Effect of Mothers' Care Adherence on Control of type 1 Diabetes Mellitus Among their Children

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Abstract: Background: diabetes in children is becoming an increasingly public health concern throughout the world. It is a chronic disorder of metabolism characterized by partial or complete deficiency of the insulin hormone. Self– cared diabetes involves a complex set of tasks and the key to successful management of diabetes is adherence to these tasks. Purpose: to evaluate the effect of mothers' care adherence on control of type 1 diabetes mellitus among their children. **Design:** A Quasi experimental design was used. Setting: It was conducted in Health Insurance Hospital of Shebein Elkom. **Sample:** purposive sample of 100 mothers admitted with their children having type 1 diabetes. **Instruments:** three data collection instruments were used; structured interview questionnaire, the Adherence in diabetes questionnaires and observational care practices checklist. **Result:** the current study demonstrated that there were high statistical significant differences between mothers' knowledge and practices on post intervention compared to pre intervention. As well, there were high statistically significant differences between mothers' adherence level on posttest compared to pretest at ($p < 0.001$). **Conclusion:** The study concluded that mothers of children with type 1 diabetes mellitus who adhere to diabetic care had effectively good glycemic control among their children on posttest compared to pretest. **Recommendation:** integration of health promotion program into school curriculum may enhance knowledge, practice, and mothers' adherence to care for their children with type 1 Diabetes Mellitus.

Key words: children, mothers' care adherence, type 1 diabetes mellitus.

Introduction

Diabetes mellitus (DM) is a group of metabolic diseases characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both (Nikitina & Kelmanson, 2021). Type 1 diabetes (T1D) is a chronic autoimmune illness, which is defined by hyperglycemia due to insulin insufficiency caused by pancreatic β-cell dysfunction. (Dai BD et al., 2022)

The incidence of T1D in children varies over 30-fold around the world (International Diabetes Federation, 2021; Ogle et al., 2021). In Egypt, 8 out of 100,000 children under the age of 14 have type 1 diabetes (WHO, 2018). Type 1 diabetes mellitus can occur at any age but it is the most common metabolic disease in children and youth. (Vojislav et al., 2020)

Type 1 diabetes mellitus (DM) is characterized by permanent,

autoimmune, pancreatic β-cell destruction. The cause of Type 1 diabetes mellitus is unknown, although genetic, immunologic, and environmental factors are recognized to increase the risk for its occurrence (Ozen et al., 2020). T1D, also called insulin-dependent diabetes, occurs commonly, during childhood or adolescence and manifest itself as a result of a vulnerability gene that makes an individual vulnerable to autoimmune mediated demolition of the pancreatic beta cells, also called islet cells (Barrett, 2020).

The duration of symptoms prior to diagnosis can vary widely from few days to several months but children and adolescent with T1DM have an abrupt clinical onset over a period of few weeks. Classical triad of polydipsia, polyuria bed-wetting in children who previously didn't wet the bed during the night and weight loss are the most common, but sometimes polyphagia and blurred vision may also be present. (Kipasika et al.,2020)

The development of type 1 diabetes entails a life-long judgment of a difficult treatment regimen that includes several daily insulin injections, blood glucose monitoring, a prescribed meal plan, and regular exercise. (Northam et al., 2020)

Improper management of IDDM may expose the diabetic children for life threating or acute complication as hypoglycemia with prevalence of 25% - 55% in Africa which associated with poorer cognitive function and diabetic ketoacidosis that represent 15% - 70% of newly diagnosed children and adolescents with T1DM and considered as a major cause of morbidity and mortality while long term or chronic complication (micro and macro-vascular) where microvascular includes neuropathy, nephropathy and retinopathy in addition to macrovascular as peripheral

vascular, cerebrovascular and cardiovascular disease complication (Nafee et al., 2022).

Adherence is defined by the World Health Organization as "the extent to which a person's behavior-taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a healthcare provider." (Steenkamp et al., 2022).

The most important determinants for good and poor glucose control are moderate caregiver involvement and mother`s involvement in all task diabetes management of their children. (Mrkulić et al., 2021)

Mothers have a significant role in delivering home-based intervention for their children with diabetes, so mother-centered empowerment programs will help mothers to improve disease control, better management and improve physical and mental functions of their children and prevention of disease complications. (Abdalla et al., 2020)

Mothers' adherent behavior can lead to improved outcomes and delay short and long-term adverse health outcomes. Mothers are typically the parents responsible for the majority of treatment management. Mothers also report constantly worrying about their children's blood sugar going too high or too low, long-term complications, and difficulty learning and mastering the complex treatment regimen. (Goethals et al., 2017)

Education is crucial and a core part of the care given to the child and the family. This education begins straight at diagnosis and aims at making families more confident and self-reliant about managing the disease at home. It should include all family members and is delivered partly by the diabetes team including a specialist nurse in pediatric diabetes care, partly by the staff nurse caring for the child

during the hospital stay, thorough education has been associated to improved glycemic control in children and improved family functioning. (Neyra Marklund et al., 2022)

Pediatric nurse plays a great role in the prevention and intervention of diabetic nephropathy (DN) for children with DM. This role can be achieved through raising the awareness of diabetic children's mothers regarding DN including its complications and effect on their children's health. The interventions can be divided into those that prevent the onset of complications (primary prevention) and those that slow their progress (secondary intervention) The goal of a prevention strategy involves changing potentially modifiable risk factors: Optimizing blood glucose control, encouraging a healthy diet, controlling blood pressure and encouraging healthy exercise. (Abdalfatah et al., 2022). So this study aimed to evaluate the effect of mothers' care adherence on control of type 1 diabetes mellitus among their children.

Purpose

The purpose of this study is to evaluate the effect of mothers' care adherence on control of type 1 diabetes mellitus among their children.

Research Hypotheses

Mothers of children with type 1 diabetes mellitus who adhere to diabetic care will control diabetes mellitus among their children on posttest than on pretest.

METHODS

Research Design

A quasi-experimental design was utilized for this study (pre and posttest).

Research Settings

This study was conducted in Health Insurance Hospital of Shebein Elkom because of decreased cases due to Corona crisis in University, Teaching Hospital and Special Outpatient Clinic.

Sampling

Purposive sample include 100 of the diabetic cases of children and their mothers who attended the outpatient clinic in the Health Insurance Hospital in Shebein Elkom every month for follow up were included in this study. Based on the enough cases in Health Insurance Hospital, no need to take any cases from the Special Outpatient Clinic.

Inclusion Criteria for Children

Children who don't have other medical problem than diabetes.
Age from 6 to 12 years.

Instruments

In order to achieve the purpose of the study, three instruments were utilized for data collection: -

Instrument one: Structured

Interviewing Questionnaire

Structured interviewing questionnaire was developed by the researcher to obtain demographic data and assess mother's knowledge about DM.
It was divided into two parts
- **Part one:** It included demographic data about children and their mothers such as children age and gender. Also, mothers' age, education, job and residence.
- **Part two:** Mothers' Knowledge Questionnaire
It includes two sections:-
- First: mothers' knowledge about DM such as definition, signs and symptoms, causes, medical treatment and health education

- Second: mothers' knowledge about actions taken to control DM Such as giving insulin, choosing appropriate meals, blood glucose testing and foot care.

Scoring System for Mothers' Knowledge About DM

Scoring system was followed to assess Mothers' knowledge about diabetes according to diabetic questionnaire. The questionnaire contained 25 questions. It has two-point scale used as the following: scale 0 to incorrect answer and scale 1 to correct answer.

The Total Scoring System of Mothers' Knowledge About DM

It was clarified in three categories:
o Good knowledge > 70%
o Average knowledge 50-70%
o Poor knowledge < 50%

Instrument Two: The Mother's Adherence in Diabetes Questionnaires Scale

(ADQS) that was developed by Kristensen et al., (2012). It Contains a questionnaire of mother's adherence which include 19 items as planning meals, alternating injection sites, exercising in some form of physical activity and detecting the early signs of hyperglycemia and hypoglycemia.

Scoring system for each item:

ranged from 1 – 5, the ADQS items were scored as 1 to haven't done it at all, 2 to rarely done it, 3 to sometimes done it, 4 to frequently done it and 5 to have always done it.

The Total Scoring System of the Adherence in Diabetes Questionnaires Scale:

It was clarified in three categories:
o Good adherence> 70%
o Average adherence 50-70%
o Poor adherence < 50%

Instrument Three: Observational Care Practices Checklist

An observational checklist was developed by the researcher to observe some care practices of diabetic children. The observational care practices checklist was designed to assess the care practices that are made for the diabetic child independently.
This checklist was established after reviewing nursing literature and previous researches.

This Part Includes: reported practice about

- Insulin Injections with 12 Items Include.
- Blood Glucose Test (Glucometer/Strip) with 10 Items Include.
- Urine Test for Glucose and/or Ketones with 9 Items Include.
- Foot Care with 7 Items Includes.

Scoring System for Each Item:

ranged from zero for not done, 1 for done incompletely and 2 for done completely.

The Total Scoring System of Observational Care Practices Checklist

It was clarified in three categories:
o Good practice > 70%.
o Average practice 50-70%.
o Poor practice <50%.

Reliability

The first and third Instrument was developed by the researcher to assess socio-demographic data of the mothers and their children, mother knowledge about DM and to observe some care practices of the diabetic children. Then was tested for reliability using test retest.

Validity

Instruments were submitted to a jury of five specialists (two professors and one assistant professor in pediatric nursing. One professor and another assistant professor in pediatric medicine were also included. All required modifications were done.

Pilot study

It was carried out on ten children and their mothers (10% of the sample) after the instruments were developed and before starting the data collection to test the practicability, applicability and to estimate the needed time to fill the instruments. No necessary modifications were done. Therefore, the pilot study was included in the total sample.

Ethical Consideration

- Ethical approval was obtained from the scientific committee of Faculty of Nursing, Menoufia University.
- A verbal and written approval was obtained from the mothers of children who participated in the study after the researcher explanation about the purpose, nature, benefits of the study to them and their children. And their right to withdraw from study at any time.
- Mothers were reassured about confidentiality of data and anonymity, ethics, values, culture and beliefs were respected.
- Confidentiality and anonymity of patients was assured through coding all data and putting all paper in a closed cabinet.
- Participants were assured that the questionnaires were fulfilled by the participants themselves or by the researcher through personal interview. Also, they were informed that the nature of the questionnaire would not cause any physical or emotional harm to them.

Procedure

1) Written Permission:

An official permission to carry out the study was obtained from the directors of Health Insurance Hospital of Shebein ElKom . After submitting an official letter from the dean of the Faculty of Nursing explaining the purpose of the study and the method of data collection.

2) Researcher Preparation:

A review of past and current literature included books and articles was done to develop data collection instruments before interviewing study subjects. This review helped the researcher to be acquainted with the actual dimensions and magnitude of the problem.

3) Data Collection:

Assessment Phase:

- Data collection lasted from the first of January 2022 to the end of April 2022; this study was conducted four days per week for four months.
- The researcher introduced herself to the children and their mothers and explained the purpose and nature of the study.
- Assessment of the socio-demographic data of the children and their mothers was done using instrument one, part one (pretest).
- Assessment of the mothers' knowledge about diabetes such as definition, causes, manifestation, complications and management of diabetes was done using instrument one, part two (pretest).
- Assessment of the mothers' adherence in diabetes questionnaire was done using the second instrument (pretest).
- Assessment of the mothers ' practice regarding DM was done using Instrument three (pretest).

- Before each session, attending mothers were informed about the objectives of the session and the activities that would be done for each child.

Planning Phase:

This phase included analysis of the assessment phase (pretest) finding and the researcher identification of the actual needs of the studied children and their mothers by using the booklet, posters and videos, setting program to meet all the needs of the children and their mothers, detecting number of sessions needed and time of each session, choosing appropriate topics and methods of education for each session and finally selecting suitable place for sessions.

General Objectives:

Apply adherence in diabetes for the mothers of the children with diabetes to improve their knowledge and practice about diabetes management and control type I diabetes in their children.

Specific Objectives:

1) Improve mothers' knowledge about diabetes.
2) Improve mothers' practice regarding diabetes care.
3) Involve mothers in the intervention to improve mothers' self-efficacy.
4) Prevent short and long term complications in children with diabetes.

Implementation Phase:

Mothers were divided into seven groups, each group included fifteen mothers and last group contain ten mothers. Each group took one session in each week. The researcher was available in the study settings four days per week, Saturday, Sunday, Tuesday and Thursday.

First Session:

1. The researcher discussed theoretical knowledge about the definition of diabetes, causes and types of diabetes mellitus. It took about 20 minutes.
2. At the end of the session, the researcher answered mothers' questions, provided needed guidance and planned for future meeting.

Second Session:

1. Theoretical knowledge was explained about manifestation, symptoms of hyperglycemia and hypoglycemia and complication of diabetes. It took about 45 minutes.
2. During the session, booklets were distributed. These assistant tools help the mothers to gain more knowledge about diabetes mellitus.
3. Each session was started by a summary of what has been discussed in the previous session. Also, the session ended by a summary of its contents and feedback from the mothers was obtained to ensure that they had got the maximum benefits.
4. At the end of session, the researcher answered mothers' questions, provided needed guidance and planned for future meeting.

Third Session:

1) The researcher divided this session into two sections:
- Section one: theoretical knowledge about the management of DM and Some tips for mothers to control diabetes in their children. It took about 30 minutes.
- Section two: health teaching for the mothers about insulin injection technique. It took about 15 minutes.
- Teaching assisted tools as videos were used.

2) At the end of the session, the researcher answered mothers' questions, provided needed guidance and planned for future meeting.

Fourth Session:

1) Regarding fourth session it was divided into two sections:
▪ Section one: health teaching for the mothers about blood glucose test, urine test for glucose or ketones and foot care. It took about 30 minutes.
▪ Section two: the researcher discussed summary and revision of the main items of the educational guidelines. It took about 15 minutes.
2) Direct reinforcement in the form of material rewards as well as affection and encouragement were provided as positive feedback.

Evaluation Phase (Posttest):

After the completion of the adherence content, the mothers' knowledge and practice was evaluated one month after implementing care adherence. The posttest was administered by using same pretest tools.

Data analysis:

Data was coded and transformed into specially designed form to be suitable for computer entry process. Data was entered and analyzed by using SPSS (Statistical Package for Social Science) statistical package version 22. Graphics were done using Excel program. Quantitative data was presented by mean ($\bar{x}$) and standard deviation (SD). It was analyzed by using student t-test for comparison between means and ANOVA (F) test for comparison between more than two means.

Qualitative data was presented in the form of frequency distribution tables, number and percentage. It was analyzed by using chi-square (χ^2) test. However, if an expected value of any cell in the table was less than 5, Fisher Exact test was used (if the table was 4 cells), or Likelihood Ratio (LR) test (if the table was more than 4 cells). Pearson correlation was used for explaining relationship between normally distributed quantitative variable.

P-value at 0.05 was used to determine significance regarding:

▪ P-value > 0.05 to be statistically insignificant.
▪ P-value ≤ 0.05 to be statistically significant.
▪ P-value ≤ 0.001 to be highly statistically significant.
▪ P-value ≤ 0.0001 to be very highly statistically significant.

RESULTS

figure (1) revealed that about one third (33%) of the mothers had higher levels of knowledge about diabetes on post-test compared to (9.0%) on pre-test. Therefore, there were high statistically significant differences regarding levels of mothers' knowledge on pre and posttests at (P < 0.001).

Table (1) revealed that the total mean score of knowledge on pre-test was (10.20 ± 5.61) compared to (14.95 ± 5.95) on posttest. Therefore, there were high statistically significant differences regarding mothers' knowledge on pre and posttests at (P < 0.001) level of statistical significance.

Table (2) showed that the total mean score of the mother's adherence on pretest was (48.68 ± 17.40) compared to (60.17 ± 16.66) on posttests. Therefore, there were high statistically significant differences on pre and posttests at (P < 0.001).

Table (3) indicated that the total mean score of the mothers practice of insulin injection on pretest was (9.46 ± 5.43) compared to (14.99 ± 6.40) on posttest. Total mean score of practice of blood glucose test on pretest was (9.32 ±

4.17) compared to (13.98 ± 4.24) on posttest. Also Total mean score of practice of urine test on pretest was (5.10 ± 5.30) compared to (11.17 ± 5.78) on posttest. Total mean score of practicing foot care on pretest was (5.01 ± 4.13) compared to (8.94 ± 3.46) on posttest. Therefore, there were high statistically significant differences regarding mothers' practice on pre and posttests at (P < 0.001).

Table (4) reflected that there was positive correlation between the total score of the mother's knowledge about type 1 diabetes in children, the total
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score of practices and the total score of the mother's adherence to caring for a child with diabetes. So there were high statistically significant differences between them.

Table (5) showed that there was a positive correlation between the total score of the mother's adherence to caring for a child with diabetes and the total score of practices. So, there was a high statistically significant difference between the total score of the mother's adherence to caring for a child with diabetes and the total score of practices

RESULTS

Figure (1): Levels of Mother's Knowledge about Diabetes on Pre and Posttests (no = 100)
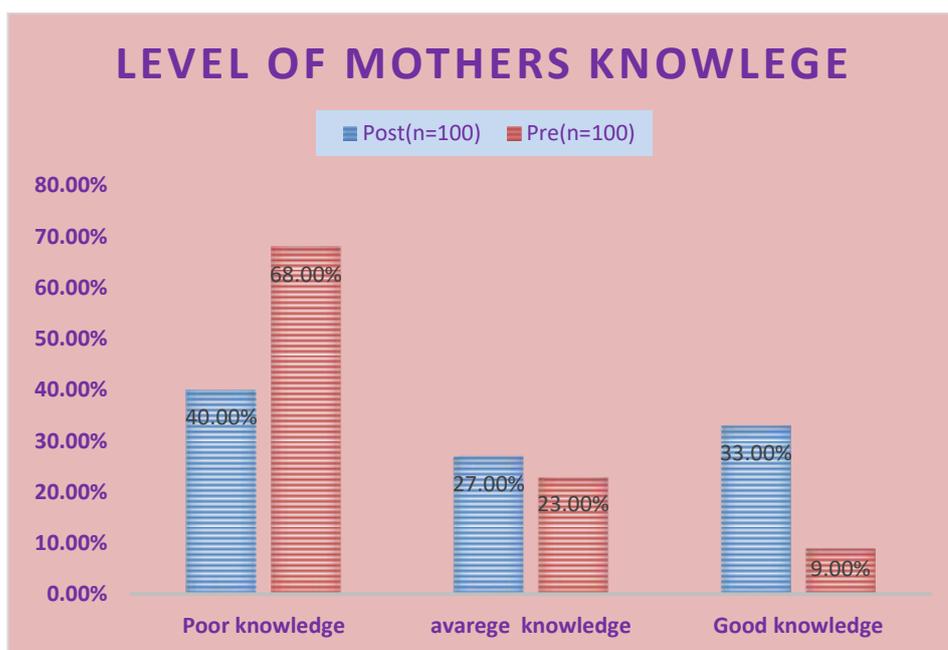
Table (1): Total Mean Score of Mothers Knowledge about Diabetes on Pre and Posttest (n=100)

	Pretest	**Posttest**	**T-test**	**P-value**
X ± SD	10.20 ± 5.61	14.95 ± 5.95	-12.4HS	P < 0.001

NB: P < 0.001: means high statistically significant difference.

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Table (2): Total Mean Score of Mother's Adherence to Diabetes on Pre and Post (n=100)

	Pretest	Posttest	T-test	P-value
X ± SD	48.68 ± 17.40	60.17 ± 16.66	-8.53HS	P < 0.001

Table (3): Total Mean Score of the Mother's Practice on Pre and Post Intervention

Items	Pretest	Posttest	T-test	P–value
Total mean score of practice of insulin injection	9.46 ± 5.43	14.99 ± 6.40	-8.36HS	P < 0.001
Total mean score of practice of blood glucose test	9.32 ± 4.17	13.98 ± 4.24	-10.10HS	P < 0.001
Total mean score of practice of urine test	5.10 ± 5.30	11.17 ± 5.78	-11.52HS	P < 0.001
Total mean score of practice about foot care	5.01 ± 4.13	8.94 ± 3.46	-11.31HS	P < 0.001
Total score of practices	28.89 ± 16.91	49.08 ±19.04	-11.469	P < 0.001

Note:
HS: means high statistical significance. (P < 0.001)

Table (4): Pearson Correlation between Total Score of the Mother's Knowledge about Type 1 Diabetes in Children, Total Score of the Mother's Adherence to Caring for a Child with Diabetes and Total Score of Practices

Items	Total score of the mother's knowledge about type 1 diabetes in children	
	r	P–value
Total score of practices	.922HS	.000
Total score of the mother's adherence to caring for a child with diabetes	.887 HS	.000

Note:
HS: means high statistical significance. (P < 0.001)

Table (5): Pearson Correlation between Total Score of the Mother's Adherence to Caring for a Child with Diabetes and Total score of practices

Items	Total score of mother's adherence to caring for a child with diabetes	
	r	P–value
Total score of practices	.822HS	.000

Note:
HS: means high statistical significance. (P < 0.001)

Discussion

Type 1 diabetes mellitus (T1DM) is one of the most common chronic pediatric diseases in which pancreatic islets are gradually destroyed in genetically susceptible individuals (Elhawy et al., 2021). Type 1 diabetes mellitus (T1DM) can occur at any age, but it is the most common metabolic disease in children and youth with reported that the incidence increased by 2–5% worldwide (Vojislav et al., 2020). Type I diabetes mellitus (T1DM) is a lifelong disease that affects all aspects of the diseased children's life and thus can negatively affect their mental, physical health and their health-related quality of life (HRQOL) (Makara-Studzińska et al., 2019).

Treatment of Type 1 Diabetes (T1D) positions several challenges, specifically for young children and their families. Parental care positively impacts the outcomes of children with T1D (Schiaffini et al., 2020). Management of T1DM requires lifelong insulin replacement therapy via an insulin pump or subcutaneous injection multiple times a day. If not managed correctly, long-term complications include retinopathy, neuropathy, cardiovascular disease, foot damage, and kidney difficulties. So, it requires changes in the behavior of the whole family and the responsibility falls mainly upon the mother (Makara-Studzińska et al., 2019).

Adequate adherence to treatment is fundamental in diabetic patients in order to achieve the maximum possible effectiveness of the treatment. In addition, it ensures an adequate balance between the risk of serious complications and the risk associated with treatment intensification (Grau-Del Valle et al., 2022). The mother is the primary caregiver for the child so that she should be involved in providing care and maintained good metabolic control for the child with diabetes, adherence to these measures is influenced by the knowledge and practices of the mothers (Tawfique et al., 2021).

Accordingly, the current study hypothesized that the mothers of the children with type 1 diabetes mellitus who adhere to diabetic care will control diabetes mellitus among their children on posttest than on pretest.

Part I: Mother's Knowledge about Diabetes on Pre and Posttest

Concerning mothers' knowledge about diabetes, the current study showed that the mothers had higher knowledge level about diabetes mellitus on posttest than on pretest. This result agreed with the result of Seth, (2020) who conducted a study about" Challenges of Achieving an Optimum Glycemic Control in Children with Type 1 Diabetes in India" Which reported that effective health education improves knowledge about glycemic control and motivate the child and his or her mother to take control of diabetes in their hands. From the researcher's perspective, this could be attributed to the positive effect of education program, good preparation of the mothers before the program; mothers were enthusiastic to know everything about diabetes, oral presentations, group discussion, feedbacks, explanatory booklets and videos, as well as facilitating effective online communication with the mothers.

Also this result was inconsistent with Hussien et al., (2019) who conducted a study about " Mothers ' knowledge and Practices toward Their Children Suffering from Juvenile Diabetes: an Assessment Study", it was found that

about two third from the diabetic children's mothers had unsatisfactory total knowledge score about care of their children.

Part II: Mother's Adherence to Caring for their Children with Diabetes

The current study revealed that there was a significant improvement in the mother's adherence on posttest than pretest. This result was consistent with Dagan et al., 2019 who conducted a study about "Adherence to Diabetes Care: Knowledge of Biochemical Processes have a High Impact on Glycemic Control Among Adolescents with Type 1 Diabetes", they stated that causal-biochemical knowledge is a valuable component for the adherence to diabetes care and glycemic control.

This result was consistent with Mahfouz et al., 2018 they conducted a study about "Effects of Mothers' Knowledge and Coping Strategies on the Glycemic Control of Their Diabetic Children in Egypt" they stated that the mothers with more knowledge about diabetes and with better education were able to maintain a better glycemic control of their children. Accepting responsibility and positive reappraisal were the most coping scale increased by increasing the mothers' knowledge regarding diabetes.

Also this result agreed with the results of Campbell et al., (2018) who conducted a study about "Follow-Up Support for Effective Type 1 Diabetes Self-management (the FUSED Model): A Systematic Review and Meta-ethnography of the Barriers, Facilitators and Recommendations for Sustaining Self- management Skills after Attending a Structured Education Program" which concluded that the control of the level of HbA1c among the studied children was linked to the knowledge of their mothers.

Moreover, this result was consistent with Ouzouni et al., (2019) who conducted a study about "Adolescents with Diabetes Type 1: Psychological and Behavioral Problems and Compliance with Treatment" which reported that educating not only the children but also the family members or friends was probably the biggest part that can lead to the better outcome of diabetes. Education and information were the key to diabetes treatment. There were indications that educational interventions in children and adolescents with diabetes had a beneficial effect both on glycemic control and on the psychology of their own and their social environment.

Also, this result agreed with Kyokunzire & Matovu, (2018) who conducted a study about "Factors Associated with Adherence to Diabetes Care Recommendations Among Children and Adolescents with Type 1 Diabetes: a Facility-based Study in Two Urban Diabetes Clinics in Uganda", caretaker involvement could be vital in improving adherence to diabetes care recommendations in children and adolescents with type 1 diabetes. From the researcher perspective this could be attributed to improving the mother's knowledge regarding diabetes and improving their adherence to care of their children to achieve maximum outcomes.

Part III: Checklists for Assessing the Mother's Care Practice to Diabetic Children

Concerning assessing the mother's care practice to diabetic children, the current study revealed that there was an improvement in the mother's practice about insulin injection, blood glucose test, urine test and foot care on posttest than on pretest. This result was consistent with Elhawy et al., 2021 who conducted a study about "Effect

of Caregiver's Health Education on Patterns of Self-Management and Glycemic Control in Pediatric Type 1 Diabetes", the study found that self-management among caregivers of type 1 diabetes children as well as the children's glycemic control improved after health education. Adaptive Self-Management pattern was significantly associated with good glycemic control. Also this result was consistent with the results of Bernier et al., 2018 who conducted a study in the United States about "New-Onset Diabetes Educator to Educate Children and Their Caregivers About Diabetes at the Time of Diagnosis: Usability Study" who stated that there was an association between the implementation of educational program to the newly diagnosed T1DM children and their caregivers and the great improvement in diabetes self-management patterns as well as the long term clinical outcome among this target group. From the researcher's point of view, the findings highlight the importance of such educational programs in such a chronic disease that needs a lifelong care.

This study showed that there was a significant improvement in the mother's practice regarding insulin injection on posttest than on pretest. This result was consistent with Awad et al., 2019 who conducted a study about "Effect of an Intervention Program on Improving Knowledge and Self-Care Practices for Diabetic School-age Children", they stated that the implementation of a training program was effective in improving their practice of the self-care skills of insulin self-injection.

The current study revealed that there was a significant improvement in the mother's practice regarding blood glucose monitoring on posttest than on pretest. This result was consistent with Predieri et al., 2020 who conducted a study about "Glycemic Control Improvement in Italian Children and Adolescents with Type 1 Diabetes Followed through Telemedicine during Lockdown due to the COVID-19 Pandemic", they stated that continuous glucose monitoring and continuous mothers management improved and promoted T1D care.

The study illustrated that there was a significant improvement in the mother's practice regarding urine test on posttest than on pretest. This result was consistent with Chen et al., 2018 who conducted a study about " Identification of Newly Diagnosed Diabetes and Prediabetes Using Fasting Plasma Glucose and Urinary Glucose in a Chinese Population: a Multicenter Cross-sectional Study", it showed that frequent monitoring of urine glucose had positive effect on HgA1C and glycemic control.

Concerning foot care, the current study showed that there was a significant improvement in the mother's practice regarding foot care on posttest than on pretest. This result was consistent with Ramirez-Perdomo et al., 2019 who conducted a study about "Knowledge and Practices for the Prevention of the Diabetic Foot", they mentioned that there was a better practice in the studied participants regarding foot care.

Part IV: Pearson Correlation between Studied Variables

The current study illustrated that there was a positive correlation between total score of the mother's knowledge about type 1 diabetes in children and total score of the mothers' practices.

This result was consistent with Hussien et al.,(2019) who conducted a study about "Mothers' Knowledge and Practices toward their Children Suffering from Juvenile Diabetes: an Assessment Study", it was found that

there was a positive correlation between the total knowledge of the studied mothers about juvenile diabetes and their total reported practices.

Concerning correlation between total score of the mother's adherence to caring for a child with diabetes and total score of the mothers' practices, the current study showed that there was a positive correlation between them. This result was consistent with Goethals et al., 2017 who conducted a study about "Parenting and Treatment Adherence in Type 1 Diabetes throughout Adolescence and Emerging Adulthood", it was found that better mother's adherence was correlated with good practice and lower HbA1c across all the participants.

Regarding correlation between total score of the mother's knowledge about type 1 diabetes in children and total score of the mother's adherence to caring for a child with diabetes, the current study revealed that there was a positive correlation between them. From the researcher's perspective, this was due to helping mothers to understand all the aspects of diabetes and its management and motivate them to adhere to diabetic care to improve outcomes and prevent complications.

Conclusion

The Study Concluded That:

Based on the findings of the current study, it can be concluded that, the mothers of the children with type 1 diabetes mellitus who adhere to diabetic care had effectively good glycemic control among their children on posttest than on pretest.

Recommendations

Based on the results and conclusion of the study, it was recommended that

- Educational and proposing training programs for the mothers of the children with type 1 diabetes mellitus is tremendously crucial to improve levels of the mothers' adherence to care for their children.
- Establishing community-based support groups for diabetic children and adolescents with type 1 diabetes children for good glycemic control, improved quality of life and fewer hospital admissions.
- Maintaining suitable health institutions in all community areas which children with diabetes and their mothers can contact in emergency situations and meet all their needs.
- Integration of health promotion program into school curriculum may enhance knowledge, practice, and the mothers' adherence to care for their children with type 1 diabetes mellitus

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