, 52.7%, 62.1% and 75% respectively) and there were statistically significant relation between age in years, sex, level of education and monthly income and overall assessment of adherence of the studied patients to therapeutic regimen as P values were ≤ 0.05.

Table (5): Relation between overall assessment of adherence of patients with insulin- dependent diabetes to therapeutic regimen and socio-demographic data (n = 150)

Socio-demographic data of the studied patients	Overall assessment of adherence of patients with insulin-dependent diabetes to therapeutic regimen						χ^2	P
	Poor (n =)		Fair (n =)		Good (n =)			
	No.	%	No.	%	No.	%		
Age in years								
20 < 30	8	57.1	6	42.9	0	0.0		
30 < 40	10	52.6	9	47.4	0	0.0	12.083[*]	MCp= 0.046[*]
40<50	7	19.4	6	16.7	23	63.9		
50 – 60	31	38.3	40	49.4	10	12.3		
Sex								
Male	29	49.2	30	50.8	0	0.0	14.037[*]	0.001[*]
Female	27	29.7	16	17.6	48	52.7		
Occupation								
Office work	11	44	9	36	5	20		
Manual	7	50	6	42.9	1	7.1		MCp= 0.433
Professional	13	37.1	21	60	1	2.9	7.804	
Housewife	20	33.3	33	55	7	11.7		
Retired /Not work	5	31.2	9	56.3	2	12.5		
Area of residence								
Urban	0	0.0	0	0.0	0	0.0	–	–
Rural	56	37.3	78	52	16	10.7		
Marital status								
Single	7	43.7	8	50	1	6.3		
Married	32	36.4	42	47.7	14	15.9	8.176	MCp= 0.194
Divorced	3	21.4	11	78.6	0	0.0		
Widow	14	43.8	17	53.1	1	3.1		
Level of education:								
Illiterate	13	52	12	48	0	0.0		
Read and write	13	32.5	22	55	5	12.5		MCp <0.001[*]
Basic education	4	25	11	68.8	1	6.3	26.397[*]	
Secondary	23	57.5	15	37.5	2	5		
University	3	10.3	8	27.6	18	62.1		
Monthly income								
Enough	0	0.0	3	25	9	75	10.261[*]	MCp= 0.004[*]
not enough	56	40.6	69	50	13	9.4		

χ^2: **Chi square test**   MC: **Monte Carlo**
p: p value for associated between different categories
*: Statistically significant at $p \le 0.05$

Table (6) demonstrated the relation between socio-demographic data of the studied patients and overall adherence barriers to therapeutic regimen. It was noticed that overall adherence barriers were moderate in the patient's age group of 50-60, male, manual occupation, divorced, secondary educated and had no enough income (65.4%,55.9%,71.1%,71.4% ,70% and 63% respectively) . Also, the findings revealed that there were statistically significant relation between patient's age in years, sex, level of education, monthly income and overall adherence barriers as P values were ≤ 0.05.

Table (6): Relation between overall adherence barriers and socio-demographic data (n = 150)

Socio-demographic data	Overall adherence barriers						χ^2	p
	Low (n =)		Moderate (n =)		High (n =)			
	No.	%	No.	%	No.	%		
Age in years								
20 < 30	5	35.7	2	14.3	7	50		
30 < 40	4	21	12	63.2	3	15.8	16.036*	MCp= 0.010*
40<50	20	55.5	11	30.6	5	13.9		
50 – 60	6	7.4	53	65.4	22	27.2		
Sex								
Male	7	11.9	33	55.9	19	32.2	7.527*	0.023*
Female	59	64.8	19	20.9	13	14.3		
Occupation								
Office work	5	20	16	64	4	16		
Manual	3	21.4	10	71.5	1	7.1		
Professional	4	11.4	18	51.4	13	37.2	9.607	MCp= 0.285
Housewife	9	15	40	66.7	11	18.3		
Retired /Not work	5	31.3	8	50	3	18.7		
Area of residence								
Urban	0	0.0	0	0.0	0	0.0	–	–
Rural	26	17.3	92	61.3	32	21.4		
Marital status								
Single	7	43.7	7	43.7	2	12.6		
Married	14	15.9	53	60.2	21	23.9	8.045	MCp= 0.220
Divorced	1	7.1	10	71.4	3	21.4		
Widow	4	12.5	22	68.7	6	18.8		
Level of education:								
Illiterate	1	4.0	13	52.0	11	44.0		
Read and write	6	15.0	26	65.0	8	20.0		
Basic education	2	12.5	9	56.3	5	31.2	18.902*	0.015*
Secondary	7	17.5	28	70.0	5	12.5		
University	10	34.5	16	55.2	3	10.3		
Monthly income(from the patient's point of view)								
Enough	6	50.0	5	41.7	1	8.3	7.638*	MCp= 0.016*
not enough	20	14.5	87	63.0	31	22.5		

χ^2: **Chi square test**   MC: **Monte Carlo**
p: p value for associated between different categories *: Statistically significant at p ≤ 0.05

DISCUSSION

In regard to **sociodemographic characteristics and clinical data of studied subjects,** the results of the present study revealed that more than half of the studied subjects were females and in the age group between 50-60 years. These results stand in line with the findings of **Memon** *et al.* [10] **and Achigbu** *et al.* [11] who reported that more than half of the studied subjects were females and in the age group from 51 to 60 years. This result was explained by **Misliza and Mas-Ayu** [12] and **Bakhotmah** [13] who stated that increased incidence of diabetes was found among women, this may be due to differences in related factors as obesity which is more encountered among married housewives.

As regards area of residence, the findings revealed that all studied patients lived in urban area, this result comes in line with **Khan** *et al.* [14] who found that two-thirds of the participants were from the urban area. Moreover more than half of them were married. This finding was in congruent with **Yang** *et al.* [15] who found that, the majority of the studied patients were married.

Concerning the educational level, the current study reported that, the highest percentage of the studied patients were of low educational level. This

explains their lack of awareness about important facts related to their adherence to therapeutic regimen. This result is in line with **Grade et al.** [16] who showed that most patients in his study were from low educational level.

In relation to occupation and monthly income, the present study pointed that, more than one third of the studied patients were housewives and the majority of them had insufficient monthly income to fulfill the daily requirements from patient's point of view. This finding may be explained by that about one third of the studied patients were housewives (married or widowed) that mean they had no own financial resource and they were depending only on husband income. This low income made them seek treatment in free hospitals which provide them free treatment and routine investigations and so will be decreased in financial burden on their family. This finding comes in line with **Anumah et al.** [17] who reported that, housewives comprised more than half of the population. While these findings contradict with the findings of **Abubakar et al.** [18] who reported that the minority were housewives.

In relation to duration of having IDDM, the majority of patients had IDDM more than five years. The result of this study in relation to this point is contradicting with **Khandekar et al.** [19] and **Achigbu et al.** [11] who revealed that, majority of their studied patients had diabetes less than five years. Regarding the family history of diabetes, the results of the present study showed that the majority of their studied patients had a positive family history of DM. This result is supported by **Geetha et al.** [20] **and Amaltinga** [21] who reported that the prevalence of diabetes was higher in patients with a family history. This finding contradicts with the study of **Nesari et al.** [22] who found that the majority of their studied patients had no family history for diabetes.

Concerning compliance to clinic appointments, it was found that more than one third of studied patients never missed their appointments. Health maintenance especially with chronically ill patient needs proper medical follow up, which require large expenses. The result of the present study may be explained by the fact that the patients' compliance to the clinic appointments was due to their desire to obtain the monthly therapy for insulin drug and also, periodic physical checkups from free hospitals state-funded. This result is incongruent with **Khan et al.** [14] who reported that minority of his study participants had not missed any appointment in the last one year, while almost half of them had missed an appointment once or twice.

Regarding diabetic complications experienced, the results of the present study revealed that the majority of the studied patients experienced diabetic complications. Moreover, it was found that more than half of the studied patients had diabetic neuropathy. **Martin et al.** (2014)????? stated that neuropathy will develop within 10 years of the onset of diabetes in 40% to 50% of people with type 1 diabetes. **Aslam et al.** [23] found that diabetic neuropathy affects 8.3% to 60% of all diabetic patients. These findings contradict with **Fereidony et al.** [24] who stated that the minority of the studied patients had neuropathic complications.

In relation to adherence to diet, the findings indicated that more than half of studied patients were fair adherent to diabetic diet. **Broadbent et al.** [25] found that, 22% of studied patient reported complete adherence to diet recommendations. **Sharma** [26] stated that, less than one third of the participants were found to be adherent to diet. Lack of awareness/knowledge was the most common cause for not following a diabetic diet. Other reasons included workplace inconvenience, food preferences, family eating habits, low income, negligence and pleasures. Several study participants were worried about stress during social occasions. Sharing food during social occasions in Egypt is considered a way of showing respect and affection to each other and refusing food from a traditional dish is unacceptable [27]. Adherence to diet can be improved by applying dietary recommendations to all diabetic patients based on individuals habit and preference by thoroughly discussing with their health care providers.

As regards adherence to medication, it was obvious that more than two-third of studied patients were good adherence to medication. Also, the majority of studied patients reported that they were always adherent to the type of insulin, dose and time of insulin injection as their prescribed by the physician. This finding is supported by **Amaltinga** [28] and **Broadbent et al.** [25] who found that the majority of the studied subjects (86%) were adherent to prescribed insulin all the time. This result could be explained by that nurses and physicians have taught the diabetic patients about importance of adherence to their prescribed insulin medications in order to prevent diabetic complications. In addition, all diabetic patients considered that insulin medication is the most vital element of the diabetes management and their survival.

In relation to adherence to blood glucose monitoring, the results of present study revealed that about three quarters of the studied patients were poor adhering to perform blood sugar level testing. Also, the majority of studied patients reported that they had never measuring blood glucose level before meals and never using glucometer at home. This result is in the same line with **Taha et al.** [29] and **Agedew et al.** [28] who found that, the lowest adherence was with self-testing of blood glucose level and as, poor adherence is detected in the blood sugar level measurement in

their study. Moreover, this result congruent with **Mahfouz and Awadalla** [30] who found that the results of their study revealed that less than one quadrant of the studied patients were good adherent to measure blood glucose level. While, this result disagrees with **Vidal Flor et al.** [31] who found that the majority of studied patients adhere to self-monitoring of blood glucose.

Regarding adherence to foot care, the results revealed that the studied patients had good adherence to foot care. This finding comes in line with **Neta et al.** [32] who reported that the data revealed that patients had good adherence to foot care. This finding contradicts with **Chappidi et al.** [33] who found that 86.7% of participants were not adherent to foot care activities. **Tewahido and Berhane** [27] reported that female study patients were more than male study patients that reported to have been caring about foot hygiene and give more attention to choosing suitable footwear.

In relation to overall adherence to therapeutic therapy, the present study revealed that the majority of studied subjects were fair adherence to therapeutic therapy in relation to dietary recommendation, medication and foot care. Adherence to blood sugar monitoring and exercise was poor. Based on result of present study, education and counseling were extremely needed to increase patients' knowledge about their disease leading to more therapeutic adherence of diabetic patients. Good adherence can be achieved through patient centered communication and empowering. Physicians might fail to devote adequate time for discussion to educate and motivate patients to follow the recommended diabetic self-care practices due to high number of patients in the facilities.

In regard to relation between overall adherence to therapeutic regimen and socio-demographic data. There was a highly statistical significant relation between patient's age, sex, level of education and monthly income and overall adherence to therapeutic regimen. In relation to age the highest value of adherence was in the age group $40 < 50$. This was supported by our findings that the highest value of adherence barriers was in the age group 30-40 years old. These findings congruent with **Perwitasari and Urbayatun** [34] who reported that there was significant relation between patient's demographic data like age and sex and patient's adherence. This indicated that younger patients are more careful about their health than older ones. This may be related to their fear of the complication and disability of the disease, which may disturb their social roles including work, family and children affairs. Regarding sex, the highest value of adherence was in females' patients, this was supported by our findings that the highest value of adherence barriers was in male patients. In regard to educational level, the highest value of adherence was in university

educated patients. This was supported by our findings as the highest value of adherence barriers was in read and write patients. Moreover, the highest value of adherence was in patients who had enough income. This was supported by our findings as the highest value of adherence barriers was in patients who had no enough income,

CONCLUSIONS

Based on the study findings, it can be concluded that more than half of the studied patients were fair adherent to diabetic diet and more than two thirds of them were good adherent to medication. While, three quarters of them were poor adhering to both exercise and blood sugar testing. Also, it can be concluded that more than half of the studied patients were fair adhering to foot care. Furthermore, there was highly statistically significant relation were found between patient's age, sex, level of education, monthly income and overall adherence to therapeutic regimen as well as adherence barriers. On the other hand, there was no statistically significant relation between patient's occupation, marital status and overall adherence to therapeutic regimen.

RECOMMENDATIONS

Based on the results of the present study, the following recommendations are derived:

Recommendations for patients:

• Development and application of educational sessions for patients to improve their knowledge about therapeutic regimen (diet, medication, blood glucose monitoring, exercise and foot care).

• Educational booklets, handouts, audiovisual materials should be provided for teaching patients and their families about therapeutic regimen for IDDM.

• Increased patient's awareness about insulin dependent diabetes and their therapeutic regimen through mass media. Disseminate health knowledge through posters, photos, video, and booklets as educational directions to patients that help to meet health needs for patients with insulin-dependent diabetes.

Recommendations for nurses:

• Manual guidelines should be available for nurse working with IDDM about recent updates about therapeutic regimen and adherence that help in prevention of complications.

• Periodic scientific meetings among physicians and nurses must be conducted to discuss patient's problems and barriers of adherence to therapeutic regimen.

• In-service education on the importance of patient's adherence to therapeutic regimen must be given to nurses by efficient and skilled physicians as well as experienced nurses.

Recommendations for further studies

• Study the impact of health teaching program in increasing patients᾽ knowledge and improving their adherence.

• Study the comparison between rural area and urban area to explore the difference in adherence and presence of barriers to therapeutic regimen.

REFERENCES

1. **Brunner S (2008):** Textbook of Medical –Surgical Nursing, 10th ed, Philadelphia: Mosby, Pp: 1197-99.

2. **Burnier M, Vrijen B (2018):** Adherence in hypertension and cardiovascular protection. Taxonomy of medications adherence, recent development. European Society of Hypertension, 3: 1-9.

3. **Ganiyu AB, Mabuza LH, Malete NH et al. (2013):** Non-adherence to diet and exercise recommendations amongst patients with type 2 diabetes mellitus attending Extension II Clinic in Botswana. Afr J Prim Health Care Fam Med., 5 (1): 457.

4. **Onur B, Jonathan B, Tony D et al. (2010):** Assessment of Adherence and Healthcare Costs of Insulin Device versus Conventional Vial/Syringe. Adv Ther., 27 (2): 94-104.

5. **Fatima AI, Omole M, Sheriff LO (2014):** Medication adherence amongst diabetic patients in a tertiary healthcare institution in central Nigeria. Trop J Pharm Res., 13 (6): 997-98.

6. **Ejeta FY, Angamo R, Mariam W (2015):** Patient Adherence to Insulin Therapy in Diabetes Type 1 and Type 2 in Chronic Ambulatory Clinic of Jimma University Specialized Hospital, Jimma, Ethiopia. International Journal of Pharma Sciences and Research, 4 (6): 796-806.

7. **Griva KL, Lim HA, Yu Z et al. (2014):** Non-adherence in patients on peritoneal dialysis: a systematic review. PloS one, 9 (2): 89001.

8. **Jimmy B, Jose J (2011):** Patient medication adherence: measures in daily practice. Oman Medical Journal, 26 (3): 155–159.

9. **Caraceni A, Fainsinger R, Foley R (2009):** Palliative Nursing, 1st ed, Saunders Elsevier Co, Pp: 1083- 106.

10. **Memon MS, Shaikh SA, Shaikh AR et al. (2015)**: An Assessment of Knowledge, Attitude and Practices (KAP) towards Diabetes and Diabetic Retinopathy in a Suburban Town of Karachi. Pakistan Journal of Medical Sciences, 31: 183-188.

11. **Achigbu EO, Oputa RN, Achigbu KI et al. (2016):** Knowledge, attitude and practice of patients with diabetes regarding eye care: A cross sectional study. Open Journal of Ophthalmology, 6 (2): 94-102.

12. **Misliza A, Mas S (2009):** Sociodemographic and lifestyle factors as the risk of diabetic foot ulcer in the university of malaya medical centre. Journal of Health and Translational Medicine , 12 (1): 15-21.

13. **Bakhotmah BA (2013):** Prevalence of Obesity among Type 2 Diabetic Patients: Non-Smokers Housewives Are the Most Affected in Jeddah, Saudi Arabia. Open Journal of Endocrine and Metabolic Diseases, 3: 25-30.

14. **Khan AR, Al-Abdul Lateef ZN, Al Aithan M A et al. (2012):** Factors contributing to non-compliance among diabetics attending primary health centers in the Al Hasa district of Saudi Arabia. J Family Community Med., 19 (1): 26-32.

15. **Yang YY, Ma S, Wang XX et al. (2017):** Modification and Application of Dietary Fiber in Foods. Journal of Chemistry, 1: 1-3.

16. **Grade A, Porsgaard T, Lykkesfeldt J et al. (2018):** Factors Affecting the Absorption of Subcutaneously Administered Insulin: Effect on Variability. doi:10.1155/2018/1205121.

17. **Anumah FO, Mshelia-Reng R, Abubakar A et al. (2017):** Management outcome of diabetic foot ulcers in a teaching hospital in Abuja, Nigeria. The Journal of Diabetic Foot Complications, 9 (1): 15 – 20.

18. **Abubakar B, Giaze R, Haliru A (2014):** Clinical Investigation of Treatment Failure in Type 2 Diabetic Patients Treated with Metformin and Glibenclamide at a Hospital in Northwestern Nigeria. Tropical Journal of Pharmaceutical Research, 13 (9): 1521-1526.

19. **Khandekar R, Al Harby S, Al Harthy H et al. (2010):** Knowledge, attitude and practice regarding eye complications and care among Omani persons with diabetes - A cross sectional study. Oman Journal of Ophthalmology, 3 (2): 60-4.

20. **Geetha A, Gopalakrishnan S, Umadevi R (2017):** Study on the impact of family history of diabetes among type 2 diabetes mellitus patients in an urban area of Kancheepuram district, Tamil Nadu. International Journal of Community Medicine and Public Health, 4(11): 4151-4156.

21. **Amaltinga APM (2017):** Non Adherence to Diabetic Medication among Diabetic Patients, a Case Study of Dormaa Hospital Ghana. Science Journal of Public Health, 5 (2): 88-97.

22. **Nesari M, Zakerimoghadam M, Rajab A et al. (2010):** Effect of telephone follow-up on adherence to a diabetes therapeutic regimen. Jpn J Nurs Sci., 7 (2): 121-8.

23. **Aslam A, Singh J, Rajbhandari S (2014):** Pathogenesis of painful diabetic neuropathy. Pain Research and Treatment, 2014: 412041.

24. **Fereidony M, Shoghiyan-davar M, Bigane O et al. (2018):** Investigating Factors Associated with Diabetes Complications among Type 2 Diabetic Patients. Journal of Research in Medical and Dental Science, 6 (3): 301-306.

25. **Broadbent E, Donkin L, Stroh JC (2011):** Illness and treatment perceptions are associated with adherence to medications, diet, and exercise in diabetic patients. Diabetes Care, 34 (2): 338–340.

26. **Sharma T, Kalra J, Dhasmana D et al. (2014):** Poor adherence to treatment: A major challenge in diabetes. Indian Academy of Clinical Medicine Journal, 15 (1): 26-9.

27. **Tewahido D, Berhane Y (2017):** Self-Care Practices among Diabetes Patients in Addis Ababa: A Qualitative Study. PloS one, 12(1): e0169062.

28. **Agedew E, Hailu T, Girema M et al. (2016):** Adherence to diabetic self-care practices and its associated factors among patients with type 2 diabetes in Addis Ababa, Ethiopia. Dovepress., 12 : 963—970.

29. **Taha NM (2011):** Factors Affecting Compliance of Diabetic Patients toward Therapeutic Management. Med J Cairo Univ., 79 (1): 211-218.

30. **Mahfouz EM, Awadalla H (2011):** Compliance to diabetes self-management in rural El-MinIa, Egypt .Cent Eur J Public Health, 19 (1): 35–41.

31. **Vidal Flor M, Jansà MM, Galindo RM *et al.* (2017):** Factors associated to adherence to blood glucose self-monitoring in patients with diabetes treated with insulin. The dapa study. Endocrinol Diabetes Nut., 65 (2): 99-106.

32. **Neta DS, Da Silva ARV, Da Silva GRF (2015):** Adherence to foot self-care in diabetes mellitus patients. Rev Bras Enferm., 68 (1): 103-8.

33. **Chappidi M, Chidambaram P, Sivananjiah S *et al.* (2018):** Non-adherence to foot-care activities and its associated factors among patients with type 2 diabetes mellitus in an urban area of South India: a cross sectional study. International Journal of Community Medicine and Public Health, 5 (12): 2-6.

34. **Perwitasari DA, Urbayatun S (2016):** Treatment adherence and quality of life in diabetes mellitus patients in indonesia. Sage Open, 26: 1 -7.