

## Effect of Health Educational Guidelines on knowledge and Self Care Practice for Patients with Diabetic Ketoacidosis

Manal Esmail Abo Elyzed Shahin<sup>1</sup>, Amany Lotfy Abdul-Aziz Ismail<sup>2</sup> Samy Abdel-Kader Khodair<sup>3</sup>, Reda Abdel Salam Ibrahim<sup>4</sup>

<sup>1</sup> Specialist nurse in El-Menshaway Hospital

<sup>2</sup> Professor of medical surgical nursing department, Faculty of Nursing, Tanta University, Egypt

<sup>3</sup> Professor of internal medicine & nephrology department, Faculty of Medicine, Tanta University, Egypt

<sup>4</sup> Assist. Professor / of medical surgical nursing department, Faculty of Nursing, Tanta University, Egypt

### Abstract

**Background:** The role of the patient with diabetes is as an active decision-maker and the role of the nurse in this case is to provide information, direction and support. The study **aimed** was to evaluate the effect of the health educational guideline on knowledge and self-care practice for patient with diabetic ketoacidosis. **Subjects and method:** A convenient sample of (60) adult patients who are present at medical department and outpatient clinic mention in previous setting. **Three tools** were used for data collection: structured interview sheet tool, consisted of two parts as follow: patients' socio-demographic data and patients' self-care sheet. Observational checklist tool and activity daily living scale tool. **The results:** It was observed that the most of the studied patients (86.67%) had incomplete correct answer regarding to the patient' knowledge level of diabetes pre the program, while two thirds (66.67%) and 55.0% of them had complete and correct answer immediately and post the program. **The study concluded** that the patients showed an improvement in their knowledge level about diabetic ketoacidosis, self-care practice, and daily living activities level. There was a statistically significant difference for patients' knowledge level, self-care practice and daily living activities level before and after the health educational guidelines. **Recommended that:** The patient should be given information about diabetic ketoacidosis. Booklet about self-care for diabetic ketoacidosis patients should be accessible in the Medical Department .

Keywords: Health educational guidelines, Knowledge, Self-care practice, Diabetic ketoacidosis

### Introduction

Diabetes Mellitus is the condition in which the body does not properly process food for use as energy. Most of the food eat is turned into glucose, for bodies to use for energy. The pancreas, an organ that lies near the stomach, makes a hormone called insulin to help glucose get into the cells of bodies. Diabetes, body either doesn't make enough insulin or can't use its own insulin as well as it should. This causes glucose to

build up in blood. Diabetes can cause serious health complications including heart disease, blindness, kidney failure, and lower-extremity amputations<sup>(1)</sup>.

The application of epidemiology of DM has provided valuable information on several aspects of this disease such as its natural history, prevalence, incidence, morbidity and mortality in diverse populations around the world.

Identification of the cause of the disease and the possible preventive measures that could be instituted to arrest or delay the onset of this disease which has reached epidemic proportions in both the developed and the developing nations. Unfortunately, the improvement in outcomes for individual patients with diabetes has not resulted in similar improvements from the public health perspective<sup>(2)</sup>.

In Egypt, the prevalence of diabetes is around 15.56% among adults between 20 and 79 years of age, with an annual death of 86,478 related to diabetes. In 2021, 8.7 million individuals have diabetes and around 2.2 million have pre diabetes in Egypt. In Elmenshawy, hospital Diabetic ketoacidosis makes up an estimated at about 65 cases per month, and at about 700 cases per years<sup>(3)</sup>.

Risk of getting diabetic ketoacidosis (DKA): When there is not enough insulin, body has to break down foods for energy. This creates ketones, which can make blood acidic. DKA happens when the acid levels in blood get too high. If not treated, DKA can be very dangerous. It can lead to a loss of consciousness, coma and even death<sup>(5)</sup>.

In general, DKA is always described to be closely linked to type 1 DM. The occurrence of DKA has been thought to indicate the underlying significant and irreversible  $\beta$ -cell damage that classifies these diabetic patients as type 1 DM. However, many DKA patients do have clinical course and metabolic features of type 2 DM. There is a strong, almost dogmatic, errant perception by physicians that DKA is a complication that occurs only in patients with Diabetic ketoacidosis (DKA) is an acute, major, life-threatening metabolic complication of diabetes occurs mostly in type 1DM also it can occur in

type II; it is characterized by hyperglycemia, ketonemia, ketonuria and metabolic acidosis<sup>(6)</sup>.

Signs and symptoms of DKA include loss of consciousness, feeling dizzy, sudden loss of sight, slurred speech, polyuria, polydipsia, weakness, fatigue and weight loss. Vomiting and abdominal pain are frequently the presenting symptoms in DKA. On physical examination, signs of dehydration are often present, including dry mucous membranes, decreased skin turgor, tachycardia and hypotension. In addition, the smell of acetone on the breath and deep and labored breathing (Kussmaul breathing) may be observed, particularly in patients with severe acidosis<sup>(7)</sup>.

Successful treatment of DKA involves identification of the precipitating factors, frequent patient monitoring, along with correcting dehydration, hyperglycemia and electrolyte imbalances. Correction of dehydration is aimed at restoring fluid volume by initial fluid replacement based on vascular status. Administration of regular insulin by IV infusion is the treatment of choice for DKA. Follow-up fluid replacement depends on the state of dehydration, serum electrolyte levels and urine output to prevent hypokalemia<sup>(8)</sup>.

Many ways to prevent DKA; One of the most important ways is proper management of diabetes to prevent complications. Preventive measures include; keep blood glucose levels within normal range by checking them several times per day, never skipping insulin doses, developing an emergency or “sick-day” plan, testing urine for ketone levels during stress or illness, seeking medical care when blood glucose and ketone levels are higher than normal as early detection is essential<sup>(9)</sup>

The role of the patient with diabetes is play an active participation in treatment

and the role of the nurse in this case is to provide information, direction and support. The nurse will be assessing risk, so that appropriate interventions can be made at appropriate times. In addition, the nurse should regard every annual review or screening visit as an opportunity to find out what information the patient has and to fill in any gaps, supported by educational materials. Exploring why patients may not feel able to make changes to their lifestyle and to undertake suggested treatments may help the nurse to suggest actions that such patients are likely to follow<sup>(10)</sup>

Also, nurses must confirm that kidneys are functioning adequately with at least 30 ml of urine output/hour. Fluid resuscitation is reserved for patients requiring restoration of circulation. The possibility of over-hydration should be monitored. Nurses should also monitor for complications related to fluid volume excess. Once the blood glucose level decreases to about 250 mg/dl., glucose is added to IV solutions to avoid hypoglycemia and cerebral edema<sup>(11)</sup>

Nurses should connect with the medical team for appropriate adjustment to insulin doses as required. Monitoring of metabolic acidosis and electrolytes this involves liaising with the medical team to ensure blood gases and appropriate blood tests are carried out regularly, results interpreted and action taken, for example potassium being added to IV infusions if require after admission. Provide psychological support for patients this includes keeping the patient and relatives fully informed about the patient's clinical condition and the care given<sup>(12)</sup>

Patients should be taught how to manage blood glucose during periods of illness (sick-day management). This should include specific information about frequency of blood glucose monitoring,

blood glucose targets, checking for ketones, taking extra quick-acting insulin, appropriate adjustment of insulin doses, identifying early signs and symptoms of Diabetic ketoacidosis (DKA) and knowing when to contact the diabetes specialist nurse<sup>(13)</sup>

Management of Diabetic ketoacidosis reduces the risk of mortality and improves clinical outcomes; this includes restoring circulatory volume, insulin therapy, correcting metabolic acidosis and electrolyte imbalance, identifying and treating precipitating factors and the early involvement of the diabetes specialist nurse<sup>(14)</sup>

### **Aim of the study**

#### **The aim of this study was to:**

Evaluate the effect of the health educational guideline on knowledge and self-care practice for patient with Diabetic Ketoacidosis

### **Research Hypotheses**

1. Post implementation of health educational guidelines, the patient is expected to have knowledge and self-care practice related to diabetic ketoacidosis.

### **Subjects**

#### **Research Design**

Quasi-experimental research design was utilized in this study.

#### **Setting of the study**

This study was conducted at medical department and outpatient clinic of the El Menshawy hospital affiliated to Ministry of Health. Medical department consisted of four wards and each one contained of 6 beds.

### **Subjects**

A convenient sample of (60) adult patients who are present at medical department and outpatient clinic mention in previous setting was selected based on

epidemiological information program and was evaluated.

**Inclusion criteria: the subjects were selected according to the following criteria**

1-Adult conscious patient, diagnosed with diabetic ketoacidosis.

2- Patient age 21 -55 years

2- Both sexes.

3-Free from any complications except diabetic ketoacidosis

#### **Tools of data collection**

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

**Tool (I): Structured Interview sheet** <sup>(111, 112)</sup>: was developed by the researcher after reviewing relevant literature to collect data it consisted of two parts as follow:

**Part one: Patient's Socio-demographic data it was including:** patient' age, educational level, sex, marital status, occupation, residence, date of admission, diagnosis, mobility level, past medical history, prescribed medication and previous training program about self-care.

#### **Part two: Patients' Self-care Sheet**

It was developed by the researcher based on literature review <sup>(111, 112)</sup> to assess Patients' knowledge related to diabetic ketoacidosis before, immediately and after one month from implementation of health education program. It was including the following: diabetic ketoacidosis' definition, causes, and clinical manifestations, medication, exercises, diet, fluid, reporting unusual signs, symptoms, and time of follow-up.

#### **Scoring system**

The patient who responded by "correct and complete answer" was given a score 2, "correct and incomplete answer" was given a score (1) who responded "wrong and not answer" was given a score (zero).

**Total level of patients' knowledge score was equal 24 as follow**

- Less than 60% considered poor,

- from 60% to less than 75% considered fair,

- from 75% and more considered good.

**Tool (II): Observational Checklist:** to assess the actual patient self-care practice related to diabetic ketoacidosis. It comprised (5) main items: medication, daily living activity, hygienic care, diet, follow up.

#### **Scoring system**

Each item is divided as sub items in check list was scored as following: One scores for each step that was done correctly, zero score for incomplete done.

**The total practice score will be calculated and equal 46 as follow**

less than 70% of total score considered unsatisfactory, 70% and more considered satisfactory.

#### **Tools (III): Activity Daily Living Scale**

- Physical self-maintenance scale (Activities of Daily Living, Or ADLs A. Toilet, B. Feeding, C. Dressing, D. Grooming (neatness, hair, nails, hands, face, and clothing), E. Physical Ambulation and F. Bathing. In each category, circle the item that most closely describes the person's highest level of functioning and record the score assigned to that level (either 1 or 0) in the blank at the beginning of the category.

- Instrumental Activities of Daily Living, Scale (IADLs)

A. Ability to Use Telephone, B. Shopping, C. Food Preparation, D. Housekeeping, E. Laundry, F. Mode of Transportation, G. Responsibility for Own Medications.

The total score ranges from 0 to 4, and for IADLs, from 0 to 4. In some categories, only the highest level of function receives a 1; in others, two or more levels have scores

of 1 because each describes competence that represents some minimal level of function<sup>(113)</sup>.

**1- Official permission** was obtained from the Faculty of Nursing of Tanta University to the responsible authorities and the head Elmenshawy hospital after explaining the aim of the study to facilitate the researcher implementation.

**2- Ethical and legal considerations**

- Written consent was obtained from every patient included in the study after explanation of the aim of the study and assuring them of confidentiality of collected data.

- Anonymity and confidentiality were maintained by the use of code number instead of name and the right of withdrawal is reserved.

- Privacy of the studied patients was maintained. study not produced harm full to the patient.

**3- Tools validity:** The tools of the study were tested for its content validity and reliability by nine experts in Medical-Surgical Nursing and and emergency field professors necessary modifications was done **Content validity index = 98.6%** and **alpha Cronbach's test (tool 1) = 0.791**, **alpha Cronbach's test (tool 2) = 0.823**, **alpha Cronbach's test (tool 3) = 0.783** and **total alpha Cronbach's test (3 tools) = 0.856**.

**4- A pilot study:** It was carried out on seven patients to test the feasibility and applicability of the developed tools accordingly, needed modification was done. Subject of pilot study was excluded from the original sample.

**5-** The study was conducted on four phases which including the following:

**Results**

Table (1) : Illustrates percentage distribution of the studied patients with

diabetic ketoacidosis regarding their total knowledge level about diabetic ketoacidosis throughout periods of study. It was observed that there was a statistically significant difference between the studied patients with diabetic ketoacidosis regarding their knowledge about diabetic ketoacidosis throughout periods of study while (P value= 0.0001).

Table(11) : Percentage distribution of the studied patients with diabetic ketoacidosis regarding their total level of self-care practice for the daily life throughout periods of study. It was observed that there was a statistically significant differences while ( $\chi^2 = 63.03$  and P value= 0.001).

Table (3): Illustrates percentage distribution of the studied patients with diabetic ketoacidosis regarding their daily living activities for the daily life about feeding throughout periods of study. It was noticed that it was noticed that one third (33.33%) of them never eats without assistance pre the program, while one third of them (33.33%) and 28.33% do it all day immediately and post the program respectively. While 5.0% of them never eats with minor assistance at meal times and/or with special preparation of food pre the program, while 5.00% and 3.33% do it all day immediately and post the program respectively.

While 5.0% of them never feeds self with moderate assistance and is untidy r pre the program, while half 8.33% and 5.00 do it all day immediately and post the program. While 5.00% of them requires extensive assistance for all meals all day pre the program, while 5.00% and 8.33 never do it immediately and post the program respectively. While 5.00% of them does not feed self at all and resists efforts of others to feed him or her all day pre the program, while 5.00% and 8.33% of them do it rarely

immediately and post the program respectively. It was observed that there was a statistically significant differences while P value= 0.001.

Table (4) : describes mean scores of the Activities Daily Living (ADLS) domains of the studied patients with diabetic ketoacidosis for the daily life throughout periods of study. It was observed that there was a statistically significant differences between mean scores of the Activities Daily Living (ADLS) domains of the studied patients with diabetic ketoacidosis for the daily life throughout periods of study. while P value= 0.001.

**Table (1): Percentage distribution of the studied patients with diabetic ketoacidosis regarding their total knowledge level about diabetic ketoacidosis throughout periods of study.**

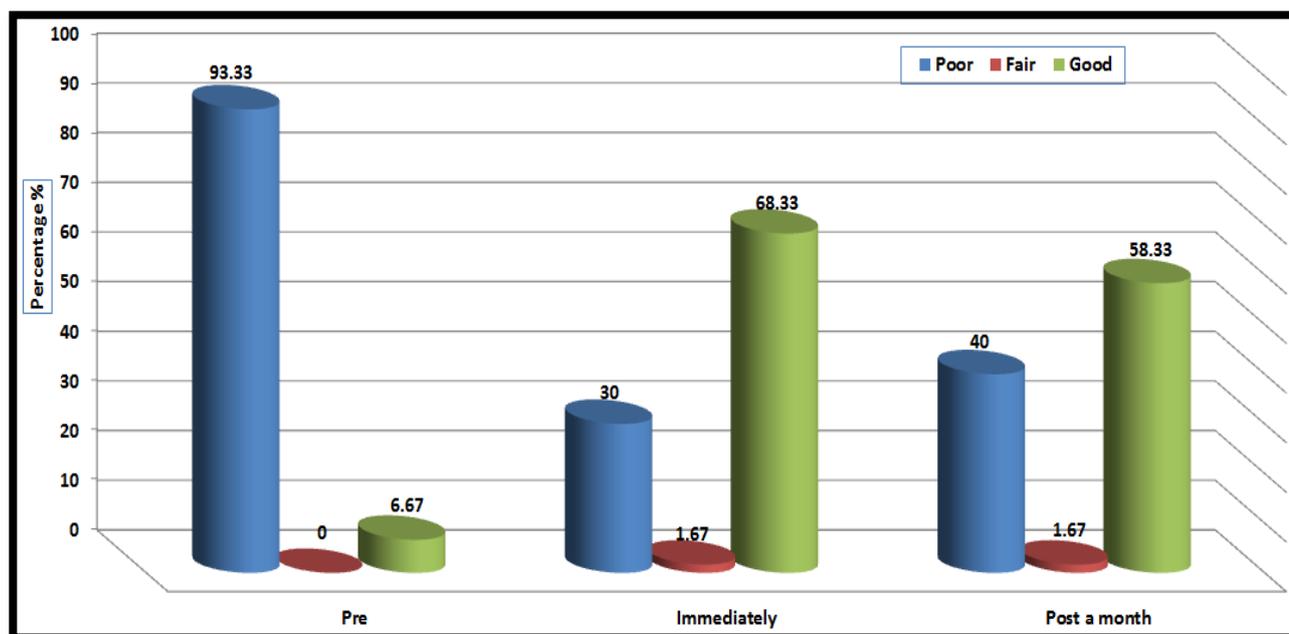
Total knowledge level	The studied patients (n=60)						$\chi^2$ P
	Pre		Immediately		Post a month		
	N	%	N	%	N	%	
- Poor	56	93.33	18	30.00	24	40.00	<b>56.13</b> <b>0.000*</b>
- Fair	0	0.00	1	1.67	1	1.67	
- Good	4	6.67	41	68.33	35	58.33	
<b>Range</b>	<b>(0-24)</b>		<b>(12-24)</b>		<b>(0-24)</b>		<b>F=36.02</b>
<b>Mean <math>\pm</math> SD</b>	<b>11.78<math>\pm</math>4.47</b>		<b>20.17<math>\pm</math>5.44</b>		<b>18.35<math>\pm</math>6.89</b>		<b>P=0.00*</b>

<60% Poor

(60-<75) % Fair

$\geq$ 75% Good

(\*) Statistically significant difference at level  $P < 0.05$ .



**Figure (1): Percentage distribution of the studied patients with diabetic ketoacidosis regarding their total knowledge level about diabetic ketoacidosis throughout periods of study.**

**Table (2): Percentage distribution of the studied patients with diabetic ketoacidosis regarding their total level of self-care practice for the daily life throughout periods of study.**

Total Practice Level	The studied patients (n=60)						$\chi^2$ P
	Pre		Immediately		Post a month		
	N	%	N	%	N	%	
- Unsatisfactory	57	95.00	15	25.00	27	45.00	<b>63.03</b> <b>0.001*</b>
- Satisfactory	3	5.00	45	75.00	33	55.00	
<b>Range</b>	<b>(3-28)</b>		<b>(0-37)</b>		<b>(0-37)</b>		<b>F=31.01</b> <b>P=0.001*</b>
<b>Mean <math>\pm</math> SD</b>	<b>10.93<math>\pm</math>7.09</b>		<b>26.83<math>\pm</math>13.31</b>		<b>23.68<math>\pm</math>13.57</b>		

$\geq 80\%$  Satisfactory

$< 80\%$  Unsatisfactory



(\* ) Statistically significant difference at level  $P < 0.05$ .

**Figure (3): Percentage distribution of the studied patients with diabetic ketoacidosis regarding their total level of self-care practice for the daily life throughout periods of study.**

**Table (3): Percentage distribution of the studied patients with diabetic ketoacidosis regarding their daily living activities for the daily life about feeding throughout periods of study.**

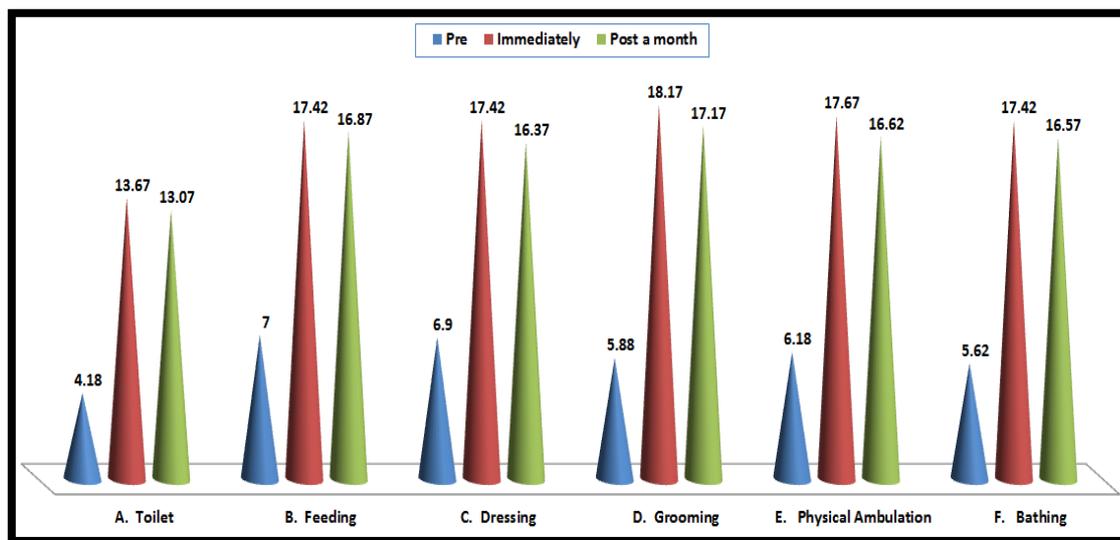
Feeding	The studied patients (n=60)						$\chi^2$ P
	Pre		Immediately		Follow up		
	N	%	N	%	N	%	
<b>1. Eats without assistance</b>							
- Never	20	33.33	0	0.00	0	0.00	<b>117.73</b> <b>0.00*</b>
- Do it rarely	10	16.67	0	0.00	5	8.33	
- Do it some day	10	16.67	5	8.33	5	8.33	
- Do it most day	0	0.00	15	25.00	13	21.67	
- Do it all day	0	0.00	20	33.33	17	28.33	
<b>2. Eats with minor assistance at meal times and/or with special preparation of food,</b>							
- Never	3	5.00	0	0.00	0	0.00	<b>144.67</b> <b>0.00*</b>
- Do it rarely	2	3.33	0	0.00	0	0.00	
- Do it some day	0	0.00	0	0.00	0	0.00	
- Do it most day	0	0.00	2	3.33	3	5.00	
- Do it all day	0	0.00	3	5.00	2	3.33	
<b>3. Feeds self with moderate assistance and is untidy</b>							
- Never	3	5.00	0	0.00	0	0.00	<b>141.63</b> <b>0.00*</b>
- Do it rarely	2	3.33	0	0.00	0	0.00	
- Do it some day	0	0.00	0	0.00	0	0.00	
- Do it most day	0	0.00	0	0.00	2	3.33	
- Do it all day	0	0.00	5	8.33	3	5.00	
<b>4. Requires extensive assistance for all meals</b>							
- Never	0	0.00	3	5.00	5	8.33	<b>131.86</b> <b>0.00*</b>
- Do it rarely	0	0.00	2	3.33	0	0.00	
- Do it some day	0	0.00	10	16.67	10	16.67	
- Do it most day	2	3.33	0	0.00	0	0.00	
- Do it all day	3	5.00	0	0.00	0	0.00	
<b>5. Does not feed self at all and resists efforts of others to feed him or her</b>							
- Do it rarely	0	0.00	3	5.00	5	8.33	<b>146.36</b> <b>0.00*</b>
- Do it some day	0	0.00	2	3.33	0	0.00	
- Do it most day	2	3.33	0	0.00	0	0.00	
- Do it all day	3	5.00	0	0.00	0	0.00	

(\*) Statistically significant at level  $P < 0.05$ .

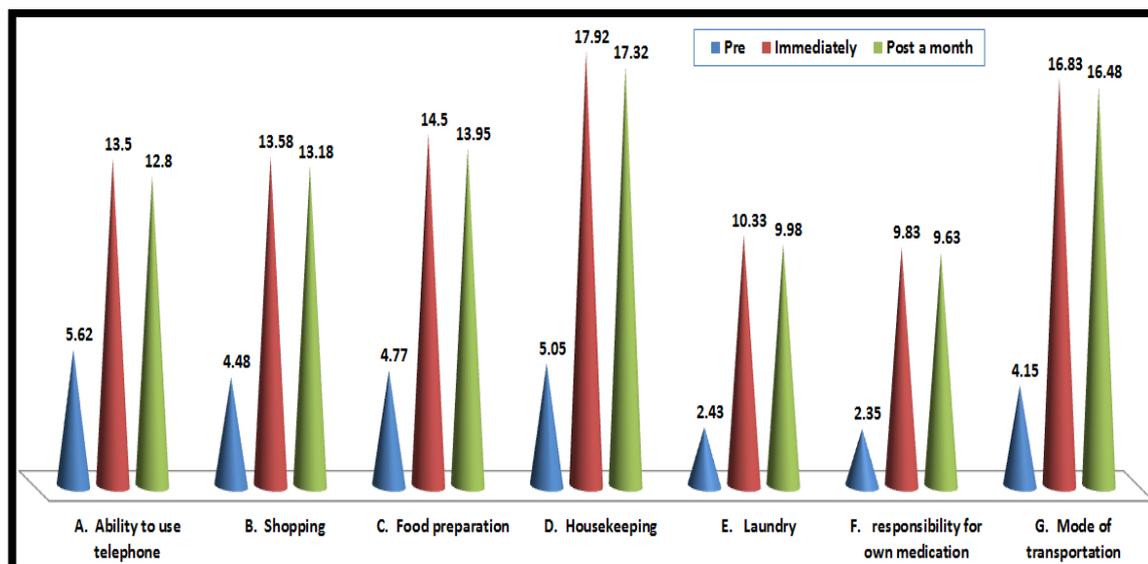
**Table (4): Mean scores of the Activities Daily Living (ADLS) domains of the studied patients with diabetic ketoacidosis for the daily life throughout periods of study.**

ADLS Domains	The studied patients (n=60)			F P
	Range			
	Mean $\pm$ SD			
	Pre	Immediately	Post a month	
<b>1) Physical self-maintenance scale</b>				
A. Toilet	(0-8) 4.18 $\pm$ 2.39	(5-20) 13.67 $\pm$ 5.47	(0-20) 13.07 $\pm$ 5.85	<b>72.72</b> <b>0.001*</b>
B. Feeding	(2-11) 7.00 $\pm$ 2.52	(13-20) 17.42 $\pm$ 2.71	(8-20) 16.87 $\pm$ 3.56	<b>234.58</b> <b>0.001*</b>
C. Dressing	(4-10) 6.90 $\pm$ 1.97	(12-20) 17.42 $\pm$ 2.90	(10-20) 16.37 $\pm$ 3.46	<b>249.22</b> <b>0.001*</b>
D. Grooming	(0-10) 5.88 $\pm$ 2.68	(13-20) 18.17 $\pm$ 2.53	(12-20) 17.17 $\pm$ 2.95	<b>376.41</b> <b>0.001*</b>
E. Physical Ambulation	(0-13) 6.18 $\pm$ 4.27	(14-20) 17.67 $\pm$ 2.23	(10-20) 16.62 $\pm$ 2.88	<b>230.57</b> <b>0.001*</b>
F. Bathing	(4-7) 5.62 $\pm$ 0.92	(8-20) 17.42 $\pm$ 3.62	(8-20) 16.57 $\pm$ 3.87	<b>269.06</b> <b>0.001*</b>
<b>2) Instrumental Activities of Daily Living</b>				
A. Ability to use telephone	(0-14) 5.62 $\pm$ 3.91	(7-16) 13.50 $\pm$ 3.01	(7-16) 12.80 $\pm$ 3.18	<b>99.56</b> <b>0.001*</b>
B. Shopping	(0-8) 4.48 $\pm$ 2.58	(10-16) 13.58 $\pm$ 2.31	(10-16) 13.18 $\pm$ 2.38	<b>269.84</b> <b>0.001*</b>
C. Food preparation	(0-11) 4.77 $\pm$ 3.20	(11-16) 14.50 $\pm$ 1.91	(8-16) 13.95 $\pm$ 2.32	<b>279.39</b> <b>0.001*</b>
D. Housekeeping	(0-10) 5.05 $\pm$ 3.03	(12-20) 17.92 $\pm$ 2.65	(12-20) 17.32 $\pm$ 2.93	<b>382.42</b> <b>0.001*</b>
E. Laundry	(0-6) 2.43 $\pm$ 1.94	(7-12) 10.33 $\pm$ 1.81	(7-12) 9.98 $\pm$ 1.77	<b>352.02</b> <b>0.001*</b>
F. responsibility for own medication	(0-6) 2.35 $\pm$ 2.20	(7-12) 9.83 $\pm$ 1.48	(7-12) 9.63 $\pm$ 1.40	<b>364.36</b> <b>0.001*</b>
G. Mode of transportation	(0-12) 4.15 $\pm$ 3.79	(9-20) 16.83 $\pm$ 3.21	(9-20) 16.48 $\pm$ 3.18	<b>269.94</b> <b>0.001*</b>

(\* ) Statistically significant difference at level  $P < 0.05$ .



**Figure (4): Mean scores of the Activities Daily Living (ADLS) domains of the studied patients with diabetic ketoacidosis for physical self-maintenance scale throughout periods of study .**



**Figure (5): Mean scores of the Activities Daily Living (ADLS) domains of the studied patients with diabetic ketoacidosis for instrumental activities of daily living throughout periods of study.**

## Discussion

Diabetic ketoacidosis is a serious complication of diabetes that occurs when the body produces high levels of blood acids called ketones. The condition develops when the body can't produce enough insulin. enter cells. Without enough insulin, the body begins to break down fat as fuel. This process produces a buildup of acids in the bloodstream called ketones. <sup>(15)</sup>

The findings of the present study clarified that one third of the studied patients were read and write and had university education. Less three quarters of them were from rural area. Less than half of the studied patients had irregular employment. As regard to monthly income, it was noticed that less than half of the studied patient had no enough and enough monthly income. This finding matched with the results of the study from **Saleh et al. B. (2012)** <sup>(16)</sup> who observed in their study that about one quarter of study group were illiterate, had a primary through grade eight education and one third of them had secondary education. About half of the respondents lived in urban areas, and the rest lived in semiurban and rural areas. Half of the respondents were homemakers, and others were service providers, businesspeople, or either unemployed or laborers. Slightly more than half of the respondents belonged to the lower-middle-income group and one-fourth belonged to the low-income group.

The findings of the present study showed that regarding smoking, it was observed that nearly half of the studied patients were smokers, more than one third of them were smoking cigarettes. One quarter of them smoking from 5 to 10 years, with mean score of years were  $(7.93 \pm 9.189)$ . This may be the cause of increase the risk of developing DKA for diabetic patient. **Yuan and Larsson (2019)** <sup>(17)</sup> were in line with the present study who reported that a causal association between smoking initiation and increased risk of type 2 diabetes. Most available studies found a consistent detrimental effect of current and past smoking on type 2 diabetes. <sup>(18, 19).</sup>

Related to clinical data, more than half of the studied patients had diabetes type II followed

by one third of them had diabetes type I. Regarding to diagnosis, less than half 45.0% of them had DM only and DM with renal disease for both and the rest of them had DM and hypertension. Regards to duration of disease, half of the studied patients had disease from 5 to 10 years. About two thirds of them had past medical history of hypertension and one quarter of them had past medical history of cardiac disease. On the other hand, all and nearly half of them had current history of DM and hyper tension disease and also take medication of diabetic and hypertensive medication respectively. This may be a possible reason for this is that either diabetes is associated with recent changes in dietary habits and lifestyle modifications, or it is a reflection of a high patient mortality.

The current study was agreed with **Jackson et al, (2014)** <sup>(20)</sup> who stated that three quarters of the respondents had had diabetes for less than 10 years, while only one quarter of them had had it for more than 10 years. On the other hand, the current study was disagreed with **Rao V et al, (2012)** <sup>(21)</sup> who stated that the incidence of occurrence of DKA with infections was more in type I DM than type II. Infections as precipitating event was identified in two thirds of episodes of DKA in type 1 whereas only one third of patients with type 2 DM had infection. In type 2 DM some stressful events like associated medical conditions; family related matters were seen in majority of cases which eventually lead to development of DKA.

Knowledge deficits for many aspects of patients about diabetic ketoacidosis before the program, as evidenced by the low mean score, they achieved. This could be due to insufficient information about diabetic ketoacidosis. This is in harmony with **Jackson et al, (2014)** <sup>(20)</sup> who mentioned that the knowledge about glycosylated hemoglobin (HbA1c), physical activities, hypoglycemic symptoms, and medication-related items performed relatively poorly. Also, this finding matched with the results of the study from **Romo-Romo et al (2021)** <sup>(22)</sup> who

revealed that in his study, the variables related to diabetes education showed a deficiency in the patients' knowledge about their disease.

Moreover, this result was supported by **Taha et al (2016)** <sup>(23)</sup> they were in the same direction with this result and stated that patients' knowledge about DM was generally low at the pre-guidelines phase. The posttest showed significant improvements in all aspects of patients' knowledge about DM, reaching 100.0% satisfactory knowledge in almost all aspects. This persisted at the follow-up test, with minimal non-significant declines in some areas. In total, more than three quarters of the patients had unsatisfactory knowledge at the pretest, compared to none at the post and follow-up tests.

In congruence with this, **Kolb et al. (2014)** <sup>(24)</sup> in a study in the United States, reported low level of knowledge about diabetes among patients, and discussed the importance of sound patient information on success of management. Furthermore, **Liebhauser et al. (2014)** <sup>(25)</sup> in Austria, mentioned that diabetic patients' knowledge about specific dietary ingredients helps in improving their dietary habits. Also, in line with the current study results, **Lewis et al. (2015)** <sup>(26)</sup> in a study in the United States revealed a retention of the post-intervention improvement in patients' knowledge at follow-up testing.

Concerning patients' self-care practice domains related to the diabetic ketoacidosis, the result of the present study showed that the majority of them had unsatisfactory practice before guideline implementation while more than half of them had satisfactory practice one month after guideline implementation. This can be explained by the patients' full communication and co-operation to formal implementation of training guideline and the effect of the teaching methods and materials which were used in the training guideline.

Moreover, this result was supported by **Sherifali D et al, (2018)** <sup>(27)</sup> recommended

a variety of education and support programs including group classes and individual counseling sessions, with technology-based strategies (e.g., Internet-based computer programs and mobile phone apps). Diabetics need self-management education and support when first diagnosed, as well as during times when there are changes in treatment, general health, or life circumstances. Diabetics were suggested to adhere to diabetes team with a trusting and collaborative relationship, set goals for caring for disease and health, and identify tailor-made strategies. <sup>(27)</sup>

In addition, this finding agreed with **Torres H et al, (2011)** <sup>(28)</sup> stressed on the importance of education and health communication guided dialogical relations and appreciation of popular knowledge, by reorienting the educational practices for self-care, to establish strategies for prevention in their study on knowledge, attitudes, and practices of self-care in individuals with DM. Bangladesh researchers feel that diabetes education improves knowledge and attitudes for self-empowerment regardless of the education program tools (workshop or training package), to promote self-care skills improving the quality of life.

Concerning the Activities Daily Living (ADLS) domains of the studied patients with diabetic ketoacidosis assessment, the result of the present study revealed that there was an improvement in the Activities Daily Living after guideline implementation compared before the health education implementation. This evidence by statistically significant difference between mean scores of the activities daily living domains of the studied patients with diabetic ketoacidosis for instrumental activities of daily living

before and after health education guideline. This could be due to their deficient knowledge, self-care practice domains related to the diabetic ketoacidosis before the guideline's intervention.

This finding is similar to **Istek and Karakurt, (2016)** <sup>(29)</sup> who found that A significant positive correlation was found between activities of daily living and self-care agency. As the level of independence of patients increased in their activities of daily living, their self-care agency behaviors also improved. Also, matched with the results of the study from **Taha et al, (2016)** <sup>(23)</sup> who stated that the model for the self-efficacy score indicates that the significant positive predictor of this score throughout the study phases was the intervention while the duration of DM was a negative predictor. As indicated by the standardized coefficient, the intervention was the most influential factor. As r-square indicates, 75% of the variance of self-efficacy score is attributed to the factors in the model.

The current study revealed that there was a statistically significant difference between daily living activities level, knowledge level and self-care practice level post month the program with positive correlation. Also, there was positive correlation between daily living activities level and knowledge level immediately after the program. These findings favor that diabetic ketoacidosis education should be included routinely in the integral care of patients with diabetes, promoting empowerment, and making informed and appropriate decision. This finding matched with the results of the study from **Romo-Romo et al (2021)** <sup>(125)</sup> who mentioned that patients attending the education sessions showed significant changes in components that promote self-management of their

disease including knowing glycemic targets, and performing an adequate insulin injection technique.

This also, agree with **Flensner and Lindergrona, (2010)** <sup>(30)</sup> who mentioned that a significant positive correlation was found in this study between activities of daily living and self-care agency. A study showed that self-care was an important factor for patients in performing their activities of daily living and they needed adequate self-care agency to be able to perform these activities of daily living.

Finally, these findings may be explained in the light of the fact that better improvement of knowledge and self-care practice of patient with diabetic ketoacidosis after implementing educational program practice related to daily living activities intervention.

#### References

1. Cox K, Cocchi M, Saliccioli J, Carney E, Howell M, Donnino M. Prevalence and significance of lactic acidosis in diabetic ketoacidosis. *J Crit Care.* 2018; 27(2): 132-137.
2. Palmer B, Clegg D. Electrolyte and Acid-Base Disturbances in Patients with Diabetes Mellitus. *N Engl J Med.* 2019; 373(6): 548-559.
3. Deeter K, Roberts J, Bradford H. Hypertension despite dehydration during severe pediatric diabetic ketoacidosis. *adult diabetes.* 2021; 12(4) Pt (1): 295-301.
4. Carlotti A, St George-Hyslop C, Guerguerian A, Bohn D, Kamel K, Halperin M. Occult risk factor for the development of cerebral edema in children with diabetic ketoacidosis: possible role for stomach emptying. *Pediatric diabetes.* 2019; 10(8): 522-533.

5. Collier S, Gura K, deLoid L, Dalton M. Parenteral Nutrition. In: Sonnevile K, Duggan C, eds. Manual of Pediatric Nutrition. 5th ed. Shelton, Connecticut: People's Medical Publishing House-USA; 2018: 196-248.
6. Sheikh-Ali M, Karon B, Basu A. Can serum beta-hydroxybutyrate be used to diagnose diabetic ketoacidosis? *Diabetes care*. 2018; 31(4): 643-647.
7. Bas V, Uytun S, Torun Y. Diabetic euglycemic ketoacidosis in newly diagnosed type 1 diabetes mellitus during Ramadan fasting. *J Pediatr Endocrinol Metab*. 2019; 28(3-4): 333-335.
8. Peters A, Buschur E, Buse J, Cohan P, Diner J, Hirsch I. Euglycemic Diabetic Ketoacidosis: A Potential Complication of Treatment With Sodium-Glucose Cotransporter 2 Inhibition. *Diabetes Care*. 2018; 38(9): 1687-1693.
9. Goldenberg RM, Berard LD, Cheng AY. SGLT2 Inhibitor-associated Diabetic Ketoacidosis: Clinical Review and Recommendations for Prevention and Diagnosis. *Clin Ther*. 2019; 38(12): 2654-2664 e2651.
10. Misaghian-Xanthos N, Shariff A, Mekala K. Sodium-Glucose Cotransporter 2 Inhibitors and Diabetic Ketoacidosis: A Case Series From Three Academic Institutions. *Diabetes Care*. 2019; 40(6): e65-e66.
11. Von Oettingen J, Wolfsdorf J, Feldman H, Rhodes E. Use of Serum Bicarbonate to Substitute for Venous pH in New-Onset Diabetes. *Pediatrics*. 2018; 136(2): e371-377.
12. Mayer-Davis E, Lawrence J, Dabelea D. Incidence Trends of Type 1 and Type 2 Diabetes among Youths, 2002-2012. *N Engl J Med*. 2019; 376(15): 1419-1429.
13. Ingelfinger JR, Jarcho JA. Increase in the Incidence of Diabetes and Its Implications. *N Engl J Med*. 2018; 376(15): 1473-1474.
14. Fazeli Farsani S, van der Aa M, van der Vorst M, Knibbe C, de Boer A. Global trends in the incidence and prevalence of type 2 diabetes in children and adolescents: a systematic review and evaluation of methodological approaches. *Diabetologia*. 2017; 56(7): 1471-1488.
15. Misra S, Oliver N. Diabetic ketoacidosis in adults (PDF). *BMJ (Clinical Research Ed.)*. 28 October 2015; 351
16. Saleh F, Mumu S, Ara F, Begum H, Ali L. Knowledge and self-care practices regarding diabetes among newly diagnosed type 2 diabetics in Bangladesh: a cross-sectional study. *BMC Public Health*. 2012; 12: 1112
17. Yuan S, and Larsson S. A causal relationship between cigarette smoking and type 2 diabetes mellitus: A Mendelian randomization study. *Scientific Reports*. 2019; 9: 19342
18. Pan A, Wang Y, Talaei M, Hu B, Wu T. Relation of active, passive, and quitting smoking with incident type 2 diabetes: a systematic review and meta-analysis. *Lancet Diabetes Endocrinol*. 2015; 3: 958–967
19. Yuan S, Xue H, Yu H, Huang Y, Tang B. Cigarette smoking as a risk factor for type 2 diabetes in women compared with men: a systematic review and meta-analysis of prospective cohort studies. *J Public Health*. 2018; 41: e169–e176.
20. Jackson I, Adibe M, Okonta M, Ukwe C. Knowledge of self-care among type

- 2 diabetes patients in two states of Nigeria. *Pharmacy Practice* 2014; 12(3): 404.
21. Rao V, Pradhan B, Mallikarjuna Y, Reddy R. Clinical profile of diabetic ketoacidosis in adults. *Health Renaissance*, 2012; 10 (2);80-86.
22. Romo-Romo A, Gómez-Velasco D, Galán-Ramírez G, Janka-Zires M, Brito-Córdova G, Gómez-Munguía L. Diabetes education and self-care behaviors in patients with diabetes in Mexico. *Rev Mex Endocrinol Metab Nutr*. 2021; 8: 183-91
23. Taha N, Zaton H, Abd Elaziz N. Impact of a health educational guidelines on the knowledge, self-management practice and self-efficacy of patients with type-2 diabetes. *Journal of Nursing Education and Practice*. 2016; 6(9): 46 – 55
24. Kolb J, Kitos N, Ramachandran A. What do primary care prediabetes patients need? A baseline assessment of patients engaging in a technology-enhanced lifestyle intervention. *J Bioinform Diabetes*. 2014; 1(1): 4.
25. Liebhauser M, Ofner M, Mittermayer F. Successful Management of Type 2 Diabetes with Lifestyle Intervention: A Case Report. *Int J Vitam Nutr Res*. 2014; 84(3-4): 133-139.
26. Lewis V, Benda N, Nassar C. Successful patient diabetes education in the emergency department. *Diabetes Educ*. 2015; 41(3): 343-350
27. Sherifali D, Berard R, Gucciardi E, MacDonald B, MacNeill G. Diabetes Canada Clinical Practice Guidelines Expert Committee. Self-Management Education and Support. Available from: <http://www.guidelines.diabetes.ca/cpg/chapter7>. [Last accessed on 2018 Aug 15].
28. Torres H, Souza E, Lima M, Bodstein R. Educational intervention for self-care of individuals with diabetes mellitus. *Acta Paul Enferm* 2011; 24: 514-519.
29. Istek N, Karakurt P. Effect of Activities of Daily Living on Self-Care Agency in Individuals with Type 2 Diabetes. *Journal of Diabetes Mellitus*, 2016; 6: 247-262.
30. Flensner G, and Lindergrona C. The Cooling-Suit: A Study of Ten Multiple Sclerosis Patients' Experience in Daily Life. *Journal of Advanced Nursing*, 2010; 29: 1444-1453