Effectiveness of the Educational Program on Nurses' Knowledge concerning Diabetic Ketoacidosis

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ABSTRACT

Background: Diabetic ketoacidosis (DKA) is one of the complications of type 1 diabetes mellitus (T1DM). This is a critical case that needs prompt and efficient intervention to avoid serious complications. Nurses play a crucial role in caring for these patients, in critical care settings.

Objectives: In this study, we want to know if the educational program changed nurses' knowledge about DKA

Methods: At Al-Diwaniyah Teaching Hospital, a quasi-experimental design was used to examine the effectiveness of the educational program on nurses' knowledge in cardiac care units, respiratory care units, and emergency rooms. A non-probability (purposive) sample was selected from nurses who works in these three unites, the study group consisted of 35 nurses, while the control group comprised 41 nurses. A statistical package for social science (SPSS) program, version 26 was used for descriptive and inferential statistics.

Results: The nurse's knowledge of diabetic ketoacidosis increased significantly, as their knowledge level was (**Mean ±SD= 7.2286 ±1.21476)** in the pretest, it increased after the educational program in the study group to became **(Mean ±SD= 8.6286± 97274)**, as for the control group, there was no difference and their knowledge did not improve, and There was a significant increase in nurses' knowledge regarding nursing care of DKA as their knowledge level was **(Mean ±SD= 14.6857± 2.01131)** in the pretest and it increased after the educational program in the study group to became **(Mean ±SD= 16.8286± 1.54322)**.

Conclusion: A study found that nurses' knowledge of DKA was improved by an educational program.

Keywords: Effectiveness, Educational Program, Nurses' Knowledge, diabetic ketoacidosis

Introduction

Diabetes is One of the most important health issues (1) Threatening the global populace in the current era(2). One of the most well-known chronic disorders that affect children and young adults is type 1 diabetes (3), it is characterized by increased blood glucose levels (hyperglycemia) caused by insufficient insulin produced by malfunctioning pancreatic β-cells (4). Diabetic ketoacidosis (DKA) which is considered as one of the major causes of hospitalization and mortality in diabetic patients, is a consequence of type 1 diabetes, the most common chronic illness in childrens(5)**.** DKA is primarily seen in individuals with untreated type 1 diabetes mellitus (T1DM). It is caused by an absolute or relative shortage of insulin and the concurrent rise of counter-regulatory hormones, which typically culminate in the triad of hyperglycemia, metabolic acidosis, and ketosis (6). Two-thirds of adult DKA episodes are experienced by individuals with T1DM, and one-third are experienced by those with T2DM(7) (8) (9)**.** Precipitating factors for diabetic ketoacidosis (DKA) in individuals with established diabetes mellitus include infections, coexisting conditions such acute coronary syndrome, problems with the insulin pump (such as infusion settings coming loose or being blocked), and inadequate or noncompliant insulin administration (10)

Monitoring of the patient's response to DKA treatment is crucial, and any necessary treatment modifications should be made in response, This involves keeping track of the patient's blood pressure, pulse, and respiration rate as well as accurately documenting their fluid intake and output(11)**.** DKA is accompanied by a variety of complications. For instance, the most common side effects of DKA treatment are hypokalemia and hypoglycemia, both of which are often manageable with continued, careful biochemical monitoring.(12) (10)**.** In children, DKA also commonly leads to acute kidney injury (AKI)(11)

The vital role that nurses play in educating and supporting diabetes patients emphasizes how important it is to make sure they

are ready to provide the information that is required. This emphasizes how important education is for nurses, especially when it comes to managing diabetes(13). Educating diabetes patients how to take care of themselves is one strategy to lower the morbidity and mortality rate from the disease.(14). One of the main challenges in managing hyperglycemia in diabetic conditions has been discovered to be a lack of knowlege among healthcare practitioners (15). In hospitals, nurses are essential in providing care for patients with diabetes mellitus (16). Because DM care is changing rapidly, nurses must receive ongoing education on current trends and evidence-based procedures for treating and avoiding DM complications in hospitalized patients (16) . Examining the knowledge of nursing staff on the treatment of diabetic patients who seek emergency services enables us to recognize the areas in which nursing care falls short and where it improves (17). The study found that the intervention program significantly affects nurses' practices on diabetic ketoacidosis, moving them from bad to good practice following the program's implementation (3). Several studies have also demonstrated the efficacy of the educational program in improving nurses' multiple fields knowledge.(18) (19) (20) (21) . The purpose of this study is to evaluate how well the educational program has affected nurses' understanding of DKA.

OBJECTIVES OF THE STUDY

The study aim to examine the effectiveness of the educational program on nurses' knowledge regarding HHS.

MATERIALS AND METHODS

Design of the study: The quasi-experimental design carried out on critical care nurses to assess the effectiveness of educational program on nursing knowledge regarding HHS.

Setting of the Study: The study was conducted in Iraq at Al-Diwaniyah Teaching Hospital in the units prepared to receive critical cases, including cases of DKA. These units are

1. Emergency room
2. Respiratory care unite
3. Cardiac care unite

This hospital was selected because it contains critical care units that receive patients from various regions within the province, including those with diabetes.

Sample of the study: A non-probability (purposive) sample was selected from nurses who works in these three unites respiratory care unite, cardiac care unite and emergency unite. As a result, a net total of 88 nurses was divided into study and control groups based on odd and even sequences, resulting in 44 nurses in each group. 9 nurses from the study group did not complete the program and were consequently excluded, leaving 35 participants. In the control group, 3 nurses did not complete the follow-up test, yielding a total of 41 participants

Study Instrument: Questionnaire was developed to evaluate the effectiveness of the educational program on nurse's knowledge about DKA. It consists of two parts

Part I: Demographic Data form:

This part consists of 7 items related to demographic data: age, gender, marital status, educational level, place of work, years of service and self-learning.

Part II: Nurses knowledge HHS

The questionnaire was developed by reviewing relevant literature on DKA, and it was adjusted based on expert opinions. This part aim to assess nurse's knowledge about DKA, which contains 30 items divided into 2 domains and each domain divided to 2 subdomain:

A: Assess nurse's knowledge toward DKA, consist of 5 items.

B: Assess nurse's knowledge toward nursing care of DKA, consist of 10 items.

All the items of nurses' knowledge were multiple-choice questions of four choices for each. These rated as (1) for correct choice and (0) for the wrong choice. The time of questionnaire answer list, for each nurse took about 10_15 minutes. Scores of response are categorized according to the following:

Poor nurses' knowledge :(1_1.33)

Moderate nurses' knowledge: (1.34_1.67)

Good nurses' knowledge: (1.68_2)

Validity of instrument and educational program

The educational program and questionnaire were validated by committee comprising 12 accomplished professionals, each boasting a minimum of five years of experience within their respective domains. This panel was convened to meticulously examine the content of both the program and questionnaire, focusing on their alignment with the requisite knowledge pertaining to (DKA). The committee included 9 academic members from the College of Nursing, University of Baghdad, and three specialized physicians from the AL Diwaniyah Teaching Hospital. The experts were given a copy of the program as well as the questionnaire to examine and evaluate the program's tools and content. Changes and revisions were made in response to the insightful comments and recommendations of the experts. This required the removal of certain elements and the insertion of other ones.

Reliability of instrument:

Test-retest reliability method was used to measure reliability of the questionnaire. The reliability of the questionnaire was evaluated using this approach. This was achieved by giving the questionnaire to a sample of ten nurses, testing again after a period of fifteen days, and figuring out the correlation between the results

of the first and second tests by using Pearson correlation coefficient. The results showed that there is good stability in the questionnaire (r=٠,٨٦٥)

Session of the programs:

First lecture: Definitions, Characteristics and precipitating factors of DKA.

Second lecture: Clinical presentation and Pathophysiology of DKA.

Third lecture: diagnostic criteria and medical management of DKA.

Fourth lecture: Nursing care of DKA.

- Tools used in the lecture

Computer

Data show screen

- Time and location of the lecture:

Continuing education hall in Al-Diwaniyah Teaching Hospital

10.00 a.m.

Result

Factors	Classification	*Study Group*		*Control Group*	
		N	%	N	%
Age/ years	20 to less than 30	**33**	**94.2**	**39**	**95.1**
	30 to less than 40	2	5.8	2	4.9
	Total	35	100	41	100
	Mean± SD	24.82 ± 3.47		24.65 ± 3.306	
Sex	Male	**19**	**54.3**	**20**	**48.8**
	Female	16	45.7	21	51.2
Years of experience	1-Less than 5 years	**27**	**77.1**	**28**	**68.3**
	5-less than 10 years	7	20	11	26.8
	Above 10 years	1	2.9	2	4.9
Educational level	Diploma	**19**	**54.3**	**24**	**58.5**
	Bachelor's	12	34.3	13	31.7
	Higher education	4	11.4	4	9.8
Area of work	RCU	10	28.6	10	24.4
	CCU	**18**	**51.4**	**18**	**43.9**
	Emergency	7	20	13	31.7
Marital status	Single	**20**	**57.1**	**25**	**61**
	Married	15	42.9	16	39

No. = Number; %= Percentage

Table 1. Distribution of Study Sample by their Socio-Demographic Variables.

DKA Items	Study Group					Control Group			
	Class	n	%	M.s	Ass	n	%	M.s	Ass
What is the original cause of Diabetic Ketoacidosis (DKA)?	Incorrect	5	14.3	1.85	G	18	43.9	1.56	M
	Correct	30	85.7			23	56.1		
What is the underlying pathology of DKA	Incorrect	6	17.1	1.82	G	20	48.8	1.51	M
	Correct	29	82.9			21	51.2		
Which (ABG) finding is commonly seen in DKA	Incorrect	8	22.9	1.77	G	21	51.2	1.48	M
	Correct	27	77.1			20	48.8		
What is the recommended fluid resuscitation in DKA?	Incorrect	23	65.7	1.34	M	34	82.9	1.17	P
	Correct	12	34.3			7	17.1		
What electrolyte disturbance is commonly seen in DKA	Incorrect	6	17.1	1.82	G	15	36.6	1.63	M
	Correct	29	82.9			26	63.4		

Each item evaluated as Poor [P]=1-1.33, Moderate [M]=1.34-1.67, Good [G]=1.68-2

Table 2. Nurses' Knowledge of DKA in the study and control groups

DKA Nsg. care Items	Study Group					Control Group			
	Class	n	%	M.s	Ass	n	%	M.s	Ass
Which assessment finding in a patient with DKA requires immediate nursing care	Incorrect	27	77.1	1.22	P	36	87.8	1.12	P
	Correct	8	22.9			5	12.2		
A patient with DKA on insulin infusion. What is the nurse's priority action?	Incorrect	3	8.6	1.91	G	12	29.3	1.70	G
	Correct	32	91.4			29	70.7		
While an assessment is being done for a DKA patient, the nurse notes acetone breath odor. What is the cause of this symptom	Incorrect	1	2.9	1.97	G	14	34.1	1.65	M
	Correct	34	97.1			27	65.9		
Which laboratory result is most indicative of good outcome for DKA management	Incorrect	7	20	1.80	G	20	48.8	1.51	M
	Correct	28	80			21	51.2		
A patient with DKA is experiencing rapid deep respirations, what is the primary cause for this respiratory pattern	Incorrect	17	48.6	1.51	M	23	56.1	1.43	M
	Correct	18	51.4			18	43.9		
which nursing intervention takes the highest priority, In a patient with DKA	Incorrect	4	11.4	1.88	G	11	26.8	1.73	G
	Correct	31	88.6			30	73.2		
A patient with DKA is receiving IV insulin. What is a possible complication that the nurse should monitor for	Incorrect	8	22.9	1.77	G	23	56.1	1.43	M
	Correct	27	77.1			18	43.9		
What nursing action is vital during	Incorrect	23	65.7	1.34	M	30	73.2	1.26	P

the rehydration phase of DKA management	Correct	12	34.3			11	26.8		
While educating a patient with DKA on self-care, what should the nurse emphasize regarding insulin therapy	Incorrect	12	34.3	1.65	M	16	39	1.60	M
	Correct	23	65.7			25	61		
When a patient with DKA has been stabilized, and the insulin infusion has been discontinued. What is the nurse's priority in the ongoing care of this patient	Incorrect	9	25.7	1.74	G	15	36.6	1.63	M
	Correct	26	74.3			26	63.4		

Each item evaluated as Poor [P]=1-1.33, Moderate [M]=1.34-1.67, Good [G]=1.68-2

Table 3. Nurses' Knowledge regarding nursing care of DKA in the study and control groups

Groups	Periods	M	SD	Paired t- test	d.f	P value	Sig.
Study	Pre-test	7.2286	1.21476	-7.248	34	.000	HS
	Post-test	8.6286	.97274				
Control	Pre-test	7.3171	.81973	-.404	40	.688	Ns
	Post-test	7.3659	.85896				

M: Mean, SD: Standard deviation, t: t-test, d.f: Degree of freedom, Sig: Significance level at 0.05.

Table 4. Comparison DKA Knowledge domain betweenPretest-Posttest Study-control Groups

Groups	Periods	M	SD	Paired t- test	d.f	P value	Sig.
Study	Pre-test	14.6857	2.01131	-8.149	34	.000	HS
	Post-test	16.8286	1.54322				
Control	Pre-test	15.1220	1.16609	.000	40	1.000	Ns
	Post-test	15.1220	1.38194				

M: Mean, SD: Standard deviation, t: t-test, d.f: Degree of freedom, Sig: Significance level at 0.05.

Table 5. Comparison DKA Nursing Care domain between Pretest-Posttest Study-control Groups.

Domains	Groups	M	SD	t-value	d.f	P valu	Sig
General DKA Knowledge	Study	8.628	.9727	6.147	68	**.000**	**Hs**
	Control	7.342	.764				
DKA Nsg. Care Knowledge	Study	16.82	1.543	5.043	68	**.000**	**Hs**
	Control	15.05	1.392				

M: Mean, SD: Standard deviation, t: t-test, d.f: Degree of freedom, Sig: Significance level at 0.05

Table 6. Comparison of Study and control Groups concerning nurses' knowledge domains

Domains	**Groups**	**M**	**SD**	**t-value**	**d.f**	**P value**	**Sig**
General DKA Knowledge	Male	8.789	.9763	1.069	33	.293	Ns
	Female	8.437	.9639				
DKA Nsg. Care Knowledge	Male	17.10	1.370	1.162	33	.254	Ns
	Female	16.50	1.712				

M: Mean, SD: Standard deviation, t: t-test, d.f: Degree of freedom, Sig: Significance level at 0.05.

Table 7. Sex differences of Study Group concerning nurses' knowledge domains.

Domains	**Groups**	**M**	**SD**	**t-value**	**d.f**	**P value**	**Sig**
General DKA Knowledge	Single	8.7500	.91047	.849	33	.402	Ns
	Married	8.4667	1.06010				
DKA Nsg. Care Knowledge	Single	17.0000	1.33771	.754	33	.456	Ns
	Married	16.6000	1.80476				

M: Mean, SD: Standard deviation, t: t-test, d.f: Degree of freedom, Sig: Significance level at 0.05.

Table 8. Marital status differences of Study Group concerning nurses' knowledge domains.

M: Mean, SD: Standard deviation, d.f: Degree of freedom,

		General DKA Knowledge	DKA Nsg. Care Knowledge
Age	Pearson Correlation	.050	.263
	Sig. (2-tailed)	.775	.127
	N	35	35
years of experience	Pearson Correlation	.019	.236
	Sig. (2-tailed)	.913	.171
	N	35	35

Sig:Significance level at 0.05.

Table 9. Differences of age and years of experience of Study Group concerning nurses' knowledge domains.

Variables \ Area of working		df	Mean Square	F	Sig.
General DKA Knowledge	Between Groups	2	.929	.980	.386
	Within Groups	32	.947		
	Total	34			
DKA Nsg. Care Knowledge	Between Groups	2	.118	.047	.954
	Within Groups	32	2.523		

	Total	34			

M: Mean, SD: Standard deviation, F: ANOVA test, d.f: Degree of freedom, Sig: Significance level at 0.05

Table 10. Area of working Differences of Study Group concerning nurses' knowledge domains.

Level of education / Variable		**df**	**Mean Square**	**F**	**Sig.**
General DKA Knowledge	Between Groups	2	1.759	1.964	.157
	Within Groups	32	.895		
	Total	34			
DKA Nsg. Care Knowledge	Between Groups	2	1.935	.803	.457
	Within Groups	32	2.409		
	Total	34			

M: Mean, SD: Standard deviation, F: ANOVA test, d.f: Degree of freedom, Sig: Significance level at 0.05.

Table 11. Differences of educational level of Study Group concerning nurses' knowledge domains

Discussion

Part I: Discussion of Socio-demographics Characteristics of nurses:

the present study find out that the majority of the sample are full at the interval (20 – 30) yrs., and their percentage was 94.2%, with an average of 24.82±3.47 years, and the majority of participants in the control group were also between 20 and 30 years , and their percentage was 95.1%, with an average of 24.65±3.306 years as in table (1). This result consistent with study conducted by Jasim (21) who found that (80 %) of nurses are at age group (20 to 29) years old. The study and control groups both showed a predominant male presence, with 54.3% and 48.8%, respectively, This results are consistent with study conducted by Baiez and Mohammod who found Most of them were male (63.6%) (22).

The majority of participants have 1-5 years of experience, constituting 77.1% in the study group and 68.3% in the control group, This finding is consistent with a study find out that the majority of nurses have (1 -5) years of experience(23).

The majority of nurses participating in the study were unmarried in both the study group (57.1%) and the control group (61%),contrary to the results of the study conducted by Jissir (24) who found that the majority (76.6%) of nurses was married.

The majority of participants, comprising 54.3% in the study group and 58.5% in the control group, possessed a diploma, This corresponds with previous research indicating that the largest proportion of the study sample holds a diploma degree.(25).

The majority of participating nurse's work in CCU, the study group demonstrated (51.4%) while the control group recorded (43.9%). This not in the same line Mousa et al which entitled "Nurses' Knowledge Concerning Early Interventions for Patients with Ventricular Tachycardia at Baghdad Teaching Hospitals" who found the majority of nurses from intensive care unit(26).

Part II: Discussion of the nurse's Knowledge Concerning DKA study and control groups:

In order to care for diabetes patients effectively, nurses play a very important role. It is essential that nurses have knowledge of DKA in order to make informed decisions and improve the quality of care provided to patients.

1. comparison DKA Knowledge domain between Pretest -Posttest Study-control Groups

In this study, five items of the questionnaire were used to assess nurses' knowledge about diabetic ketoacidosis. Nurses' knowledge of diabetic ketoacidosis significantly increased as their knowledge level was **(Mean ±SD= 7.2286 ±1.21476)** at the pre-test, but their knowledge level increased in the study group following the educational program to become **(Mean ±SD= 8.6286± 97274),** whereas there was no difference in the knowledge of the control group and their knowledge level did not increase (Table 3.4). These findings, were in conformity with the study done by Saad Shaker et al, (27) which conducted to determine whether a training program would affect nurses' performance in the field of diabetes ketoacidosis as well as health outcomes for those patients, It has been found that after the implementation of an educational program regarding DKA, there was a significant improvement in nurses' level of knowledge in this area, in which nurses gained knowledge regarding this condition.

Comparison DKA Nursing Care domain between Pretest-Posttest Study-control Groups

An assessment of nurses' knowledge regarding nursing care for DKA was conducted using ten items of a questionnaire. It has been observed that the knowledge of nurses regarding nursing care has improved significantly as their knowledge score was (Mean ±SD= 14.6857± 2.01131) in the pretest and it increased after the educational program in the study group to become (Mean ±SD=

16.8286± 1.54322), These findings were in conformity with the study done by Abd Elkhalek Mekky, Ahmed Mohamed Hassan, and Ali Ibrahim (28) which Examines how Nurses' Performance and Patient's Health Outcomes are affected by an Educational Program for Diabetic Ketoacidosis, It has been found that after the implementation of the educational program regarding DKA, nurses' knowledge level has improved significantly in relation to DKA.

Compared to the control group, there was no difference and their knowledge did not improve **Pre-test 15.1220± 1.16609** and **Post-test 15.1220 ±1.38194 table (3.5)**. Several factors may account for these results, including a lack of orientation program, a lack of care conferences during work, a lack of a procedure book specifically prepared for critical care areas, and a lack of nurse direction and assessments of the patient's care.(27).

Nurses knowledge and demographic characteristic

As a result of the present study, there was no statistically significant difference in total knowledge score based on demographic characteristics, this result is in agreement with the results obtained by Abees and Mohammed's study (29).

Conclusion

It has been demonstrated in this study that introducing an educational program leads to significant improvements in nurses' understanding of diabetic ketoacidosis (DKA).

Recommendation

To effectively manage DKA in critical care units, hospitals must prioritize the implementation of educational initiatives designed specifically for nurses who work in these areas.

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