

Effect of Implementing Clinical Pathway on Nursing Care for Children with type one Diabetes Mellitus Suffering from Hyperglycemia

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Abstract:

Diabetes is a global health problem. This is a slow killer with no known cure. However, proper detection and timely treatment can reduce complications. Clinical path is the best way to treat diabetic children. **Aim of the study was to determine** the effect of implementing clinical pathway on nursing care for children with type one diabetes mellitus suffering from hyperglycemia. **Setting:** The study was conducted at the department of endocrinology, Assiut University Children's Hospital. **Method:** Quasi-experimental research design was utilized in this study, A convenient sample of (40) nurses and all the available children with diabetes mellitus (40 children). **Tools:** Used four tools.

Tool I: Background information form: It composed of three parts, demographic characteristics of studied nurses, demographic characteristics of the studied children, clinical data of studied children. **Tool II:** A nurse's knowledge consists of two parts: Nurses' knowledge of juvenile diabetes and Nurses' knowledge about nursing care of children with type one diabetes. **Tool III:** Clinical pathway of care checklist. **Tool IV:** Children' medical outcomes assessment form. **Results:** There was a statistical significance differences in nurse's knowledge and practices before and after using clinical pathway. **Conclusion:** There were an improvement on nurses' knowledge, practice and nursing care of children with type one diabetes suffering from hyperglycemia after implementing clinical pathway and it is effective in improving children' clinical outcomes. **Recommendations:** Clinical approaches to caring for children with typed one diabetes should be applied to children with diabetes in a variety of settings.

Keywords: *Clinical pathway, type one Diabetes Mellitus & Nursing care.*

Introduction

A serious worldwide health problem is diabetes. In 2015, diabetes ranked as the 15th most significant cause of years lost to premature death due to its fast rising prevalence around the globe. In order to reduce early mortality from non-communicable diseases (NCDs) by one-third by 2030, one of the prior targets of the World Health Organisation (WHO) and the Sustainable Development Goal (SDG) was to stop the rise in the prevalence of diabetes. Diabetes mellitus (DM) is a group of metabolic diseases characterized by chronic hyperglycemia caused by abnormalities in insulin production, insulin action, or both characterises a group of metabolic illnesses known as diabetes mellitus (DM). In children and adolescents, type 1 diabetes (T1DM) is the most prevalent kind of the disease. (American Diabetes Association, 2018). T cells are the primary cause of type one diabetes in the majority of children. In this case, the body is fighting a portion of itself, which is referred to as autoimmune damage. When 90% of cells are killed, the pancreas is injured, and it is unable to generate enough insulin that the body needs to function. (Chiang, et al., 2017).

Hyperglycemia is defined as a blood glucose level above 140 mg/dl (7.8 mmol/l). It is exacerbated as a result of lack of biochemical testing and is sufficient to cause pathological and functional changes that may exist long before a diagnosis is made, leading to complications of diagnosis (Hass, et al., 2020).

Diabetes can manifest with typical symptoms including increased thirst, frequent urination, hazy eyesight, and weight loss, among others. Diabetes problems such as retinopathy, nephropathy, neuropathy, and other issues are among its long-term repercussions. Children with diabetes are more likely to develop additional illnesses such heart disease, peripheral artery disease, cerebrovascular disease, obesity, cataracts, erectile dysfunction, and non-alcoholic fatty liver disease. Additionally, it raises the possibility of contracting illnesses like TB. (Maryam & Ozra, 2019).

Currently, there are four diagnostic procedures that are advised for diabetes. This included measuring the plasma glucose levels before and after a 75-gram oral glucose tolerance test (OGTT), which was done two hours after exercise. Diabetes symptoms and indicators include glycated haemoglobin (HbA1c)

and incident blood sugar. Children with fasting plasma glucose 7.0 mmol/L (126 mg/dl), 2-hour post-exercise plasma glucose 11.1 mmol/L (200 mg/dl), HbA1c 6.5% (48 mmol/L), or if signs and symptoms appear with blood glucose levels over 11.1 mmol/L (200 mg/dL), diabetes is considered. (Abdulellah, et al., 2016).

The primary goal of diabetes management and treatment is to prevent or delay complications and maximize quality of life. Pediatric nurses should be aware of recent advances in the management of diabetes in adolescents, their associated complications, and technological advances. Pediatric nurses use an appropriate approach in caring for children with diabetes to improve adherence to the treatment recommendations of health professionals and to help children become more informed about their diabetes care (Bakalis, et al., 2018).

Evidence-based guidelines from leading organizations such as the American Diabetes Association (ADA), the American Association of Clinical Endocrinologists (AACE), and the Endocrine Society of America (ACE) provide a framework for developing clinical pathways for the diabetic children. In 2018, AACE and ACE published joint guidelines for developing a comprehensive treatment plan for diabetes. In 2020, AACE and ACE jointly published an algorithm for the comprehensive management of children with type 1 diabetes to complement the 2018 guidelines. This algorithm provides physicians with practical guidance for comprehensive whole-child management and uses an evidence-based therapeutic approach that considers the child's risks and complications. (Journal of clinical pathways, 2018).

Evidence-based nursing is steered by a tool called a clinical pathway (CPWs). It is made to advise medical professionals on the best way to choose treatments for people with particular ailments or diseases. The clinical pathway's objectives include reducing variation in care quality, promoting efficient use of healthcare resources, reducing hospital stays, improving clinical procedures through risk mitigation, using standardised tools to lessen duplication of effort, and improving care quality. They have been met by suggestions for screening, diagnosis, monitoring, treatment objectives, and interventions throughout the course of a disease or continuum of care. (Mahmoud & Abd-ElSadik, 2016).

The process of CPWs development and implementation consists of the following steps: Identify target patient population, procedure, or disease category. Educate staff about CPWs. Convene a multidisciplinary group of care providers. Identify ideal key outcomes and corresponding timeline for accomplishment of key outcomes. Gather

information, which may include chart audits. Develop CPWs based on ideal, realistic, or current practice. Educate the staff about the clinical pathway and the implementation plan. Implement the CPWs (Cheney, 2015).

Nurses play an important role in all aspects of CPWs application. Participation in development of the pathway is the first step. Nurses initiate and terminate the chain of staff involved in care giving, so they have a unique perspective on how the health care system can improve or impede care giving. Pediatric nurses are also responsible for initiating an eligible patient's child care pathway and for regularly evaluating the CPWs. Insert new options, interventions, and plans into the critical path to improve performance and re-evaluate the CPWs after each adjustment (Kim & Barrett, 2019).

Significant of study

Type 1 diabetes is the most common form of diabetes in childhood and adolescence. The number of children and adolescents with diabetes is increasing each year. The incidence of type 1 diabetes among Egyptian children is 1 in 1,000 (Abdel Karim & Abo Elyazed, 2020). The clinical pathway is a tool for guiding evidence-based medicine practiced internationally since the 1980s. Improving the knowledge and practice of pediatric nurses in managing children with DM is key to ensure that death does not become an emergency, so this study aimed to improve nursing care of children with type one diabetes suffering from hyperglycemia.

Aim of the study:

The aim of the present study was to: Determine the effect of clinical pathway on nursing care of children with type one diabetes mellitus suffering from hyperglycemia.

Theoretical definition:

Clinical Pathway: Means guidelines that all healthcare providers should follow to achieve expected patient outcomes. They are structured multidisciplinary care plans. They are also called care maps, critical paths, standards or practical guidelines of care, clinical protocols, collaborative care plans, anticipated recovery pathways, multidisciplinary action plans, parameters, and benchmarks.

Research Hypotheses:

H1: Implementation of clinical pathway interventions is expected to significantly improve nursing care for young diabetic children suffering from hyperglycemia.

H2: Improvements in blood glucose levels, daily living activities and exercise, eating habits, and weight loss are expected in children exposed to clinical pathways, compared those in the control group.

H3: Children exposed to clinical pathway are expected to have fewer hospitalizations and lower readmission rates than children in the control group.

Subjects and Method:

The research Subjects and method were presented in four designs: Technical, operational, administrative and statistical design.

Technical Design: This involved research design, setting, study sample, and tools of data collection.

Research Design: A quasi- experimental research design (pretest and posttest) was utilized in this study.

Settings: The study was conducted at the department of endocrinology, Assiut University Children's Hospital

Subjects: Subject of the study included the following Convenient sample of all available nurses working in the above settings (40 nurses) and of all available children with type one diabetes suffering from hyperglycemia (40 children) selected.

Inclusion criteria:

- Children from 6-18 years with type one DM suffering from hyperglycemia
- Both genders
- No medical problems as (Hypertension, Heart diseases, Kidney diseases, etc

Tools of data collection:

There were four tools utilized to collect the required data. Those tools as the following:

Tool I: Background information form: Developed by researchers after reviewing relevant literature (Victor, 2019 & Ewald, et al., 2020), and written in Arabic language to suit study sample. It composed of three parts

Part (1): Demographic characteristics of studied nurses such as; age, gender qualifications, years of experience and attendance of training courses about type one diabetes mellitus.

Part (2): Demographic characteristics of the studied children such as age, gender, level of education and residence.

Part (3): Clinical data of studied children: Weight on admission, level of glycemic control, types of insulin, frequency of injection/ day

Tool II: Nurses' knowledge: It consists of two parts

Part (1): Nurses' knowledge about type one diabetes mellitus as (definition, sign & symptoms, complications, laboratory measurements, treatments,etc).

Part (2): Nurses` knowledge of nursing care of children with type one diabetes mellitus , such as; knowledge about maintaining adequate nutrition, regulating glucose levels, promoting skin integrity, preventing infection, learning about and managing

hyperglycemia, insulin administration, and exercise needs for the child.

Knowledge scoring system:

It consisted of 28 closed ended questions and each question was scored (1 point) for correct answers and 0 points for incorrect answers. The researchers categorized overall knowledge into three categories, whereas nurses' knowledge was poor when the score is less than 60% (<17), fair when it is from 60% to <75% (17<21) and good when it is from 75%-100% (17-28).

Tool III: Clinical pathway checklist for care of children with DM suffering from hyperglycemia:

It was adopted from (American Diabetes Association released a position statement on type 1 diabetes in children and adolescents, 2018). It was used to assess daily nursing care provided to children with type one diabetes. The total practices were 15 practices. It included the following:

1. Consult pediatric endocrinologist when hyperglycemia is discovered in children with acute illness.
2. Maintain adequate hydration
3. Insulin therapy
 - The majority of children with type 1 diabetes should be treated with intensive insulin regimens using multiple daily injections of prandial insulin and basal insulin or continuous subcutaneous insulin infusion
4. Adequate nutritional therapy
5. Blood glucose testes
 - Blood glucose levels should be monitored up to 6-10 times daily
 - Continuous glucose monitors (CGM) should be considered in all children and adolescents with type one diabetes; the benefits of CGM correlate with adherence to ongoing use of the device
6. Anthropometric measurement for assessment of children 'weight
7. Physical activity and exercise
 - Exercise is recommended, with a goal of 60 minutes a day of moderate to vigorous aerobic activity, along with vigorous muscle-strengthening and bone-strengthening activities at least 3 days a week
 - It is important to frequently monitor glucose before, during, and after exercise (with or without CGM use) to prevent, detect, and treat hypoglycemia and hyperglycemia
 - Explore children's health beliefs about physical exercise and review exercise program recommendations with the children.
8. Lab and monitoring
 - HbA1c should be measured every 3 months
 - Blood or urine ketone levels should be monitored in children with type 1 diabetes in the presence of prolonged/severe hyperglycemia or acute illness

- In children with type 1 diabetes, consider testing for antithyroid peroxidase and antithyroglobulin antibodies soon after diagnosis
- 9. Glucagon should be prescribed for all individuals with type 1 diabetes, and caregivers or family members should be instructed regarding administration
- 10. Blood pressure should be measured at each routine visit
 - Initial treatment of high-normal blood pressure includes dietary modification and increased exercise for weight control; if target blood pressure is not reached within 3-6 months after lifestyle intervention, consider pharmacologic treatment
- 11. Glycemic monitoring and control.
- 12. Child self-care
 - Insulin self-injection
 - Foot care and protection
 - Hygienic care
- 13. Care giver of children education
- 14. Discharge plan and follow up
- 15. Improve expected outcome

Practices scoring system:

It involved 15 actions, each practice was scored as (2) for a done completely, (1) for done incompletely and (zero) for not done. While the total practices score was calculated as <75% (23) was unsatisfactory and if 75% (23) and more was satisfactory.

Tool IV- Children' medical outcomes assessment form: It was developed by the researchers to assess the improvement of children' condition after using of the CPW. It included; glycemic control, daily living activity and exercise, feeding habits, weight control, and length of hospital stay.

Tools Validity

The tool was reviewed for clarity and completeness by a panel of five experts in the fields of pediatrics and pediatric nursing. Tool III, IV was valid (American Diabetes Association, 2018).

Tools Reliability

The internal consistency of the tools scale was calculated by using Cronbach's Alpha; and its results: **Tool I & II:** Demographic and knowledge data (0.743), **Tool III:** The practices and outcomes (0.602).

Operational design

It was included two phases: pilot study and fieldwork.

Pilot study

A pilot study was conducted to assess the applicability of the Tools, the feasibility of the study and to estimate the time needed for data collection. It was conducted on 10 % of the total participants according to the selection criteria. All children participated in the pilot study were excluded from the study sample. Based on the results of the pilot study

and expert's opinion, modifications and omissions of some details were done and then set the final fieldwork schedule.

Ethical Considerations:

Written informed consent was taken from parents of each child participating in the study and they are secured that data will be confidential and used only for the research purpose. The parents had the right to withdraw their children from the study at any time without any effect on the care provided for their children

Field work:

The three-month period from the beginning of December 2022 to the end of November 2023 was dedicated to collecting data for this study. Four processes were used to complete this: assessment, planning, implementation, and evaluation.

Assessment Phase:

The researcher introduces himself to the nurse. The investigator conducted one-on-one interviews with nurses who want to take part in the study to explain the nature, purpose, and intended outcomes of the study, gather data on children who fit the thorough criteria for this investigation, and assess nurses' knowledge about DM.

Planning phases:

- 1- Set objective.
- 2- Preparation of content and explaining why the session applies.
- 3- Preparation of appropriate media such as lectures, power points,...etc. to teach nurses about type one diabetes mellitus and clinical pathway.

Implementation Phase which included the following steps:

- The researcher using observational check list (Tool III) to observe nurse during their care. The time required for one observation was 15-20 minutes during providing of care for children with DM.
- The studied nurses were divided into groups.
- Clinical pathway was performed separately for each group by conducting consecutive sessions.
- Clinical pathway was performed twice a week for 5 sessions. Duration of each session (30-60 minutes), including a discussion stage, depending on progress and feedback from nurses. A variety of teaching methods were used including lectures, group discussions, demonstrations and media.
- Each group of nurses was attended the following sessions:

The First Session: It was focused on the following items: Defining type one diabetes mellitus, Predisposition to type one diabetes, Symptoms and Complications, Treatment, Nursing care of children with type one diabetes mellitus. This session lasted 30 minutes.

The Second Session: It focused on the role of nursing staff in the diagnosis and management of illness. This session lasted 60 minutes.

The Third Session: It was concentrated on CPW in terms of diagnostic selection definitions, goals, and indicators.

The Fourth Session It focused on teaching nurses the steps to develop a CPW.

The Fifth Session: It was focused on how to use the clinical pathway. Content is presented to nurses through discussions and power points.

Administrative design

The study was conducted with the approval of the ethics committee of the Assiut University, faculty of Nursing, formal approval was obtained from the Director of the Assiut University Children's Hospital, and informed consent was obtained from all nurse involved in the study. It was confidential. Nurses were free to withdraw from the study at any time.

Evaluation Phase

- The nurse started using clinical pathway after 1 week of sessions. Nurses' practice was assessed immediately after application of the clinical pathway and compared with usual care (**Tool II**).
- Children's clinical outcomes are measure after three months from implementing clinical pathway which

including, 1) glycemic control, it can be measure by test glycosylated hemoglobin (HbA1C) if HbA1C below 5.7% is good, HbA1C 5.7%- to 6.4% is fair, HbA1C 6.5% or more is poor, 2) activities of daily living which measured by self-report and direct observation, 3) feeding habits, 4) weight control, 5) length of stay, were assessed before and after the clinical course (**Tool III**).

Statistical design

Data entry and data analysis were performed using statistical package for the social science (SPSS) version 26. Data were presented as number, percentage means and standard deviation. Mc Nemar test was used to show difference between variables in pre and posttest, Pearson Chi-square was used to show relation between variables. P-value considered statistically significant when $p < 0.05$ and highly statistically significant when $p < 0.01$.

Results

Table (1): Percentage distribution of the studied nurses regarding to their demographic characteristics (n=40):

| Nurses' personal characteristics | N | % |
|---|-------------------|------|
| Age group/ years | | |
| • < 25 years | 14 | 35.0 |
| • 25 – 30 years | 14 | 35.0 |
| • More than 30 years | 12 | 30.0 |
| Mean±SD | 27.15±4.69 | |
| Gender | | |
| • Male | 10 | 25.0 |
| • Female | 30 | 75.0 |
| Residence | | |
| • Urban | 28 | 70.0 |
| • Rural | 12 | 30.0 |
| Academic qualification: | | |
| • Diploma degree of secondary nursing school | 8 | 20.0 |
| • Diploma of Technical institute of nursing | 12 | 30.0 |
| • Bachelor degree of nursing | 20 | 50.0 |
| Years of experience:- | | |
| • < 1 year | 6 | 15.0 |
| • 1<5 years | 16 | 40.0 |
| • 5-10 years | 12 | 30.0 |
| • >10 years | 6 | 15.0 |
| Years of experience mean±SD | 5.45±3.63 | |
| Received adequate training program on type one diabetes mellitus | | |
| • Yes | 7 | 17.5 |
| • No | 33 | 82.5 |

Table (2): Percentage distribution of the studied children regarding to their demographic characteristics (n=40):

| Children's personal characteristics | N | % |
|-------------------------------------|------------------|------|
| Age group/ years | | |
| • < 10years | 29 | 72.5 |
| • ≥ 10years | 11 | 27.5 |
| Age mean ± SD | 10.0±2.15 | |
| Gender | | |
| • Male | 22 | 55.0 |
| • Female | 18 | 45.0 |
| Residence | | |
| • Urban | 18 | 45.0 |
| • Rural | 22 | 55.0 |
| Level of education: | | |
| • Primary | 26 | 65.0 |
| • Preparatory | 12 | 30.0 |
| • Secondary | 2 | 5.0 |
| Family history of diabetes | | |
| • Yes | 26 | 65.0 |
| • No | 14 | 35.0 |

Table (3): Percentage distribution of the studied children according to their clinical data (n=40):

| clinical data | N | % |
|-----------------------------------|------------------|------|
| Weight on admission: | | |
| • Underweight | 0 | 0.0 |
| • Normal | 14 | 35.0 |
| • Overweight | 16 | 40.0 |
| • Obese | 10 | 25.0 |
| Diabetes duration: | | |
| • <5 years | 20 | 50.0 |
| • 5- <10years | 14 | 35.0 |
| • 10 years and more | 6 | 15.0 |
| Duration mean±SD | 5.10±2.89 | |
| Level of glycemic control: | | |
| • Good | 0 | 0.0 |
| • Fair | 6 | 15.0 |
| • Poor | 34 | 85.0 |
| Types of insulin: | | |
| • Rapid or short action | 10 | 25.0 |
| • Short and intermediate action | 14 | 35.0 |
| • Long action | 8 | 20.0 |
| • Short and long action | 8 | 20.0 |
| Frequency of injection/day | | |
| • Once/ day | 20 | 50.0 |
| • Twice/day | 20 | 50.0 |

Table (4): Percentage distribution of the studied nurses according to their knowledge (correct answer) about type one diabetes mellitus before and after applying clinical pathway (N=40):

| Knowledge about type one diabetes | Correct answer | | | | p-value |
|---|----------------|------|-------------|-------|----------------|
| | In pretest | | In posttest | | |
| | N | % | N | % | |
| Definition of diabetes mellitus. | 16 | 40.0 | 36 | 90.0 | 0.002** |
| Causes of T1DM. | 2 | 5.0 | 34 | 85.0 | 0.001** |
| Differences between the characteristics of type 1 and type 2 diabetes. | 0 | 0.0 | 30 | 75.0 | 0.001** |
| Symptoms of hyperglycemia | 0 | 0.0 | 32 | 80.0 | 0.001** |
| Problems are usually associated with diabetes. | 4 | 10.0 | 31 | 77.5 | 0.001** |
| Clinical characteristics of type one diabetes mellitus. | 8 | 20.0 | 38 | 95.0 | 0.001** |
| Criteria for the diagnosis of diabetes mellitus. | 2 | 5.0 | 35 | 87.5 | 0.001** |
| Methods of insulin administration would be used in the initial treatment of hyperglycemia | 6 | 15.0 | 37 | 92.5 | 0.001** |
| The priority nursing diagnosis for child with hyperglycemia | 6 | 15.0 | 34 | 85.0 | 0.001** |
| Benefits of physical activity on diabetic children: | 16 | 40.0 | 39 | 97.5 | 0.001** |
| Causes of low blood glucose reaction | 14 | 35.0 | 38 | 95.0 | 0.001** |
| Serum measurements used for the diagnosis of diabetes mellitus | 10 | 25.0 | 35 | 87.5 | 0.001** |
| HbA1C test measures considered a diagnosis of diabetes mellitus. | 10 | 25.0 | 36 | 90.0 | 0.001** |
| Rotation sites for insulin injection should be separated from one another by 2.5 cm (1 inch) and should be used only every: | 10 | 25.0 | 36 | 90.0 | 0.001** |
| Benefits of controlled diabetes mellitus. | 8 | 20.0 | 38 | 95.0 | 0.001** |
| Complication may result from untreated hyperglycemia | 8 | 20.0 | 32 | 80.0 | 0.001** |
| Confirmed values meet the diagnostic threshold for diabetes | 10 | 25.0 | 20 | 50.0 | 0.001** |
| Laboratory measurement best indicate the blood glucose control over a period of weeks | 18 | 45.0 | 40 | 100.0 | 0.002** |
| The test for checking mean plasma glucose concentration over the previous 8-10 weeks is: | 14 | 35.0 | 36 | 90.0 | 0.001** |
| Chronic complications associated with diabetes mellitus. | 6 | 15.0 | 39 | 97.5 | 0.001** |

Mc Nemar test

(**) highly statistical significant difference

T1DM: Type one diabetes mellitus

Table (5): Percentage distribution of the studied nurses according to their knowledge about nursing care of children with type one diabetes suffering from hyperglycemia before and after applying clinical pathway (N=40):

| Knowledge about nursing care of children with type one diabetes | In pretest | | In posttest | | p-value |
|---|------------|-------|-------------|-------|----------------|
| | N | % | N | % | |
| Maintaining adequate nutrition | | | | | |
| • Correct answer | 8 | 20.0 | 36 | 90.0 | 0.001** |
| • Incorrect answer | 32 | 80.0 | 4 | 10.0 | |
| Regulating glucose levels | | | | | |
| • Correct answer | 24 | 60.0 | 40 | 100.0 | 0.003** |
| • Incorrect answer | 16 | 40.0 | 0 | 0.0 | |
| Insulin administration | | | | | |
| • Correct answer | 26 | 65.0 | 40 | 100.0 | 0.003** |
| • Incorrect answer | 14 | 35.0 | 0 | 0.0 | |
| Learning about and managing hyperglycemia | | | | | |
| • Correct answer | 2 | 5.0 | 36 | 90.0 | 0.001** |
| • Incorrect answer | 38 | 95.0 | 4 | 10.0 | |
| Exercise needs for the child. | | | | | |
| • Correct answer | 16 | 40.0 | 40 | 100.0 | 0.001** |
| • Incorrect answer | 24 | 60.0 | 0 | 0.0 | |
| Promoting skin integrity | | | | | |
| • Correct answer | 6 | 15.0 | 26 | 65.0 | 0.001** |
| • Incorrect answer | 34 | 85.0 | 14 | 35.0 | |
| Learning to adjust to having a chronic disease | | | | | |
| • Correct answer | 0 | 0.0 | 34 | 85.0 | 0.001** |
| • Incorrect answer | 4 | 100.0 | 6 | 15.0 | |
| Prevent infection | | | | | |
| • Correct answer | 2 | 5.0 | 32 | 80.0 | 0.001** |
| • Incorrect answer | 38 | 95.0 | 8 | 20.0 | |

(Mc Nemar test

(**) highly statistical significant difference

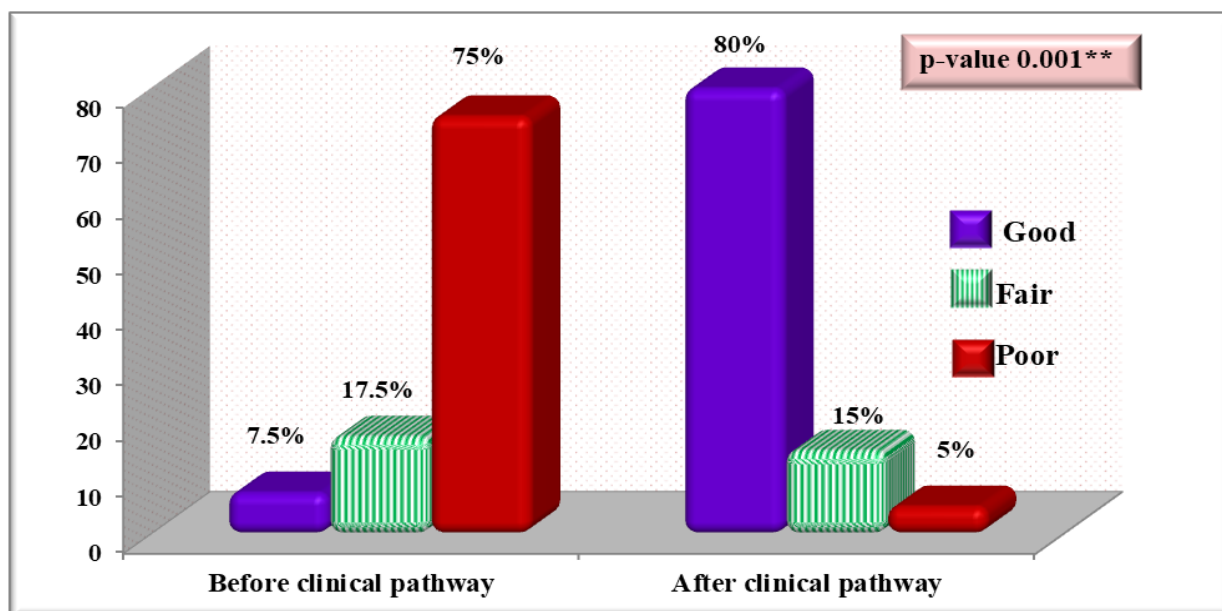


Figure (1): Percentage distribution of total knowledge scores of the studied nurses about type one diabetes before and after applying clinical pathway (N=40)

Table (6): Percentage distribution of the studied nurses according to their practices for care of children with type one diabetes suffering from hyperglycemia before and after applying clinical pathway (N=40):

| Practices for care of children with DM suffering from hyperglycemia | | Before clinical pathway | | After clinical pathway | | p-value |
|--|-------------------|-------------------------|------|------------------------|-------|---------|
| | | N | % | N | % | |
| Consult pediatric endocrinologist when hyperglycemia is discovered in children with acute illness. | Done completely | 28 | 70.0 | 40 | 100.0 | 0.004** |
| | Done incompletely | 12 | 30.0 | 0 | 0.0 | |
| | Not done | 0 | 0.0 | 0 | 0.0 | |
| Maintain adequate hydration | Done completely | 6 | 15.0 | 36 | 90.0 | 0.001** |
| | Done incompletely | 26 | 65.0 | 4 | 10.0 | |
| | Not done | 8 | 20.0 | 0 | 0.0 | |
| Insulin therapy | Done completely | 4 | 10.0 | 38 | 95.0 | 0.001** |
| | Done incompletely | 32 | 80.0 | 2 | 5.0 | |
| | Not done | 4 | 10.0 | 0 | 0.0 | |
| Adequate nutritional therapy | Done completely | 2 | 5.0 | 40 | 100.0 | 0.001** |
| | Done incompletely | 12 | 30.0 | 0 | 0.0 | |
| | Not done | 26 | 65.0 | 0 | 0.0 | |
| Blood glucose testes | Done completely | 4 | 10.0 | 38 | 95.0 | 0.001** |
| | Done incompletely | 28 | 70.0 | 2 | 5.0 | |
| | Not done | 8 | 20.0 | 0 | 0.0 | |
| Anthropometric measurement for assessment of children 'weight | Done completely | 1 | 2.5 | 28 | 70.0 | 0.001** |
| | Done incompletely | 10 | 25.0 | 12 | 30.0 | |
| | Not done | 29 | 72.5 | 0 | 0.0 | |
| Physical activity and exercise | Done completely | 4 | 10.0 | 32 | 80.0 | 0.001** |
| | Done incompletely | 14 | 35.0 | 8 | 20.0 | |
| | Not done | 22 | 55.0 | 0 | 0.0 | |
| Lab and monitoring | Done completely | 6 | 15.0 | 34 | 85.0 | 0.001** |
| | Done incompletely | 14 | 35.0 | 6 | 15.0 | |
| | Not done | 20 | 50.0 | 0 | 0.0 | |

| Practices for care of children with DM suffering from hyperglycemia | | Before clinical pathway | | After clinical pathway | | p-value |
|---|-------------------|-------------------------|-------|------------------------|------|----------------|
| | | N | % | N | % | |
| Glucagon for all children with type 1 diabetes | Done completely | 0 | 0.0 | 24 | 60.0 | 0.001** |
| | Done incompletely | 6 | 15.0 | 16 | 40.0 | |
| | Not done | 34 | 85.0 | 0 | 0.0 | |
| Blood pressure should be measured at each routine visit | Done completely | 2 | 5.0 | 26 | 65.0 | 0.001** |
| | Done incompletely | 4 | 10.0 | 14 | 35.0 | |
| | Not done | 34 | 85.0 | 0 | 0.0 | |
| Glycemic monitoring and control | Done completely | 3 | 7.5 | 32 | 80.0 | 0.001** |
| | Done incompletely | 16 | 40.0 | 8 | 20.0 | |
| | Not done | 21 | 52.5 | 0 | 0.0 | |
| Child self-care | Done completely | 0 | 0 | 22 | 55.0 | 0.001** |
| | Done incompletely | 6 | 15.0 | 18 | 45.0 | |
| | Not done | 34 | 85.0 | 0 | 0.0 | |
| Care giver of children education | Done completely | 2 | 5.0 | 26 | 65.0 | 0.001** |
| | Done incompletely | 4 | 10.0 | 14 | 35.0 | |
| | Not done | 34 | 85.0 | 0 | 0.0 | |
| Discharge plan and follow up | Done completely | 4 | 10 | 32 | 80.0 | 0.001** |
| | Done incompletely | 6 | 15.0 | 8 | 20.0 | |
| | Not done | 30 | 75.0 | 0 | 0.0 | |
| Improve expected outcome | Done completely | 0 | 0.0 | 30 | 75.0 | 0.001** |
| | Done incompletely | 0 | 0.0 | 6 | 15.0 | |
| | Not done | 40 | 100.0 | 4 | 10.0 | |

(Mc Nemar test

(**)highly statistical significant difference

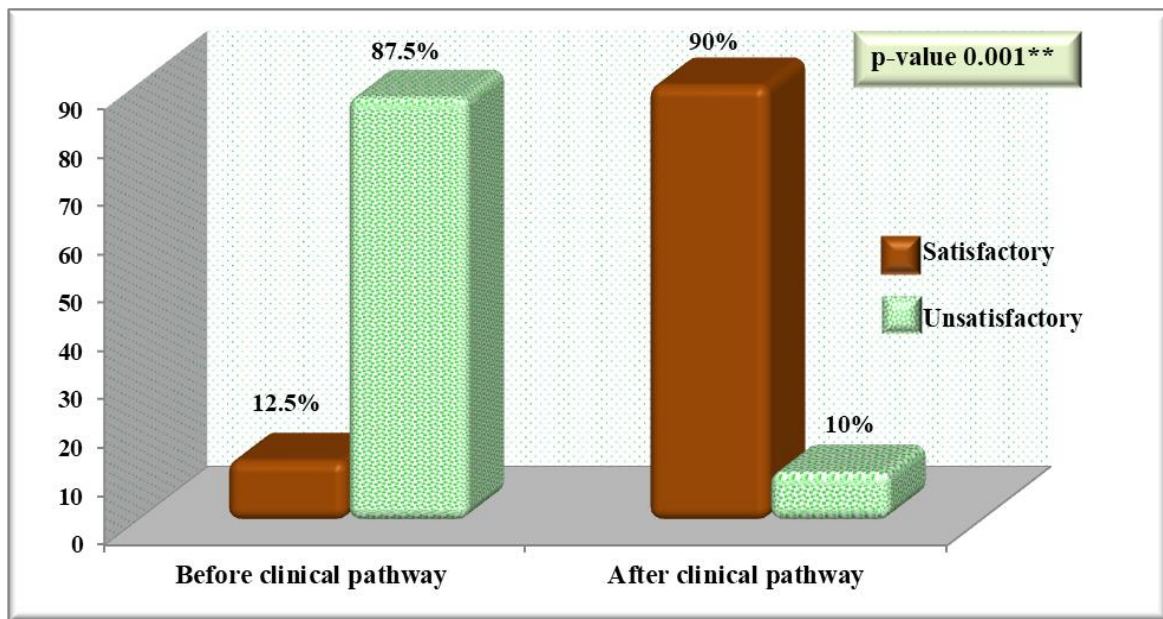


Figure (2): Percentage distribution of total practices scores of the studied nurses for care of children with type one diabetes suffering from hyperglycemia before and after applying clinical pathway(N=40)

Table (7): Percentage distribution of the studied children regarding to effect of clinical Pathway on children' medical outcomes before and after applying clinical pathway (N=40):

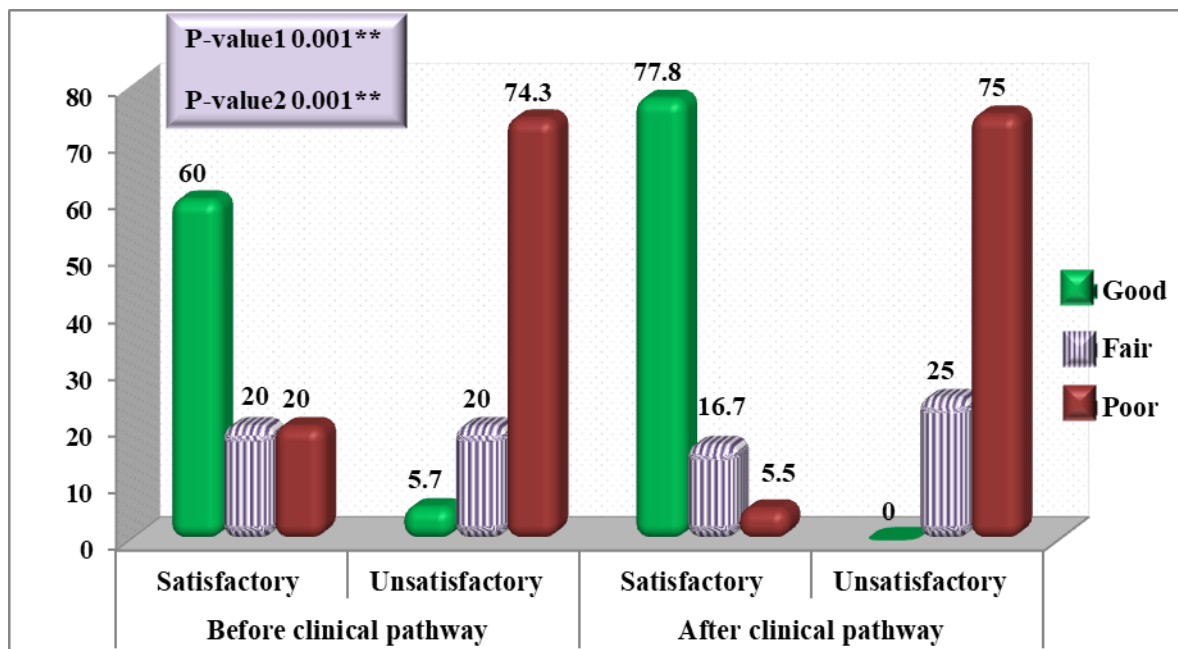
| Children' medical outcomes | Before clinical pathway | | After clinical pathway | | p-value |
|---------------------------------|-------------------------|------|------------------------|-------|----------------|
| | N | % | N | % | |
| Glycemic control: | | | | | 0.001** |
| • Good | 2 | 5.0 | 40 | 100.0 | |
| • Fair | 14 | 35.0 | 0 | 0.0 | |
| • Poor | 24 | 60.0 | 0 | 0.0 | |
| Daily living activity: | | | | | 0.001** |
| • Hyperactivity | 2 | 5.0 | 2 | 5.0 | |
| • Normal activity | 10 | 25.0 | 36 | 90.0 | |
| • Limited activity | 28 | 70.0 | 2 | 5.0 | |
| Feeding habits: | | | | | 0.001** |
| • Improve | 10 | 25.0 | 40 | 100.0 | |
| • Not improved | 30 | 75.0 | 0 | 0.0 | |
| Weight control: | | | | | 0.001** |
| • Normal | 9 | 22.5 | 30 | 75.0 | |
| • Overweight | 17 | 42.5 | 5 | 12.5 | |
| • Obesity | 14 | 35.0 | 5 | 12.5 | |
| Length of hospital stay: | | | | | 0.001** |
| • One day | 0 | 0 | 32 | 80.0 | |
| • Two day | 10 | 25.0 | 8 | 20.0 | |
| • Three day or more | 30 | 75.0 | 0 | 0.0 | |

(**) highly statistical significant difference

Table (8): Correlation between nurses' personal characteristics and their total knowledge and practices before and after applying clinical pathway (N=40):

| Nurses' personal characteristics | | Total knowledge | | Total practices | |
|---|---------------------|-------------------------|------------------------|-------------------------|------------------------|
| | | Before clinical pathway | After clinical pathway | Before clinical pathway | After clinical pathway |
| Age group/ years | Pearson Correlation | -.230- | -.004- | -.137- | -.235- |
| | Sig. (2-tailed) | .153 | .979 | .399 | .144 |
| Gender | Pearson Correlation | .323* | .285 | .236 | .443** |
| | Sig. (2-tailed) | .042 | .075 | .142 | .004 |
| Residence | Pearson Correlation | .325* | -.147- | .309** | -.027- |
| | Sig. (2-tailed) | .041 | .364 | .040 | .870 |
| Academic qualification | Pearson Correlation | .244 | .188 | .408** | -.244- |
| | Sig. (2-tailed) | .130 | .246 | .009 | .130 |
| Years of experience | Pearson Correlation | .014 | -.005- | .004 | -.107- |
| | Sig. (2-tailed) | .931 | .975 | .980 | .513 |
| Received adequate training program | Pearson Correlation | -.299- | .117 | -.104- | -.349* |
| | Sig. (2-tailed) | .061 | .470 | .524 | .027 |

(**) Correlation is significant at the 0.01 level (2-tailed). (*) Correlation is significant at the 0.05 level (2-tailed).



P-value1 (for total knowledge and practices before clinical pathway)

P-value2 (for total knowledge and practices after clinical pathway)

(**) highly statistical significant difference

Figure (3): Relation between the studied nurses' total knowledge and practices before and after applying clinical pathway (N=40)

Table (1): Shows percentage distribution of the studied nurses regarding to their demographic characteristics. It was observed that 35 % of studied nurses were age between 25-30 years with mean age of 27.15 ± 4.69 years, with mean years of experience was 5.45 ± 3.63 years. The highest percentage (75 %) were female while half of the studied nurses had a bachelor's degree in nursing. Also, the majority (82.5%) hadn't attended training programs related to applying clinical pathway on diabetic children.

Table (2): Represents the percentage distribution of studied children in relation to demographic characteristics, it was noticed that (72.5%) of the studied children had age < 10 years with mean age of 10.0 ± 2.15 years, more than half (55 %) of them were male while less than half (45 %) of them were from urban. Also, more than two thirds (65 %) of them had family history of diabetes.

Table (3): Illustrates percentage distribution of the studied children according to their clinical data. More than one third (40 %) of studied children were overweight and half of them had diabetes duration <5 years. Finally, the majority (85 %) of them had poor level of glycemic control.

Table (4): Reveals percentage distribution of the studied nurses according to their knowledge (correct answer) about type one diabetes before and after applying CPW. It was found that the knowledge of all

items improved after applying CPW compared to before applying CPW, with a highly statistically significant difference ($p < 0.001$).

Table (5): Views percentage distribution of the studied nurses according to their knowledge about nursing care of children with type one diabetes suffering from hyperglycemia before and after applying CPW. Whereas, there was a highly statistically significant difference in the knowledge of studied nurses after using CPW compared to their pre-CPW knowledge about caring for children with juvenile diabetes ($p < 0.001$).

Figure (1): Reveals percentage distribution of overall knowledge about type one diabetes among studied nurses before and after CPW use, 75% of them had poor knowledge before applying CPW compared with the majority (80%) of them had good knowledge after applying CPW.

Table (6): Clarifies percentage distribution of the studied nurses according to their practices for care of children with type one diabetes suffering from hyperglycemia before and after applying clinical pathway. Therefore, there was a statistically significant difference ($p < 0.05$) in the practice scores of studied nurses after using the CPW compared to before using the CPW.

Figure (2): Presents percentage distribution of total practices of the studied nurses for care of children

with type one diabetes suffering from hyperglycemia before and after applying CPW. It was revealed that, Majority of nurses (87.5%) practiced unsatisfactory before using CPW, compared to those who practiced satisfactorily after using CPW (90%).

Table (7): Shows percentage distribution of the studied children regarding to effect of CPW on children' medical outcomes before and after applying clinical pathway. It was found that there was an improvement in children' medical outcomes in all items after applying CPW compared with before applying CPW with high statistical significant difference ($p < 0.001$).

Table (8): Illustrates that there were correlations between total knowledge before clinical pathway and gender and residence. And there were no correlations between total knowledge after clinical pathway and nurses' personal characteristics. Regarding correlations between total practices before clinical pathway, there were correlations between total practices and residence and academic qualifications. But after clinical pathway there was correlations between total practices and gender and received adequate training.

Figure (3): Notices relation between the studied nurses 'overall knowledge and practices before and after applying CPW. There was a highly statistically significant relation between pre- and post-clinical knowledge and practice, with both p-values less than 0.01.

Discussion

Diabetes mellitus (DM) is glucose intolerance caused by a lack of insulin production and action, resulting in hyperglycemia and abnormal carbohydrate, protein, and lipid metabolism. Diabetes includes many disorders characterized by high blood sugar. Clinical pathways are the common denominator for improving quality of care, reducing variability, improving quality of care and maximizing outcomes for specific patient populations (Victor, 2019). So the aim of this study was to determine the effect of implementing clinical pathway on nursing care of children with type one diabetes suffering from hyperglycemia.

In this study, there was an improvement in nurses' knowledge in all items after applying clinical pathway compared with before applying clinical pathway with high statistical significant difference. The improvement of nurse's knowledge may be due to nurses' own interest in expanding, developing, or at least updating their knowledge in order to maintain quality care. This result was in agreement with (El-Rahman Younis, et al., 2018) who found that the majority of studied nurses had a good knowledge post intervention.

Pertaining to nurses' knowledge about nursing care of children with type one diabetes before and after applying clinical pathway, the finding of the present study indicated that there were a highly statistical significant difference in the studied nurses' after applying clinical pathway knowledge scores compared with before applying clinical pathway knowledge scores. This was on the same line with (Bahgat & Elsobkey, 2017) who applied their study in Benha University Hospital to determine the effect of using clinical pathway on clinical outcomes of neonates with respiratory distress syndrome and found that there was a significance difference in the studied nurses' knowledge before and after applying clinical pathway.

In relation to improvement of nurses' knowledge after applying of CPW on children with T1DM suffering from hyperglycemia. The results of the current study are consistent with those reported by (Hussein, 2014) who found that there was a statistically significant difference regarding mean scores of nurses' knowledge about pneumonia between pretest and posttest scores.

As regard nurse' practice, the current study revealed that the majority of them had unsatisfactory practice before clinical pathway compared with the majority of them had satisfactory practice after applying clinical pathway. From researcher points of view unsatisfactory nurses' practices care of children with T1DM suffering from hyperglycemia may due to most of the nurses in pediatric hospitals are not qualified to work with children and their distribution to hospitals based upon ministry of health besides lack of training courses and staff development in hospitals for nurses but when training program became available their knowledge and performance improved. Also, this may be reflecting their understanding that the clinical pathway differs from routine care and will lead to improvement in children's condition.

This result matches with what was found by (Tantawi, et al, 2019) who found that there are highly statistically significant differences among nurses performance regarding care of pneumonia before and after applying CP guidelines. Also, The result of the current study in compatible with what reported by (Mahmoud & Abd-El Sadik, 2017) in their study that the mean score of nurses' performance regarding to invasive procedure pre and post CP guidelines implementation had a highly significant difference, in addition (Refai, 2011) had found in her study that there was an improvement in nurses' practice scores in post nursing CP higher than in pre nursing CP implementation.

Clinical outcomes are the main indicator on improvement of children after applying clinical pathway; they are including glycemic control, daily

living activity, feeding habits, weight control and length of hospital stay. These results confirm the positive effect of the intervention on nurses' practices, which was positively reflected on child's outcomes. Regarding length of hospital stay, the present study revealed that there was a decrease in length of hospital stay after applying clinical pathway. This may be due to improvement of health status of children due to effect of clinical pathway.

This finding was in line with (Pickkers, 2017) who mentioned that clinical pathway had an important effect on decrease hospital stay, improve quality of care, improve clinical outcome without any side effects (Weihua, 2016) & (Menga, 2016) they found that implementation of values of clinical nursing pathway improved the clinical outcome and the length of hospital stay in study group with statistically significant difference.

Regarding demographic characteristics, this study results showed that more than one third of studied nurses had age between 25-30 years. The highest percentage were female while half of them had bachelor degree of nursing. Also, the majority of them hadn't attended training programs related to applying clinical pathway on diabetic children. The study of (Prasanna & Dhileeban, 2015) was inconsistent with the current study results which, indicated that the highest percent of the studied patients were male.

In addition, the present study found that, more than two thirds of the studied children with DM had age < 10 years, more than half of them were male while less than half of them were from urban. Also, more than two thirds had family history of diabetes. This result was explained by (Meihuan, 2017) that found more than two thirds of studied children were boys and more than one third were girls.

Also the present study revealed that, more than one third of studied children had overweight, half of them had diabetes duration <5 years and the majority of them had poor level of glycemic control as reported by (Tantawi, et al., 2019) and found that the majority of studied children had poor level of glycemic control.

Finally, the current study indicated that, there were correlations between total knowledge before clinical pathway and gender and residence, and there were no correlations between total knowledge after clinical pathway and nurses' personal characteristics. Regarding correlations between total practices before clinical pathway, there were correlations between total practices and residence and academic qualifications. But after clinical path way there were correlations between total practices and gender and received adequate training. These findings were in accordance with (Youngmi, et al., 2021) their results

showed positive correlation between total knowledge of studied nurses before and after clinical pathway and gender. While in contrast with (Safari, et al., 2014) who stated that negative correlation between demographic characteristics of children and total knowledge of studied nurses before and after clinical pathway.

Conclusion

Based on the results of this study, we can conclude that:

Improved knowledge, practice, and nursing care of children with type one diabetes who suffer from hyperglycemia after CPW use are effective in improving clinical outcomes for children. This was reflected in glycemic control, weight control, improved eating habits, and ultimately shorter hospital stays in the study group.

Recommendations:

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

- Clinical pathway for caring for diabetic children should be applied to diabetic children in different settings.
- Re- application of the study on a larger and different group of nurses and children with other diseases to be generalizes the results of current study.
- Provide nurses with a training program of clinical pathway to treat DM.

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