

Effect of Using Clinical Pathway on Outcomes of Children with Type One Diabetes Mellitus Suffering From Diabetic Ketoacidosis

¹Rahma Soliman Bahgat, ²Fatma Ahmed Elsobkey

¹ Professor of Pediatric Nursing, Faculty of Nursing, Tanta University

² Lecturer of Pediatric Health Nursing, Benha University, Egypt

Abstract: Diabetic ketoacidosis (DKA) is a leading cause of morbidity and mortality in children with type 1 diabetes. **Aim:** The aim of the current study was to evaluate the effect of using clinical pathway on outcomes of children with type one diabetes mellitus suffering from Diabetic Ketoacidosis. **Subjects and method:** A quasi experimental research design was utilized. The current study was conducted at Pediatric intensive care unit (PICU) and pediatric ward of Benha Specialized Pediatric Hospital and Benha University Hospital. Sample of 60 children (30 as the study group and 30 as the control group) who were admitted at PICU and pediatric ward with DKA were participated in the study. The following tools were utilized for data collection, questionnaire sheet, self care activity sheet, self care hygiene sheet, nutrition assessment sheet, Glasgow coma scale, dehydration level, diabetic follow up sheet and follow pathway design for the study group **Results:** The study revealed that there were statistically significant differences between diabetic children regarding DKA before and after implementation of a clinical pathway. Children in the study group had early improvement in DKA follow up sheet as well as reduced length of hospital stay than those in the control group. **Conclusion:** Clinical pathway was effective in improving children suffering from DKA and follow up among diabetic children. **Recommendations:** Clinical pathways of care of diabetic ketoacidosis should be applied for children with diabetic ketoacidosis and provision of training program for nurses about clinical pathway.

Keywords: Clinical pathway, Type one diabetes mellitus, Diabetic Ketoacidosis.

1. INTRODUCTION

Diabetes mellitus (DM) described as an unending metabolic issue brought about by an outright or relative lack of insulin, an anabolic hormone. Requiring a constant medicinal and nursing care, and ought to execute systems for lessening the related dangers past the glycemic control (**American Diabetes Association, 2015**). Type 1 diabetes mellitus defined as a chronic illness characterized by the inability of the body to produce insulin due to the destruction in immune system found in the beta cells in the pancreas. Most pediatric patients have type 1 diabetes and require a lifetime dependence on exogenous insulin (**WHO, 2016**).

Type 1 diabetes mellitus is the consequence of natural elements cooperating with hereditary reasons for the children. This communication prompts to the advancement of immune system sickness coordinated to islet cells of Langerhans that creating insulin. These cells are decimated and result in insulin insufficiency, normally creating sort (1) diabetes after the demolition of 90% of islet cells (**Chiang et al., 2014**).

Diabetic Ketoacidosis create when untreated total or relative lack of insulin in type 1 or type 2 diabetes mellitus, it is a complex metabolic condition of hyperglycemia, ketosis, and acidosis (**Kurien et al, 2015**). Meanwhile, metabolic

acidosis produces from lactic acidosis and Ketosis; be that as it may, supplemental bicarbonate is not suggested. Acidosis more often than not settles with isotonic liquid volume recharging and insulin treatment (**Hsia et al, 2015**).

Diabetic Ketoacidosis is a serious, creating a life-threatening medical and emergency nursing. When insulin is present ketosis usually does not occur. However serious hyperglycemia, parchedness, and ketone generation add to the advancement of DKA without insulin. The advancement of cerebral edema is the most genuine complication of DKA, which prompt to the danger of death and high dismalness rate. At the season of first determination exceptionally young children are destined to create cerebral edema (**Clark & Dalabih A, 2014**).

There is a guideline on the management of DKA in pediatrics compared to adult patients. Large volumes of fluid are harmful in pediatric DKA, while adults require large volumes of intravenous fluids. The administration of IV fluids should be done very judiciously in the pediatric population. Regarding to administration of insulin, insulin boluses are contraindicated in the pediatric patient with DKA, while insulin is bloused in the adult patient. Monitoring and correction of potassium heavily stress in the adult patient with DKA (**Wherrett et al, 2013**). In addition, in children IV fluids are started prior to insulin administration, and a potassium level will always be available prior to initiating insulin. With respect to the acidosis, bicarbonate is indicated in adult patients who are profoundly acidotic. In contrast, sodium bicarbonate is not indicated in children outside of an arrest situation. (**Wolfsdorf et al, 2014**).

Nursing care is very important in child with DKA according to the British Society for Pediatric Endocrinology and Diabetes (BSPED) the nurse should begin with the resuscitation of the child, assess the Glasgow Coma scale, assess, and correct dehydration and fluid replacement therapy (**IDF, 2011**). Otherwise, the nursing care of Diabetic Ketoacidosis (DKA) in Children is primarily aimed at providing a minimum standard for the assessment (including investigations) and management of DKA, it does not replace or remove clinical judgment or the professional care and necessary duty for each specific case (**Journal of clinical pathways.com. 2015**).

Clinical pathway is interdisciplinary care maps manage client's arrangement of care through achievement of specific clinical results by the patient from admission to release (**Panella, 2014**). More ever, to enhance children' results and advance financially savvy restorative and nursing care put rules of CP apparatuses into practice, (**Brian J Gebhardt & MD; Sushil Beriwal, MD. 2016**). In addition, the points of CP are enhanced results through increment institutionalization of care, diminished cost and length of stay, documentation and assessment apparatuses, expanded correspondence among individuals from the social insurance group, , and expanded patient and family fulfillment (**Journal of Clinical Pathways, 2015**).

The principle parts of the nurse utilize all parts of clinical pathway. Taking an interest in the advancement of the clinical pathway is the initial step, since they start and end the chain of staff required in conveying consideration of children with various the medical issues. In the mean time, nurses have a one of a kind point of view on how the human services framework attempts to upgrade or obstruct the conveying of care. Hence, attendants are in charge of starting the pathway for proper patients and guaranteeing that the different occasions happen as arranged (**Coyne et al, 2010**).

SIGNIFICANCE OF THE STUDY:

There are children aged under 15 years with type (1) diabetes in the world, approximately 500,000 (**Patterson et al., 2014**); children developed type (1) in 2013 alone, 79,000 (**IDF Diabetes Atlas, 2015**). The incidence of type 1 diabetes increased, Worldwide on average. Children aged 1-4 years are at risk and may die due to complication of DKA at the time of diagnosis. Most deaths result from neglected treatment or delayed diagnosis and subsequent cerebral edema during treatment for DKA. Unexplained death during sleep may also occur and appears more likely to affect young children. Clinical pathways are tools used to guide evidence-based healthcare that have been implemented internationally since the 1980s. Enhancement of the pediatric intensive care nurses' knowledge and practical skills related to the management of children with DKA is the key to preventing the death from progressing to an emergency situation. Therefore, the nurse's knowledge and practice about the DKA is crucial.

AIM OF THE STUDY:

The aim of the current study was to determine the effect of using clinical pathway on outcomes of children with type one diabetes mellitus suffering from Diabetic Ketoacidosis

RESEARCH HYPOTHESES:

H1: Children who will expose to the clinical pathway will have improvement of GCS, Level of dehydration and the diabetic Ketoacidosis follow up sheet than children in the control group.

H2: Children who will expose to the clinical pathway will have less hospital stay have and less readmission rate than children in the control group.

2. SUBJECTS AND METHOD

RESEARCH DESIGN:

A quasi experimental research design was utilized.

SETTING:

The current study was conducted at the pediatric intensive care unit and pediatric ward of Benha Specialized Pediatric Hospital affiliated to the ministry of health and Benha University Hospital.

SUBJECTS:

Sixty children with DKA were selected from previously mention setting. The sample was randomly selected and divided into two equal groups.

Study group: Consist of thirty school age children were exposed to clinical pathway by the researchers

Control group: Consist of thirty school age children were exposed to routine hospital care.

Determination of the sample was calculated according statistical procedure known as power analysis of the sample according to phenomenon of diabetic ketoacidosis and power analysis, the size of the sample which results 60 children

Inclusion criteria

- Aged from 6-12 years
- Both sexes
- No other medical problems

DATA COLLECTION TOOLS:

Seven tools were developed and used by researchers to collect information

Tool I: Bio-socio-demographic and children knowledge Structure interview schedule

It was developed by the researchers after extensive reviewing the related literature; it consisted of four parts:

Part I: Bio-socio-demographic data related to children: such as age, gender, birth order, history and time of diagnosis.

Part II: Medical History:

Medical history was designed by the research to identify eligible criteria for clinical pathway implementation; researcher searched for present diagnosis, type of treatment, past type of insulin, level of glycemic control, onset of diabetes, practice of blood glucose analysis and urine analysis.

Part III: Children knowledge about Daily living activity and exercise as hyper activity, normal and limited activity, types of activity children were performed (walking, riding bicycle, swimming and football) hours of play during the day.

Part IV: Child Self-care as (insulin injection, analysis of blood sugar, selecting of food, amount of food, body hygiene, tooth hygiene and foot hygiene).

Scoring system: every Item divided into two categories dependent on self-care took score (0) Independent on self-care took score (1).

Tool II: Observation check list about hygienic care: the researchers observed children about hygienic care; it included five items (skin care, face care, foot care, socks care and shoes care) to assessed children level of care.

Scoring system: every Item divided into two categories unsatisfactory on his self-care took score (0) satisfactory self-care took score(1).

Tool III: Nutritional Assessment Sheets: it included three parts

Part I: Feeding habits : food frequency form to estimated daily intake according to the food exchange list included the seven main groups (milk group, meat and fish, fruit and juice, green vegetable, rice and bread, sweets and fast food) it was be calculated by number serving \ day .

Scoring system: every items divided into 3 categories, never took 1 score, once/day took 2 score and more than once /day took 3 score.

Part II: Daily dietary intake: Using 24 hours recall method: to estimate the carbohydrate, proteins and fat intake by 24 hours recall method. It was determined by more than requirements, less than requirements and daily requirements.

Scoring system: every items divided into 3 categories, daily requirement took 1 score, less than requirements took 2 score and more than requirements took 3 score.

Part III: Anthropometric measurement sheet which included: Weight, height, body mass index, upper arm circumference .Each of these measurements were taken according to the standard procedure recommended.

- Weight/age was measured using bathroom scale and recorded to the nearest tenth of a kilogram. It was used as indicator of the nutritional status for the children, and weight is estimated according to APLS formula, 2011 (APLS 2011) (Age $\times 3 + 7$) as normal weight, above normal and under normal.

- Height /age was measured and was taken to the nearest 0.1 cm and then recorded.

- Body Mass Index (BMI) was calculated as follows: $BMI = \text{weight in kg} \div (\text{height in meter})^2$

Body Mass Index for age percentile (BMI), developed by the National Center for Health Statistics (2000). It calculated as follow:

Underweight: BMI for age and sex $< 5\%$

Normal weight: BMI for age and sex $> 5\%$ to $< 85\%$

Risk for overweight: BMI for age and sex 85% to $< 95\%$

Overweight BMI for age and sex $> 95\%$

- Mid arm circumference was measured by placing the tape gently but firmly around the left upper arm while hanging freely and on its midpoint .The measurements will be recorded to the nearest 0.1 cm.

Children having less than 90% of the standard were considered under normal

Children having 90% -110 of the standard were considered normal

Children having more over 110 of the standard were considered above normal

Tool IV: Glasgow Coma Scale Assessment (GCS): Adopted from **Jennett Bond (2014)**; it consisted of (3 Items) eye, best verbal response and best motor response. The maximum GCS score was 15 and the minimum score (2).

Scoring system: from 13-15, was considered mild condition, moderate condition was scored from 9-12. A GCS score of 8 or less defines a severe condition.

Tool V: Assess level of dehydration: Adopted from **Koves et al (2004)**, it consisted from (8 items) such as blood pressure, skin turgor, eye, oral mucosa.

Scoring system: less than 5% considered mild dehydration, from 5-10% considered moderate dehydration and more than 10% considered severe dehydration. Dehydration can be estimated at 5% if there was reduced skin elasticity, dry mucous

membranes, tachycardia, and deep breathing, and up to 10% with capillary refill time greater than 3 seconds and sunken eyes.

Tool VI: Follow up schedule of children with diabetic ketoacidosis: it was adapted from **BC Children Hospital (BCCH) (2015)**, it involved 7 elements to assess and record the child's condition after CP (blood pressure, serum electrolyte, respiration, heart rate, serum ketone, serum glucose and GCS). Serum ketone and glucose are estimated by fasting and postprandial blood sugar level, random blood glucose level, urine analysis. The calculation of total length of hospital stay was done at discharge time.

Tool VII: Clinical pathway designed for children: The clinical pathway outcome was designed by the researcher, implemented and evaluated for the clinical pathway included following items: -Feeding habit and problems, daily living activity, nutritional assessment sheet for diabetic child, appropriate assessment of DKA children, measuring GCS and level of dehydration, Fluid replacement therapy and electrolyte balance as the first step of DKA management before given insulin and safety measures for self-insulin injection and self-care hygiene.

DATA COLLECTION PROCEDURE:

The actual field work was carried out from May 2016 up to November 2016 for data collection. The researchers were available in the study settings four day per week, on Saturday and Tuesday at the morning shift from 8.00 Am to 2.00 PM in PICU and pediatric ward in Benha Specialized Pediatric Hospital, and on Sunday and Wednesday in Benha University Hospitals (Pediatric department), the researchers introduced them self to all hospital staff members in the two hospitals settings. The researchers explained the aim of the study and asked for the hospital team for cooperation. Children with type 1 diabetes suffering from DKA were divided into two equal groups (study and control group). The researchers performed the research in the following phase:

Assessment phase:

Assessment of both study and control group of children with type 1 diabetes suffering from DKA, socio demographic data, medical history , the child daily living activity, self care activity, self care hygiene, nutritional assessment, GCS assessment and level of dehydration Pre-implantation of clinical pathway.

Implementation phase:

The researchers implemented the clinical pathway step by step for the children and their family, pediatric staff consultant and nurse, those responsible for providing clinical pathway.

Steps of the Clinical pathway Implementation:

The researchers were available in the study settings four days per week consecutive, at the morning shift from 8.00 A.M to 2.00 P.M in PICU and pediatric ward in Benha Specialized Pediatric Hospital and in Benha University Hospitals (Pediatric department)

The researcher s explained the aim of the study and asked for the hospital team for cooperation.

Children with type 1 diabetes suffering from DKA divided into two equal groups (study and control group).

The implementation of clinical pathway applied to all children in the study group and divided into 5 sessions. Each session took duration of 30 minutes and gave to each individually with family member. Discussion and power point for illustration used for each child individually.

The first session: It was focus on assess the children with type 1 diabetes suffering from DKA for GCS and level of dehydration in the study and control group

The second session: It was concentrated on select the children with type 1 diabetes suffering from DKA, assess all self-care activity and hygiene for study and control group.

The third session: Documented all gathered data for comparison to evaluate the efficacy of clinical pathway.

The fourth session: Application of clinical pathway for study group and all nursing staff deal with the child by the researchers only included the following items: self-care, Feeding habit, daily living activity, nutritional assessment sheet of diabetic child as daily dietary intake and anthropometric measurement,

The fifth session: Fluid replacement therapy, safety practice done by the nurse: that was included electrolyte balance, fluid therapy, insulin injection and laboratory investigation for glucose and ketone analysis.

Evaluation phase:

Evaluate the effect of clinical pathway outcome on studied group and compare them with control group who received routine care after 24 of clinical pathway implementation through a diabetic follow up sheet, GSC, dehydration level and estimate the hospital stay and readmission rate through 3 months of discharge.

VALIDITY:

Data collection tools were submitted to five experts to test the content validity. Modifications of the tools were done according to the experts' judgment on clarity of sentences, appropriateness of content and sequence of items. The experts' agreed on the content of the CP, but recommended minor language changes that would make the information clearer and more precise. The suggested changes were made.

PILOT STUDY:

The refined CP was implemented with 10% of the nurses and children. Based upon the implementation of CP no changes were made. The pilot study sample was included in the total sample.

ETHICAL CONSIDERATIONS:

All nurses and caregivers of children received written and verbal explanations about the nature of the study; voluntary participation; what study involvement would entail; anonymity and confidentiality issues; and, the right to withdraw from the study at any time without any effect on their child's care. For research ethical consideration data was collected firstly from the control group then the study group.

Statistical Analysis:

Data was analyzed using SPSS version 21. Descriptive data were expressed as mean and standard deviation. Qualitative data were expressed as frequency and percentage. A comparison between qualitative variables carried out by using parametric Chi square test. Comparison of means was performed using paired-sample t-test. Correlation among variables was done using Pearson correlation coefficient. Level of significance at $p < 0.05$, 0.001 were used as the cut of value for statistical significance.

3. RESULTS

Table (1): As regards Bio-socio-demographic characteristics of studied children with DKA, 50% and 46.6% respectively of children in the study and control group their ages from 10-12 years. The highest percentages (73.3%) of control group were female. (70% & 73.3% respectively) of children in both study and control group the first child in the family respectively. It was found that 80% and 50 % respectively of children in both groups had previous familial tendency to diabetes. There was no statistically significant difference between both groups as regards to their characteristics ($p = > 0.05$).

Table (2): As regards medical history of the studied children, illustrated from table, all children (100%) in control and study group have type 1 diabetes. And more than half of them have diabetes more than 5 years. As regard the level of glycemic control (43.3% and 50%) in the study and control group have fair control respectively. This table also showed that, most of children (80%) in the study group and two third (63.3%) of control group have their type of treatment continues subcutaneous insulin respectively. There was no statistically significant difference between both groups as regards to their medical history ($p = > 0.05$).

Table (3): As regards level of activity, more than half (53.1 & 56.7 respectively) in the study and control group have limited activity. As regard the type of activity, 40% of children in the study group football were the major type practiced

by diabetic children; while in the control group walking and football were the major type of physical exercise practiced by diabetic children (30.0%).az

Table (4): Level of self care, cleared that most of the children (83.3%, 76.6%, 86.6% & 100% respectively) in both group were dependant in insulin injection, analysis of blood sugar and analysis of sugar in urine. While (53.3% & 83.3% respectively) were independent in selecting of food. As regard to amount of food about two third (73.3%) of them were independent in determine amount of food. This table also showed that two third (70%, 60%, 76.7% & 63.3% respectively) of both study and control group were independent in body hygiene and foot hygiene respectively. There was no statistically significant difference between both groups as regards to their self care activity. ($p > 0.05$).

Table (5): Self-care practice showed that, 60% of study group have satisfactory skin care, while 60% of control group have unsatisfactory skin care. As regard to face care, about two third (70%, 73.3%, 66.7% respectively) of control and study group have satisfactory mouth and teeth care respectively. As regard to foot care more than two third (86.7%, 80%, 70% & 80.3% respectively) of them have unsatisfactory clean toe & nail and didn't cut nails probably respectively. This table also illustrated that, 90% & 76.7% of control and study group have unsatisfactory clean socks and as regard shoes, more than half (63.3% & 60% respectively) have unsatisfactory proper and comfortable shoes. There was no statistically significant difference between both groups as regards to their self care hygiene. ($p > 0.05$).

Table (6): Illustrated that food frequency, more than half of children in the study and control group have more than once/day regard to fruits & juice, rice & bread, sweets and fast foods respectively. There was no statistically significant difference between both groups as regards to food frequency form ($p > 0.05$).

Table (7): As regards daily dietary intake 24 hours Recall method revealed that, more than half (66.7%, 63.4% & 66.6% respectively) of diabetic children in control and study group have more than daily requirements of carbohydrate and fat in food 24 hours recall. While 66.7% and 76.7% respectively of them have less intake of protein in food 24 hours recall. There was no statistically significant difference between both groups as regards 24 hours food recall. ($p > 0.05$).

Figure (1): This figure cleared that 66.75 and 63.3% respectively of the study and control group above weigh. And 60% of both group their mid arm circumference above normal respectively. There was no statistically significant difference between both groups.

Figure (2): As regard body mass index illustrated that 33.3% and 43.4% respectively of the study and control group classified as overweight. There was no statistically significant difference between both groups.

Table (8): level of dehydration proved that, there was statistically significant difference between diabetic children in both groups concerning level of dehydration post CP ($p < 0.001$). On contrary, there were no statistically significant differences between diabetic children in both groups concerning level of dehydration pre CP ($p > 0.05$). It was evident from the study results that diabetic children in the control group showed a higher percentage of "suspect" high level of dehydration than diabetic children in the study group post CP.

Table (9): Glasgow Coma Scale revealed that, there was statistically significant difference between diabetic children in both groups concerning GCS post CP ($p < 0.001$). On contrary, there were no statistically significant differences between diabetic children in both groups concerning GCS pre CP ($p > 0.05$). It was evident from the study results that diabetic children in the control group showed a higher percentage of "suspect" low of GCS than diabetic children in the study group post CP.

Table (10): As regard to DKA follow sheet cleared that, the majority (80.7%) of the study group had normal heart rate, glucose and electrolyte level after implementation of CP, while 43.3% of children in the control group had bradycardia and half of them (50%) had hyperglycemia and 53.3 had imbalance of electrolyte after implementation of routine care. with statistically significant difference between the two groups in all items of DKA follow sheet ($p < 0.001$).

Table (11): showed that, hospital stay of children with DKA and exposed to clinical pathway a few hospital stay was found, 75% of them stay one day. As compared to children in control group 56.7% of them discharged after 2 days, with statistical difference was found in the both group.

Table (12): Readmission rate illustrated that, more than (73.3%) two third of the study group didn't admission to the hospital during three month after implementation of CP as compared to control group only 13.3% didn't admission and half of them admission in the second month after discharge from hospitals. There was highly statistical significance between two groups regarding to readmission rate.

Table (1): Percentage Distribution of Studied Children Related to Bio-socio-demographic Characteristics

Characteristics of studied children related to socio-demographic	Study group (n=30)		Control group (n=30)	
	No	%	No	%
Child's age:				
6 - Less than 8 years	8	26.7	6	20.0
8 - less than 10 years	8	26.7	9	30.0
10-12 years	14	46.6	15	50.0
Mean ± SD	9.83 ± 1.86		9.20 ± 2.39	
Child's gender:				
-Male	15	50.0	8	26.7
-Female	15	50.0	22	73.3
Birth order				
-First	21	70.0	22	73.3
-Second	6	20.0	6	20.0
-Third	3	10.0	2	6.7
Relatives with the same diagnosis:				
-Mothers	24	80.0	15	50.0
- Grandparent	6	20.0	9	30.0
- Father	0	0.0	6	20.0

Table (2): Percentage Distribution of Studied Children Related to Medical History of Disease

Medical history of disease	Study group (n=30)		Control Group (n=30)		X ²	p
	No	%	No	%		
Onset of diabetes:						
- Less than one year	13	43.3	12	40	8.16	> 0.05
- 5 years and more	17	53.1	18	60		
Level of glycemic control:						
- Good (6-7.5%)	10	33.3	1	3.3	8.4	> 0.05
- Fair (8-10.5%)	13	43.3	15	50		
- Poor (more than 10%)	7	23.3	14	46.7		
Practice of glucose test:						
- Blood by glucose meter	5	16.7	7	23.3	.037	> 0.05
- Urine by strip	25	83.3	23	76.7		
Type of treatment:						
- Insulin and diet	6	20	11	36.7	4.34	> 0.05
- Continuous subcutaneous insulin	24	80	19	63.3		
- Type of insulin:						
- rapid or short action	6	20	4	13.3	26.99	< 0.05
- Short and intermediate action	17	56.7	21	70		
- Long action	3	9.4	0	0.0		
- Short and long action	4	13.3	5	16.7		
- Frequency of injection/day						
- Once/day	10	33.3	10	33.3	27.7	<0.05
- Twice/day	12	40.0	11	36.7		
- Three/day	8	26.7	9	30.0		

**Highly significant p at <0.001

*Significant p at <0.05

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Table (3): Percentage Distribution of Studied Children Related to their Level of Activity.

Level of activity	Study group (n=30)		Control Group (n=30)		X ²	P
	No	%	No	%		
- Level of activity						
- Hyper activity	3	9.4	5	16.7	13.26	> 0.05
- Normal activity	10	31.3	8	26.7		
- Limited activity	17	53.1	17	56.7		
- type of exercise:						
- Walking	5	15.6	9	30.0	32.22	> 0.05
- Ride bicycle	8	26.7	8	25.0		
-Swimming	5	16.7	4	13.3		
-Football	12	40.0	9	30.0		

Table (4): Percentages Distributions of Studied Children Related to their Level of Self Care.

Level of Self care	Study group (n=30)		Control Group (n=30)		X ²	P
	No	%	No	%		
Insulin						
- Dependent	25	83.3	23	76.7	4.50	> 0.05
- Independent	5	16.7	7	23.3		
- Analysis of blood sugar:						
- Dependent	25	83.3	26	86.7	3.69	> 0.05
- Independent	5	16.7	4	13.3		
- Analysis of sugar in urine:						
- Dependent	25	83.3	30	100.0	.02	> 0.05
- Independent	5	16.7	0	0.0		
- Selecting of food:						
- Dependent	14	46.7	5	16.7	5.25	> 0.05
- Independent	16	53.3	25	83.3		
- Amount of food:						
- Dependent	8	26.7	8	26.7	3.03	> 0.05
- Independent	22	73.3	22	73.3		
- Body hygiene:						
- Dependent	9	30.0	12	40.0	19.28	> 0.05
- Independent	21	70.0	18	60.0		
- Teeth hygiene						
- Dependent	10	33.3	5	16.7	3.00	>0.05
- Independent	20	66.7	25	83.3		
- Foot hygiene						
- Dependent	7	23.3	11	36.7	5.28	>0.05
- Independent	23	76.7	19	63.3		

Table (5): Percentage Distribution of Studied Children Related to their Self Care Practice Hygiene.

Self care practice hygiene.	Study group (n=30)		Control Group (n=30)		X ²	p
	No	%	No	%		
-Skin care :						
- Satisfactory	18	60.0	12	40.0	.37	> 0.05
- Unsatisfactory	12	40.0	18	60.0		
- Clean eye						
- Satisfactory	15	50.0	6	20.0	.83	> 0.05

- Unsatisfactory	15	50.0	24	80.0		
- Clean mouth						
- Satisfactory	8	26.7	10	33.3	4.17	> 0.05
- unsatisfactory	22	73.3	20	66.7		
c- Clean teeth:						
- Satisfactory	9	30.0	9	30.0	8.23	> 0.05
- Unsatisfactory	21	70.0	21	70.0		
- Foo clean t:						
- Satisfactory	7	23.0	12	40.0	6.08	> 0.05
- Unsatisfactory	23	76.0	18	60.0		
Clean toes and nails :						
- Satisfactory	4	13.3	6	20.0	18.46	< 0.05
- Unsatisfactory	26	86.7	24	80.0		
Cut nails probably:						
- Satisfactory	9	30.0	5	16.7	2.57	>0.05
- Unsatisfactory	21	70.0	25	83.3		
- Wear cotton socks:						
- Satisfactory	3	10.0	7	23.3	1.01	>0.05
- unsatisfactory	27	90.0	23	76.7		
wear clean socks:						
- Yes	8	26.7	13	43.3	8.34	>0.05
- No	22	73.3	17	56.7		
wear proper and comfortable shoes:						
- Satisfactory	11	36.7	12	40.0	1.53	>0.05
- unsatisfactory	19	63.3	18	60.0		
Wear sandals or slippers:						
- Satisfactory	13	43.3	19	63.3	4.47	>0.05
- unsatisfactory	17	56.7	11	36.7		

Table (6): Percentage Distribution of Studied Children Related to Food Frequency.

Food Frequency	Study group (n=30)		Control Group (n=30)		X ²	P
	No	%	No	%		
- Milk and milk product :						
- More than once/day	21	70.0	18	60.0	2.78	> 0.05
- Once /day	4	13.3	7	23.3		
- Never	5	16.7	5	16.7		
- Meat & fish:						
- More than once/day	13	43.3	20	66.6	11.8	> 0.05
- Once /day	12	40.0	5	16.7		
- Never	5	16.7	5	16.7		
- Fruits and juice						
- More than once/day	22	73.4	20	66.7	38.7	< 0.01
- Once /day	4	13.3	7	23.3		
- Never	4	13.3	3	10.0		
- Green vegetables:						
- More than once/day	4	13.3	7	23.3	30.0	< 0.01
- Once /day	12	40.0	7	23.3		
- Never	14	46.7	16	53.4		
- Rice & Bread:						
- More than once/day	21	70.0	20	66.6		

- Once /day	5	16.7	5	16.7	23.14	< 0.01
- Never	4	13.3	5	16.7		
- Sweets :						
- More than once/day	19	63.3	20	66.6	38.13	< 0.01
- Once /day	5	16.7	6	20.0		
- Never	6	20.0	4	13.4		
- Fast foods:						
- More than once/day	17	56.7	22	73.3	11.06	<0.05
- Once /day	7	23.3	8	26.7		
- Never	6	20.0	0	0.0		

Table (7): Percentage Distribution of Studied Children Related to Daily Dietary Intake by Using 24 Hours Recall Method.

Daily Dietary Intake by Using 24 Hours Recall Method.	Study group (n=30)		Control Group (n=30)		X ²	P
	No	%	No	%		
Carbohydrate :						
- Less than daily requirements	6	20.0	7	23.3	8.68	> 0.05
- Daily requirements	4	13.3	4	13.3		
- More than daily requirements	20	66.7	19	63.4		
Intake of protein:						
- Less than daily requirements	20	66.7	23	76.7	5.50	> 0.05
- Daily requirements	6	20.0	5	16.7		
- More than daily requirements	4	13.3	2	6.6		
Intake of fat						
- Less than daily requirements	5	16.7	5	16.7	17.47	< 0.01
- Daily requirements	5	16.7	5	16.7		
- More than daily requirements	20	66.6	20	66.6		

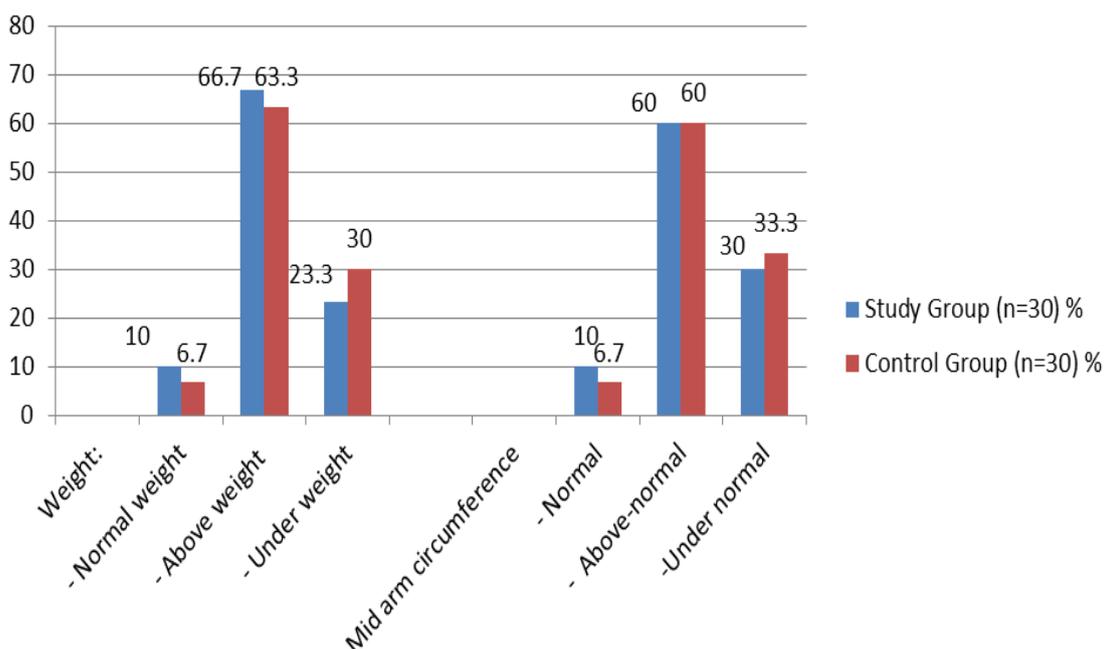


Figure (1) Percentages Distribution of Children According to their Anthropometrics Measurements in Both Study and Control Groups

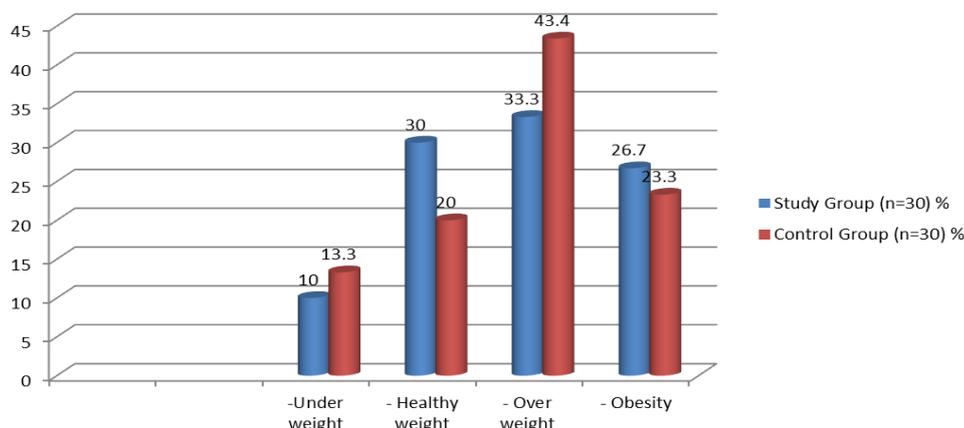


Figure (2): Percentages Distribution of Studied Children related to Body Mass Index

Table (8): Percentage Distribution of Studied Children related to Dehydration Level Pre and Post Clinical Pathway

Dehydration Level	Pre CP				X ²	P	Post Cp				X ²	P
	Study Group (n=30)		Control Group (n=30)				Study Group (n=30)		Control Group (n=30)			
	No	%	No	%			No	%	No	%		
Clinical state:												
- Alert	2	6.6	0	0.0	8.85	>0.05	27	90.0	12	40.0	12.25	<0.001
-Drowsy	20	66.7	20	66.7			3	10.0	18	60.0		
- Lethargic	8	26.7	10	33.3			0	0.0	0	0.0		
Blood pressure:												
-Normal	23	76.7	16	53.3	4.33	>0.05	25	83.3	11	36.7	10.0	<0.05
-Low	7	23.3	14	46.7			5	16.7	19	63.3		
Heart rate:												
-increase or decrease pulse	21	70.0	16	53.3	3.08	>0.05	22	73.3	13	43.3	11.3	<0.05
-rapid feeble pulse	9	30.0	14	46.7			8	26.7	17	56.7		
Skin turgor:												
- Normal	2	6.7	0	0.0	1.77	>0.05	23	76.7	9	30.0	17.14	<0.001
-Tenting	22	73.3	20	66.7			7	23.3	19	63.3		
- absent	6	20.0	10	33.3			0	0.0	2	6.7		
Eye:												
-Normal	0	0.0	0	0.0	9.13	>0.05	23	76.7	8	26.7	16.12	<0.001
- slightly sunken	15	50.0	23	76.7			7	23.3	14	46.6		
- Sunken and soft eye ball	15	50.0	7	23.3			0	0.0	8	26.7		
Oral mucous fluid:												
- Moist	0	0.0	3	10.0	5.61	>0.05	22	73.3	13	43.3	11.3	<0.05
- Dry	16	53.3	20	66.7			8	26.7	17	56.7		
- Very dry	14	46.7	7	23.3			0	0.0	0	0.0		
Urine output:												
- Normal	0	0.0	0	0.0	10.0	<0.05	27	90.0	13	43.3	12.01	<0.001
- oliguria	12	40.0	20	66.7			3	10.0	17	56.7		
- Anuria	18	60.0	10	33.3			0	0.0	0	0.0		
Capillary refill:												
- Normal	0	0.0	2	6.7	18	>0.05	28	93.3	12	40.0	11.56	<0.001
- 2 second	11	36.7	22	73.3			2	6.7	18	60.0		
- > 7 second	19	36.3	6	20.0			0	0.0	0	0.0		

Table (9): Distribution of a Studied Children related to Glasgow Coma Scale Pre and Post Clinical Pathway

Diabetic Follow-Up after DKA Management	Study group (n=30)		Control group (n=30)		P
	No	%	No	%	
Heart rate:					
- Normal	26	86.7	17	56.7.	< 0.05
-Bradycardia	4	13.3	13	43.3	
Blood pressure:					
-Normal	25	83.3	14	46.7	< 0.005
-hypotension	5	16.7	16	53.3	
Respiration					
- Normal	28	93.3	15	50.0	< 0.005
-Decrease respiration rate	2	6.7	15	50.0	
Serum electrolyte:					
- Normal	26	86.7	14	46.7	< 0.005
-Imbalance serum electrolyte	4	13.3	16	53.3	
Serum glucose:					
Normal	26	86.7	15	50.0	< 0.001
-hypoglycemia	0	0.0	0	0.0	
-hyperglycemia	4	13.3	15	50.0	
Serum ketone:					
-Normal	27	90.0	15	50.0	< 0.001
-Low	0	0.0	0	0.0	
-High	4	10.0	15	50.0	
GCS:					
Normal	27	90.0	17	56.7.	< 0.001
-Low	4	10.0	13	43.3	

Table (10): Percentage Distribution of Studied Children related to Follow-Up after DKA Management

Glasgow Coma Scale	Pre CP				X ²	P	Post Cp				X ²	P
	Study Group		Control Group				Study Group		Control Group			
	N	%	N	%			N	%				
Eye:												
- Open	0	0.0	0	0.0	8.2	>0.05	23	76.7	12	40.0	15.25	<0.001
-To voice	17	43.3	23	76.7			7	23.3	18	60.0		
- To pain	13	56.7	7	23.3			0	0.0	0	0.0		
Verbal:												
-Oriented and alert	11	36.7	11	36.7	2.3	>0.05	25	83.3	14	36.7	13.0	<0.05
-Disoriented	19	63.3	19	63.3			5	16.7	16	53.3		
Motor:												
-Follow commends	0	0.0	0	0.0	5.4	>0.05	21	70.0	17	56.7	12.3	<0.05
-Localized pain	16	53.3	19	63.3			9	30.0	13	43.3		
Withdraw to pain.	14	46.7	11	36.7			0	0.0	0	0.0		

Table (11): Percentage Distribution of Studied Children Related to Hospital Stay \ Day among Children with DKA after Implementation of a Clinical Pathway

Hospital stay \ day among studied children	Study group (n=30)		Control group (n=30)		P
	No	%	No	%	
One day	25	75.0	0	0.0	< 0.001
Two days	5	25.0	17	56.7	
Three days	0	0.0	13	43.3	

**Highly significant p at <0.001

*Significant p at <0.05

Table (12): Readmission Rate among Studied Children with DKA after Discharge from Hospital.

Discharge from Hospital	Study group (n=30)		Control Group (n=30)		X ²	p
	No	%	No	%		
1- No admission	22	73.4	4	13.3	24.99	< 0.01
2- The first month	0	0.0	6	20.0		
3- the second month	4	13.3	15	50.0		
4- Third month	4	13.3	5	16.7		

4. DISCUSSION

Clinical pathways are organized multidisciplinary mind arranges containing point by point fundamental strides being taken care of by patients with particular clinical issues. They are frequently formed by making an interpretation of rules into nearby conventions for application in clinical practice (WHO, 2010). The utilization of clinical pathways is probably going to favorably affect persistent results, length of healing facility stay, doctor's facility expenses and expert practice; no antagonistic outcomes were accounted for with their utilization.

The present study revealed that about half of the children in the study and control group aged from 10-12 years and two third of children in both group were the first child in the family. In the research study increased prevalence of DKA at presentation was detected in school age children, this may be due to the younger children are more prone to misdiagnosis when initially presenting with T1DM. This can reflect a lower index of suspicion on the physician's side combined with the difficulty of identifying the classic symptoms in a school age; young children might not be able to describe symptoms, and findings may be similar to those of other acute illnesses. However, school age may actually suffer a more aggressive progression of metabolic decomposition. This finding is supported by Usher-Smith JA et al (2015) who reported that although type 1 diabetes mellitus occur at any age yet study increased prevalence of DKA was detected in children more than 4 years of age. As regard to sex of children the present study revealed that the similar of the sex in the study sample and two third of control sample were female. This study agrees with Dabelea D et al (2014) and de Vries L et al (2013). The majority of data points to similar rates of DKA at diabetes diagnosis in boys and girls worldwide and suggest a slightly increased prevalence in girls and another suggested increased prevalence in girls. It illustrated from the study that, more than one third of the study group and half of control group respectively have fair glycemic control. Fritsch M et al (2011) & Rewers A et al (2002), stated that poorer diabetes control, higher hemoglobin A1c, higher insulin doses, and previous episodes of DKA are important risk factors. Recurrent DKA episodes peak in younger years. Moreover, the incidence of DKA was found to increase with age in females.

As regard to type of treatment most of the study sample and two third of control group used subcutaneous insulin only this may be due to the younger age were difficult to control their diet with insulin administration. Yee and Edward (2003) who mentioned that appropriate management requires more than the adjustment in insulin dose, where practical, medical and psychosocial factors also need to be considered in treatment and insulin therapy was mentioned more than controlling diet as the treatment of diabetes mellitus by the majority of the children. This can be explained in the light of the fact that most of these children have type 1 diabetes where its main treatment is exogenous insulin.

The study result illustrated that more than half of children in the study and control group have limited activity and about one third of them performed football. Physical activity and exercise are critical components of diabetes management. Everyone can benefit from regular physical exercise. **American Diabetes Association, (2003); Kollipara and Warren – Boulton, (2004) who** stated that the benefits of physical exercises included lowering blood glucose level and increase tissue sensitivity to insulin even in resting stage. **Taib (2004)** suggested that with the epidemic incidence of diabetes in youth; physical education should be part of the school day for all children. School-age children and adolescent with diabetes should participate fully in physical exercises and team sports. To maintain blood glucose level during exercise, they will make adjustments in their insulin and food intake.

The study result revealed that most of children in the study and control group dependent on insulin injection. This may be due to children's fear and annoyance with insulin injection. The whole process of the insulin injection and urine test were done either by educated and development practice and most of children wholly compensatory self-care practice in carrying these procedures. Hygienic care were mainly done by the two third of the diabetic children independently, This finding figuring-out the fact that these children are at the age of preschool age- school age, therefore they are usually capable of taking the full responsibility for their hygienic care under slight parental supervision. About half and two third in the study and control group were found independently in the selection of food and amount of food. The researcher believes that their diabetic patients did not have the requisite knowledge concerning nutrition for self-management; therefore, these children must seek their advocate's advice. This result inconsistent with **AMER, S. (2005)** who found in her study that half of the diabetic children in this study were found to participate with their advocates in their dietary self-care practices and selection of shoes and socks.

It showed from the result of the study that nearly two third of diabetic children in the study and control group have unsatisfactory clean the mouth and teeth this may be due to family negligence of their children hygienic care or/and children's lack of information about the relationship between the gingivitis and tooth decay. In addition to the fact that dental care of decayed teeth is painful so children might try to avoid these visits. Children lack of importance of dentist visit reflected in their teeth cleanliness. **Arrieta et al (2003) who** emphasized that periodic check-up to dentist and good dental care is vital parts of the self care practice. Children who practiced dental care on early age usually maintain the habit throughout life. As regard foot and socks care most of children in the study and control group have unsatisfactory care of their foot and cut their nail and have unsatisfactory cotton socks. This may be a result of children and their mother's lack of knowledge and may be due to inadequate instruction given by diabetic nurse educators. This result inconsistent with **AMER,(2005)** who found in her study two third of children had cut nails straight, only one third of them knew it's important.

As regard food frequency form the present study illustrated that about two third of children in both study and control group have more once /day in cereals, rice, fruit, juice and sweet respectively. This finding can be explained in the light of the fact that the diabetic children need energy for their growth and development and physical activities in this age. Also taking insulin injection as treatment forces them to eat the main meals. Feeling of hunger is another factor contributed to children's adherence to the main meals. **American Diabetes Association (2000-d)** reported that the standard daily food intake is divided into 3 main meals with snacks between meals and before going to bed to prevent hypoglycemia. **Jones et al, (2000); Hoffman (2001); McConne et al,(2001) who** mentioned that adequate calories play a role in preventing and treating acute and long- term complications of diabetes. This finding was supported by **AMER, (2005)** who found in her less than half of them restricted eating sweets.

It was clear from the result of the study that two third of diabetic children in both group they have more than requirements of fat and carbohydrate in food recall 24 hours which is reflected in Their poor or fair glycemc control level. These findings may be returned to the role of the diabetic nurse educators and dietitians in the ambulatory clinic who may not promote the children's self-care educations by not considering the children readiness for dietary self-care management. This finding is supported by **Venters et al (2004)** who stated that nurses and dietitians gave different information to their diabetic patients. This can be explained in the light

Hissa, et al (2004) who indicated that calculation of calories intake is difficult and associated with some physiological and psychological problems and disordered eating behavior.

Several studies have shown that exchange diet is difficult to understand and implement without knowing the carbohydrate content of food and that many children with diabetes do not improve glycemic control and their parents cannot understand and follow food exchange and calculate calories (Waldron et al, 2002).

As regards to level of dehydration in children the present study revealed that children in both study and a control group have moderate dehydration level of 5 -10 % pre CP. The evaluation of lack of hydration in the present study is bolstered by the cozy relationship between the triage classification and level of parchedness. Fruitful administration of diabetic ketoacidosis relies on upon sufficient rehydration to maintaining a strategic distance from cerebral edema. **Wolfsdorf and Glaser (2006)** stated that children with DKA regularly give 5–10% liquid shortfall. They may do not have the established indications of hypovolemia and lack of hydration as a result of the intense and constant misfortunes of both extracellular and intracellular water (**Koves et al, 2004**). Findings rely on upon the level of parchedness and may incorporate dry oral mucosa and diminished skin turgor, tachycardia, depressed fontanel, and additionally indented eyes.

Regarding to Glasgow coma scale level in children the present study illustrated that, the majority of children in the study and control group had mild score of GCS. It is sensitive to distinguish children right on time throughout creating cerebral edema. Extreme neurologic trade off is a poor prognostic pointer, essentially in light of the fact that such youngsters are at expanded hazard for creating cerebral edema amid treatment. In a similar line **Sholeen (2014)** found that, in her study about Biomarkers and genetics of brain injury risk in diabetic ketoacidosis: A pilot study, Forty percent exhibited abnormal mentation (Glasgow Coma Scale <15), consistent with CNS dysfunction.

It is illustrated from the study result the children follow CP will showed improve in DKA follow sheet as compared to children didn't follow CP. This may be due to the effect of CP and the importance of follow up sheet. A stream sheet of research center qualities and clinical parameters permits better representation and assessment of the clinical picture all through treatment of DKA. Accentuation ought to be set on the hourly assessment of the kids' liquid status, changes in osmolality, glucose, and electrolytes, and changes in the patient's mental and neurologic status. **Arlan, (2010)** stated that, Effective administration and early mediation for confusions requires close checking. A flow sheet ought to be kept up to report every pertinent episode with respect to the children condition. observing recurrence suggestions incorporate vital signs and neurologic checks hourly; blood glucose hourly; Na, K, and ionized calcium like clockwork for 6 hours, then like clockwork; magnesium and phosphorus at regular intervals; fundamental metabolic profile at affirmation and after that each morning.

The study results showed that children who were cared by the nurses after receiving CP had less duration of hospital stay than children in the control group and didn't admission to hospital after 3 months from discharge. This result showed the incremental advantage of implementing the CP for reducing the children' lengths of hospital stay and reduced from readmission rate. It also supports the hypothesis of the current study. This underlines the importance of the application of CPs for pediatric DKA patients to improve quality of care, reduce the length of hospital stay as well as to streamline costs. Several previous studies by **Hussein, (2014)** show that children who cared by nurses exposed to CP had a lesser duration of hospital stay than those in the control group.

5. CONCLUSION

The current study concluded that the designed CP is effective in improving outcome of children with type 1 diabetes suffering from DKA. CP is effective in improving outcomes of children with DKA. This is manifested by DKA follow sheet, and reduced period of hospital stay and decrease readmission rate after discharge among children in the study group than those who received routine hospital care .DKA is largely preventable, and efforts to further increase awareness to this complication of children with type one diabetes should be encouraged

6. RECOMMENDATION

Based on the results of the current study, the following recommendations were suggested:

- 1-Application of clinical pathway for children suffering from diabetic ketoacidosis was essential for reducing complication and less readmission
- 2- Hospital should establish a policy concerning clinical pathway that should be available to each hospital units

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3-Multidisciplinary team should be involved in developing, implementing and evaluating different CP in pediatric medical and intensive care units to achieve better outcomes for children.

Further recommendation:

1-Development of CPs for other pediatric nursing medical and intensive care units health problems focusing on the nurse's practical skills is mandatory.

2- Establish health education unit in the hospital for all health team member and children with type one diabetes

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