THE EFFECT OF A STEPWISE PROGRAM ON PREVENTING DIABETIC COMPLICATIONS AMONG CHILDREN SUFFERING FROM DIABETES MELLITUS

EBTSAM MOSTAFA IBRAHIM AHMED *

Technical Institute of Nursing Faculty of Nursing – BeniSuef University Egypt. (Corresponding Author)

HYAM REFAAT TANTAWI

Professor of Pediatric Nursing Ain-Shams University Egypt.

SAFAA SALAH ISMAIL

Professor of Pediatric Nursing Department, Faculty of Nursing, Helwan University, Egypt.

Abstract

Background: Diabetes in children is becoming an increasingly important public health concern throughout the world. It is associated with many serious complications. Self-management is essential to prevent or delay such complication. **Aim:** was to evaluate the effect of a stepwise program on preventing diabetic complications among children suffering from diabetes mellitus. **Design** A Quasi experimental design pre and post-test was utilized achieve aim of this study. **Setting** conducted at pediatric in patient and out-patient unit in Beni-Suef university hospital**. Sample** a convenience sample composed of 60 children and their accompanying mothers. **Tools**: three tools was used; first tool structured questionnaire and child assessment sheet, second tool diabetes self-management questionnaire, and third tool was observational checklists for diabetic self-care practices. **Results**: Significant improvement in the mean total scores of diabetic self-care management in post-program (38.73±5.85) compared to pre-program (17.80±8.86). At post program, there were significant improvements in all procedures after stepwise program. **Conclusion**: Stepwise program was prevent diabetic complications among children suffering from diabetes mellitus observed by increased mean total scores of diabetic self-care management and practices post-program. **Recommendations**: Health care providers should promote diabetes self- care programs for children with diabetes mellitus to enhance diabetic's self- care practices and prevent diabetes related complications.

Index Terms: Diabetes mellitus, Diabetic Complications, Children, Stepwise, and Program

INTRODUCTION

Diabetes mellitus (DM) is a chronic disorder of metabolism characterized by hyperglycemia and insulin resistance. It is the most common metabolic disorder, resulting in metabolic adjustment or physiologic change in almost all areas of the body. DM in children can occur at any age, but 40% of children are diagnosed are between 10 to 14 years old and 60% are between 15 to 19 years old. Girls are 1.3 to 1.7 times more likely to develop type 2 diabetes than boys [1].

Diabetes is one of the most challenging health problems in the 21st Century. It is one of the most common chronic diseases of childhood after asthma and mental retardation. Type 1 diabetes is classically a disease of the young but can occur at any age; onset is generally rapid and presentation acute. The causes in the majority of cases is an autoimmune process, which destroys the insulin-producing pancreatic beta cells [2].

Both genetic and environmental factors have been implicated as important factors in the initiation of the autoimmune process, with viruses often acting as a trigger **[4]**. Type 1 diabetes (T1D) may occur at any age, it tends to develop in childhood; hence, it has long been called juvenile diabetes **[3].** According to the **[3]**. More than half of a million children are estimated to have type 1 diabetes, and around 86 000 developed the disease worldwide in 2019. The rate is increasing by around 3% every year.

The largest contribution to the total number of childhood type 1 diabetes comes from Egypt, accounting for about a quarter of the region's total. In Eastern Mediterranean and Middle Eastern countries, the incidence varies between 1/100 000 per year (Pakistan) and 8/100 000 per year (Egypt) in children under the age of 15 years. The diabetes children must follow certain self-care practices to achieve optimal glycemic control and prevent complications **[2]**.

Long-term complications of diabetes involve both the microvasculature and the macrovasculature. The principal microvascular complications are nephropathy, retinopathy, and neuropathy. Microvascular disease develops during the first 30 years of disease, beginning in the first 10 to 15 years after puberty, with renal involvement evidenced by proteinuria and clinically apparent retinopathy. Macro vascular disease develops after 25 years of diabetes and creates the predominant problems in patients with type 2 DM. **[5]**. The process appears to be one of glycosylation, where in proteins from the blood become deposited in the walls of small vessels (e.g., glomeruli), where they become trapped by "sticky" glucose compounds (glycosyl radicals). The buildup of these substances over time causes narrowing of the vessels, with subsequent interference with microcirculation to the affected areas **[5]**.

Vascular changes can appear as early as 3 years after diagnosis with poor diabetic control, however with good to excellent control, changes can be postponed for 20 years or more. Intensive insulin therapy appears to delay the onset and slow the progression of retinopathy, nephropathy, and neuropathy. Hypertension and atherosclerotic cardiovascular disease are also major causes of morbidity and mortality in children with DM **[6]**.

The complications have been observed in children with DM. Hyperglycemia appears to influence thyroid function, and altered function is frequently observed at the time of diagnosis and in poorly controlled diabetes. Limited mobility of small joints of the hand occurs in 30% of 7 to 18 years old children with type 1 DM and appears to be related to changes in the skin and soft tissues surrounding the joint as a result of glycosylation **[7]**. Children with diabetes need to learn to self-manage their disease early and gradually after diagnosis, and this should be integrated in their personal routines **[8]**.

There might be some differences in self-care between pediatric and adult patients related to cognitive ability of children and emotional maturity in adolescents **[9]**. However, research demonstrated better glycemic control among children who practice self-monitoring of blood glucose. Moreover, they showed good tolerance of the testing

process **[10]**. This would also help a smooth transition from pediatric to adult care for diabetes **[11]**.

The role of the pediatric nurse in educating diabetes children in self-care is essential **[12].** Patient education of self-care and the enhancement of the role of nurses in diabetes care leads to improvement in patient outcomes and the process of care. Nurses' responsibilities are numerous, educating the children   understand their condition in such a way that they know enough about their management and self-care in order to change their lifestyle **[10]**. Hence, this study is an attempt to fill a gap regarding self-care in the management of children with diabetes in Egypt.

The American Diabetes Association (ADA) and the International Diabetes Federation recommend stepwise diabetes prevention (lifestyle modification plus metformin when risk remains elevated) for individuals with any form of diabetes **[13]**. Several stepwise approaches are provided to plays an important role in the effective management of diabetes. Formal assessment of diabetes knowledge of children with diabetes is a prerequisite. **[14]**.

The nurse as a member of the health care team must be involved in self-management of diabetic children. Diabetes is largely a self-managed disease and the patients' role is complex and demanding. Education is the key to the successful management of diabetes and is central to clinical management **[15]**.

Significance of the study

Diabetes mellitus, is significant among the chronic diseases, in accordance with the International Diabetes Federation **[16]**. Diabetes mellitus is one of the most common chronic conditions that can develop in childhood. **Globally,** DM affects about 500 000 children (0-14 years old), with additional cases among late childhood and young adults **[2]***...* The number of children worldwide living with DM is expected to double in the next 15 to 20 years [**17**]. In Eastern Mediterranean and Middle Eastern countries, the largest contribution to the total number of childhood with diabetes mellitus comes from **Egypt**, accounting for about a quarter of the region's total.

The incidence varies between 1/100 000 per year (Pakistan) and 8/100 000 per year **(Egypt)** in children under the age of 15 years **[2]**... Therefore this study will conduct to provide stepwise program for children suffering from diabetes to prevent diabetic complications.

AIM OF THE STUDY

This study aimed to evaluate the effect of a stepwise program on preventing diabetic complications among children suffering from diabetes mellitus.

Research Hypothesis

The current study hypothesized that

Stepwise program will prevent diabetic complications among children suffering from diabetes mellitus.

Subjects and Methods

The study was portrayed under the four main designs as follows:

> I. Technical design.
>
> II. Operational design.
>
> III. Administrative design.
>
> IV. Statistical design.

I. Technical design

It included research design, setting, subject and tools for data collection.

Research design: A quasi experimental study (one group pre / posttest) was used to achieve the aim of the current study.

Research setting: This study was conducted at pediatric in patient and out-patient unit affiliated in Beni-Suef University Hospital.

Research subjects: a convenience sample composed of 60 children and their accompanying mothers according to the following criteria:

1) All children diagnosed with diabetes mellitus and their accompanying mothers

2) Both sex.

3) Children free from any other chronic illness or mental disorders.

Tools for data collection

Three tools were used in this study and were developed by the researcher after reviewing the related literature.

Tools of this study included

First Tool

Part 1: Structured questionnaire sheet: to elicited data about the children and their accompanying mothers includes: - age, sex, diabetes duration years, weight, height, educational level of mothers, occupation, and family history of DM.

Part 2: Child assessment sheet: include child's diagnosis, number of previous hospitalization, diabetic type, presence of diabetic complications.

Second Tool

Diabetes Self-Management Questionnaire (DSMQ)

The DSMQ was developed at the Research Institute of the Diabetes Academy designed by **[18].** This scale was used to assess diabetes self-care management activities.

A 16 item questionnaire to assess self-care activities associated with glycemic control was developed based on theoretical considerations and a process of empirical improvements seven of them are positively worded items directed and nine are negatively worded items. Four subscales, 'Glucose Management' (GM), 'Dietary Control' (DC), 'Physical Activity' (PA), and 'Health-Care Use' (HU), as well as a 'Sum Scale' (SS) as a global measure of self-care was derived.

This tool with 16 self-care items has four subscales as follows: 1) Glucose Management (GM), consisting of five statements: 1, 4, 6, 10, 12, which are related to medication adherence and blood glucose monitoring; 2) Dietary Control (DC), consisting of four statements: 2, 5, 9, 13, which are related to diabetes-associated dietary management behaviors; 3) Physical Activity (PA) consisting of three statements: 8, 11, 15, which are related to exercise or activity for management of diabetes and 4) Health Care Use (HU) consisting of three statements: 3, 7, 14, which are related to adherence to diabetes-related physicians' appointments.

Third Tool

Observational checklists for self-care practices

This checklists were adopted from **[19]**. Checklists were for insulin injection by syringe (24 items), insulin injection by pen (13 items), blood glucose (glucometer) test (17 items), and foot care (17 items). Each step was to be checked as 'done' or 'not done.' These were scored 1 and 0, respectively. The scores of each checklist and for total performance were summed up and converted into percent scores. Adequate self-care practices were 60% or more and inadequate self-care practices were less than 60% of the total score of each observational checklist.

II- Operational Design

The operational design was included preparatory phase, content validity and reliability, pilot study, ethical considerations and field work.

Ethical considerations

An official permission to conduct the study was obtained from the Scientific Research Ethical Committee of Faculty of Nursing Helwan University. The studied children and their accompanying mothers were informed that participation in the study is voluntary and subjects were be given complete full information about the study and their role before signing the informed consent. The ethical considerations included explaining the purpose and nature of the study, stating the possibility to withdraw at any time, confidentiality of

the information where it would not be accessed by any other part without taking permission of the participants.

Pilot Study

The pilot study was carried out at May, 2021 on 10% (6) children suffering from diabetes mellitus from pediatric in patient ant out-patient unit and their accompanying mothers of the total study sample (n=60) to examine the clarity of questions and time needed to complete the study tools. Based on the results, no modifications were done. Subjects included in the pilot study were included in the main study sample.

Field work

The actual field works for this study for the beginning of Jun 2021 until end of Jun 2022.The researcher collected the data by herself. Consisted of four phases: assessment phase, plan phase, implementation phase and evaluation phase

Assessment phase

This stage began on May 2021 to end of July 2021. At this stage the data was collect to know the needs of children with diabetes and their accompanying mothers for knowledge about self-management and practices to prevent diabetic complications. After obtaining the official permissions the involved children were submitted with the first and second data collection tools (Structured questionnaire and diabetes self-management questionnaire sheet).

The researcher was available at the clinic during the data collection sheet filling time to answer any question, and to provide the needed explanations. Then the researcher revised the questionnaire to be sure that there was no missing data/ items.

Observation of children was carried out by utilizing the third tool (Observational Checklist). The children and their accompanying mothers direct observation was done, so that the children were observed during their practice of specific diabetic skills, each child was asked to carry out the selected self-care practices (insulin injection by syringe and pen, blood glucose check by glucometer, and then their knowledge and practice about feet care) as a pretest and was observed using the corresponding checklists.

The children and their accompanying mothers took 30 munities to complete the questionnaires. Five children and their accompanying mothers were included per day. The researcher met with the children and their accompanying mothers for a clear and simple explanation of the aim and procedures of the study. Those who gave their consent were interviewed individually in the education room in the pediatric outpatient and inpatient unit, and have the right to withdraw from the study at any time.

Plan phase

This stage began on August 2021 to end of October 2021.In this stage stepwise educational program building based on the results obtained from reviewing the literature that cover the various aspects of the study by using books, periodical articles, and network

about studies related to diabetes self - care management and practices to prevent diabetic complications among children suffering from diabetes mellitus.

The program content was developed by the researcher. General objective of the program was to evaluate the effect of a stepwise program on preventing diabetic complications among children suffering from diabetes mellitus. Specific objective were to explain (definition, diagnosis, classification and presentation of diabetes), describe the impact of (age, growth, development and maturity on diabetes care child), describe the effect of diabetes on transition from pediatric to adult, explain the behavior and mental and psychosocial influences of diabetes on child and family.

Also, recognize the importance of ongoing self-management education for children with diabetes to prevent diabetic complications, discuss insulin therapy, physical activity, nutrition therapy, discuss short-term and long-term complications prevention and management , explain importance of follow up and care, recognize oral health eye care, and teach the children how to provide some self-care practice for his / her self to prevent diabetic complications such as insulin injection by syringe and pen, blood glucose check by glucometer, and their knowledge and practice about feet care. The program duration were 9- 12 hours to be applied with each session duration 30 – 60 minutes.

Implementation phase

During implementation phase the program began at November 2021 to end of April 2022. At this stage a stepwise program was divided by the children and their accompanying mothers into 6 groups each group consisted of 10 children and their accompanying mothers. The program duration was 9 – 12 hours distributed to 30 – 60 minutes for each session. The program component was 16 session's, the time needed to apply it was 4 weeks, with 3 - 4 days per week for each group, with total time 6 month to all groups.

In session (1) the researcher welcome children and their accompanying mothers and explain the nature and purpose of the study. And all children and their accompanying mothers have the right to withdraw from the study at any time, also she explains the definition, diagnosis, classification and presentation of diabetes mellitus. Session (2) the researcher discusses with the children and their accompanying mothers the impact of age, growth, development and maturity on diabetes care.

During session (3) the researcher describes the effect of diabetes on transition from pediatric to adult care. In session (4) the researcher explain the behavior and mental health and psychosocial influences of diabetes on diabetic children and their families. At session (5) the researcher discusses the concept of diabetes self-management education and support and life style management and their importance to prevent diabetic complications.

At session (6) the researcher discusses the causes and manifestations of short-term complications such as hypoglycemia, diabetic ketoacidosis (DKA), hyperglycemic state and how to prevent it and management of home emergencies. At session (7) of the program the researcher discusses with the children and their accompanying mothers the

causes and manifestations of long-term complications of diabetes such as diabetic retinopathy, diabetic nephropathy, diabetic neuropathy, macro-vascular complications and how to prevent it. In session (8) the researcher explains the importance of management and follow-up at home, school and special occasions to prevent diabetic complications.

During session (9) the researcher learn nutrition therapy to the children with diabetes and their accompanying mothers and how to prepare diabetic food. In session (10) the researcher teach physical activity and exercise and their importance to prevent diabetic complications, and learn them simple exercise can provided by himself. During the session (11) of the program the researcher teach oral health and diabetes and how can provide oral care by himself. In session (12) the researcher demonstrate importance of eye care and how can provide oral care by himself. Session (13) the researcher provide children with an understanding of insulin therapy and their different routes of administration.

During sessions from (14 to 16) the researcher teach the children and their accompanying mothers how to provide some self-care practice for his / her self-such as insulin injection by syringe and pen, blood glucose check by glucometer, and their knowledge and practice about feet care to prevent diabetic complications as the following :- In session (14) , each child was asked to carry out the selected self-care practices (insulin injection by syringe and pen, blood glucose check by glucometer, and their knowledge and practice about feet care) as a pretest and was observed using the corresponding checklists.

After completion of the pretest, the children were informed about the importance of the four selected self-care practices under study. Instructions about insulin injection by syringe and pen were explained and demonstrated by the researchers, and re-demonstration was carried out by each child individually on a small doll.

In session (15), the researchers asked each child to re-demonstrate insulin injection by syringe and pen, and the other three children were asked to act as peer evaluators. The researchers observed each child, and reassured the children if any mistake was committed, and the mistakes were discussed. Instructions about blood glucose check by glucometer were explained and demonstrated by performing the procedure on each child as a re-demonstration.

At session (16), blood glucose check by glucometer was re-demonstrated on each child to measure his/her blood glucose level, and then some items of feet care were done by the children on themselves using a mirror to see the bottom of his/her feet, checking the color of his/her legs and feet with observation for any abnormality, how to trim his/her nails straight across; the children and the researchers also inspect their shoes to check for appropriateness. The remaining items of feet care were discussed and then evaluated to give the children feedback about their performance.

Then the final session (post-intervention test) evaluation phase was done using the diabetes self-management questionnaire sheet and observational checklists. The

children and their accompanying mothers took 30 munities to complete the questionnaires. The researches tried to evaluate the child in his/her group of training because they became friends and had no problems making mistakes among themselves. After evaluation, the mistakes of all children were discussed again with them.

The intervention program included a DVD, Lectures, diabetes booklet, diabetes self-care practices pamphlet, discussion and presentation sessions and diabetes demonstration skills sessions.

III - Administrative Design

A written approval letter was being issued from Dean of Faculty of Nursing-Helwan University. The letter was being directed to the general manager of Beni-Suef University Hospitals asking for cooperation and permission to conduct this study. After explanation of the study aim, an official permission was obtained from the Dean of Faculty of Nursing and the General Manager of Beni-Suef University Hospitals. Consent was obtained from parents ensuring complete privacy and total confidentiality.

IV-Statistical design

Upon completion of data collection, data will be computed and analyzed using Statistical Package for the Social Science (SPSS), version 24 for analysis. The P value will be set at 0.05. Descriptive statistics tests as numbers, percentage, mean ± standard deviation (± SD), will be used to describe the results. Appropriate inferential statistics such as "F" test or "t" test will be used as well.

RESULTS

Table 1: Demographic Characteristics of the Studied Children. (N=60)

	No.	Percentage %
Age:		
≤6	13	21.7
7-12	19	31.7
13-18	28	46.7
Mean ± SD	**11.50±4.58**	
Gender:		
Male	28	46.7
Female	32	53.3
Education:		
Educated	33	55.0
Not educated	27	45.0
Previous hospitalization:		
No Previous hospitalization	15	25.0
Diabetic complications(Diabetic coma, DKA ,hypo and hyperglycemia)	30	50.0
Recurrent respiratory infection and Pneumonia	9	15.0
Surgical operation	6	10.0

Diabetes onset:		
≤5	13	21.7
6-12	30	50.0
13-18	17	28.3
Mean ± SD		**9.43±4.61**
Duration of illness:		
Less than one year	27	45.0
More than one year	33	55.0
Mean Height:		**137.33±21.30**
Mean Weight:		**41.42±18.27**

* Numbers are not mutually exclusive.

Table (1) illustrates that near half 46.7 % of the studied children's age ranged between 7-12 with Mean±SD (11.50±4.58) , slightly more than half studied children's were females 53.3 % , and more than half 55.0 % of studied sample were educated, as regard the previous hospitalization, it was clear that half 50.0 % of the studied children, the causes of previous hospitalization were diabetic coma, DKA ,hypo and hyperglycemia , half 50.0 % of studied children diabetes onset at age 6-12 years , more than half 55.0 % of studied children duration of illness were more than one year , mean height (137.33±21.30) and mean weight (41.42±18.27).

Table 2: Demographic Characteristics of the Parents of Studied Children. (N=60)

	No.	**Percentage**
Mothers' age		
≤35	6	10.0
36-45	34	56.7
46-55	20	33.3
Mean±SD	43.00±6.18	
Mothers' Education		
Educated	42	70.0
Uneducated	18	30.0
Fathers' Education		
Educated	52	86.7
Uneducated	8	13.3
Residence		
Rural	44	73.3
Urban	16	26.7
Income		
Enough	13	21.7
Not enough	47	78.3

Table (2) revels that more than half 56.7% of the mothers' age was between 36 - 45 years, which a majority of fathers and mothers' 86.7% and 70.0% were educated , a majority of the studied children 73.3% and 78.3% were living in rural areas, and had not enough monthly income respectively .

Table 3: Child Assessment Questionnaire of the Studied Children. (N=60)

	No.	Percentage
Number of previous hospitalizations		
One	24	40.0
Two	20	33.3
Three	16	26.7
Diabetes type		
Diabetes type 1	46	76.7
Diabetes type 2	14	23.3
Family history		
Positive	51	85.0
Negative	9	15.0
Treatment		
Insulin only	19	31.7
Insulin with other medicines	41	68.3
Insulin injections per day		
One	13	21.7
Two	34	56.7
Three	13	21.7
Complications		
No complications	20	33.3
Recurrent infection, hypo/hyperglycemia, DKA	27	45.0
Nephropathy	4	6.7
Neuropathy	4	6.7
Retinopathy	3	5.0
Hypertension	2	3.3
Glucometer at home		
No	32	53.3
Yes	28	46.7

Table (3) illustrates that more than one third 40.0% of the studied children had previous hospitalizations once, Also near than three quarters 76.7% of the studied children had type 1 diabetes , a more than two third 85.0% of them had positive family history to diabetes , and more than half 68.3% of them were an insulin with other medicines , it was clear 56.7% , 33.3% , 45.0 % , and 46.7 % of the studied children were injected twice daily by insulin , had no diabetes complications, had short term complications, and have glucometer at home respectively .

Table 4: Total Scores of Diabetes Self-Management Questionnaire (DSMQ of the Studied Children. (N=60)

Item	Pre			Post			t test (Sig.)
	Poor Diabetic Self-Management	Good Diabetic Self-Management	Mean ± SD	Poor Diabetic Self-Management	Good Diabetic Self – Management	Mean ± SD	
Glucose Management (GM)	48 (80.0)	12 (20.0)	5.07±3.25	2 (3.3)	58 (96.7)	13.67±2.00	-18.064 (0.000**)
Dietary Control (DC)	52 (86.7)	8 (13.3)	3.98±2.94	10 (16.7)	50 (83.3)	9.07±1.97	-12.220 (0.000**)
Physical Activity (PA)	43 (71.7)	17 (28.3)	3.37±2.67	8 (13.3)	52 (86.7)	7.87±1.62	-13.976 (0.000**)
Health Care Use (HU)	39 (65.0)	21 (35.0)	4.72±1.70	18 (30.0)	42 (70.0)	5.37±1.13	-2.296 (0.025*)
Total DSMQ	49 (81.7)	11 (18.3)	17.80±8.86	7 (11.7)	53 (88.3)	38.73±5.85	-17.458 (0.000**)

Paired samples t test (Significance) ** highly statistically significant at p≤0.01

Table (4) Shows that in pre-program the more than three quarters 81.7% of the children were poor diabetic self-care management, while in post-program the more than three quarters 88.3% of the children were good diabetic self-care management, with highly statistically significant difference between pre and post-program mean total scores of all domains of diabetic self-care management (dietary control, medication adherence, physical activity, health care use). Moreover, a significant improvement in the mean total scores of diabetic self-care management in post-program (38.73±5.85) compared to the mean total score of diabetic self-care management in pre-program (17.80±8.86), at p≤0.01. The findings of the table provide support to research hypothesis by improvement in the children diabetic self-care management that can lead to preventing diabetic related complications

Table 5: Total Scores of diabetic self-care practice of the Studied Children. (N=60)

Item	Pre			Post			T test (Sig.)
	Poor practice	Good practice	Mean ± SD	Poor practice	Good practice	Mean ± SD	
Blood Glucose Testing	52 (86.7)	8 (13.3)	4.40±4.41	11 (18.3)	49 (81.7)	14.33±3.01	-14.974 (0.000**)
Foot Care	48 (80.0)	12 (20.0)	3.37±4.42	14 (23.3)	46 (76.7)	12.80±2.96	-12.322 (0.000**)
Insulin Injection by Pen	46 (76.7)	14 (23.3)	2.05±3.42	21 (35.0)	39 (65.0)	8.58±2.24	-13.437 (0.000**)
Insulin Injection by Syringe	50 (83.3)	10 (16.7)	3.77±5.84	23 (38.3)	37 (61.7)	14.30±2.89	-12.517 (0.000**)
Total Performance	60 (100.0)	0 (0.0)	13.58±9.10	10 (16.7)	50 (83.3)	0.02±7.44	-23.205 (0.000**)

Paired samples t test (Significance) **Highly statistically significant at p≤0.01

Concerning with total scores of performance of diabetic self-care practice (blood glucose testing, foot care, insulin injection by pen and by syringe), Table (5) illustrates that in pre-program all of the children (100.0) were poor performance of diabetic self-care practice, while in post-program the majority (88.3%) of the children were good performance, with highly statistically significant difference between pre and post-program mean total scores of all of diabetic self-care practice. These finding indicated the significant effect of the stepwise program on subjects' diabetic self-care management and practice. Moreover, a significant improvement in the mean total scores of diabetic self-care practice in post-program (50.02±7.44) compared to (13.58±9.10) in pre-program, at p≤0.01.

Table 6: Relation between demographic Characteristics and Diabetes Self-Management Questionnaire (DSMQ) of the studied subjects (n=60)

	Diabetes Self-Management Questionnaire				X^2	P value
	Pre		Post			
	No.	%	No.	%		
Age						
≤6	1	14.3	12	22.6	2.379[FE]	0.304
7-12	4	57.1	15	28.3		
≥13	2	28.6	26	49.1		
Gender						
Male	3	42.9	25	47.2	FE	1.000
Female	4	57.1	28	52.8		

Education						
Primary	3	42.9	17	32.1	3.510^{FE}	0.271
Preparatory	1	14.3	13	24.5		
Secondary	0	0.0	13	24.5		
Uneducated	3	42.9	10	18.9		
Duration of illness						
Less than one year	3	42.9	24	45.3	FE	1.000
More than one year	4	57.1	29	54.7		
Number of previous hospitalizations						
One	3	42.9	17	32.1	3.041^{FE}	0.549
Two	1	14.3	11	20.8		
Three	4	57.1	24	45.3		

X^2 Chi Square test (Significance)

^{FE} Expected cell count less than 5, Fisher's exact test was used.

Table (6) revels that there is no statistical significant relation between diabetes self-management questionnaire (DSMQ) and demographic characteristics of the children pre and post program.

Table 7: Relation between demographic Characteristics and total practice of the studied children. (n=60)

	Practice total				X^2	P value
	Pre		Post			
	No.	%	No.	%		
Age						
≤6	2	20.0	11	22.0	FE	0.035*
7-12	5	50.0	14	28.0		
≥13	3	30.0	25	50.0		
Gender						
Male	8	80.0	20	40.0	2.003^{FE}	0.367
Female	2	20.0	30	60.0		
Education						
Primary	4	40.0	16	32.0	1.221^{FE}	0.872
Preparatory	3	30.0	11	22.0		
Secondary	2	20.0	11	22.0		
Uneducated	1	10.0	12	24.0		
Duration of illness						
Less than one year	3	30.0	24	48.0	1.125^{FE}	0.488
More than one year	7	70.0	26	52.0		
Number of previous hospitalizations						
One	2	20.0	25	50.0	2.321^{FE}	0.734
Two	3	30.0	12	24.0		
Three	5	50.0	13	26.0		

X^2 Chi Square test (Significance)

* Statistically significant at p≤0.05

^{FE} Expected cell count less than 5, Fisher's exact test was used.

Table (7) shows that there is no statistical significant relation between total self-care practice and demographic characteristics of the children , but found statistically significant relation between children age and total self-care practice in pre and post program at p≤0.05

DISCUSSION

Diabetes is contributing to the global burden of complications [20]. These complications mostly associated with sedentary lifestyle, unhealthy dietary habits, skipping doctor's appointment, noncompliance with prescribed medication [21]. Thus, it is necessary to provide an optimal care for diabetes pediatric patients through self-management interventions that include set of self-management skills and practice [22]. Effective self-management skills and practice in pediatric diabetic patients involves the collection of advanced techniques and is best achieved by engaging in high-quality structured education [23].

The current study reported that near half of the children's age ranged between 7-12 with Mean ± SD (11.50 ±4.58), this findings was agreement with [1]. , in study in titled «Epidemiology, presentation, and diagnosis of type 2 diabetes mellitus in children and adolescents» , who reported DM in children can occur at any age, but 40% of children diagnosed are between 10 to 14 years old and 60% are between 15 to 19 years old.

As regards gender, more than half of studied children were female, this findings is in line with an epidemiological study of diabetes made in Egypt which found that the gender distribution is 1:1 male to female ratio [24]. Also this findings consistent with [25]. In study in titled «Effect of instructions on selected self-care practices among type-1 diabetic children» who found that more than half of the children were female. Also this findings inconsistent with [26]. In study in titled «Factors Affecting Self-Care Practices of Diabetic School Students», who found that more than half of the students were males?

As regards children educational level more than half of the studied children in the current study had educated this findings agreed with [25]., , in study in titled «Effect of instructions on selected self-care practices among type-1 diabetic children» , who reported the majority of the diabetic children were educated .

Concerning diabetes related complications; the present study showed that half of studied children previous hospitalization caused by diabetes related complications. This finding was in agreement with [27]. In study in titled « A community based study on perceived knowledge of diabetes on cause, control, prevention and complications among diabetic patients in Bengaluru city», who reported that diabetes related complications were prevalent in about forty two percent.

In relation to duration of illness the findings present study revealed that more than half of the children **duration** of illness were more than one year this findings was in agreement with study done in Egypt by [28]., study *«Effect of Caregiver's Health Education on*

Patterns of Self-Management and Glycemic Control in Pediatric Type 1 Diabetes*,* reported that more than half of the sample duration of illness more than one year.

The current study revealed that half of the children diabetes onset at age 6-12 years, this findings was in line with study done by **[27].** , in study in titled «Education effectiveness in diabetes mellitus type 1 management made by children´s caregivers», reported that the most of sample were on the school stage. The disease has appeared abruptly in early childhood, with solid symptoms indicating the presence of the disease *[29]*.

As regards family history of diabetes, the findings of the present study revealed that the majority of children had reported positive family history of diabetes. This finding was in agreement with **[27]**, in study in titled «A community based study on perceived knowledge of diabetes on cause, control, prevention and complications among diabetic patients in Bengaluru city», and revealed that the positive family history of diabetes was reported by forty percent of the diabetic patients in Bengaluru City. Similarly, **[30]** in Port Said City-Egypt , , in study in titled « The effect of educational intervention on knowledge, attitude and glycemic control in patients with diabetes mellitus» found that seventy five percent of patients with diabetes had positive family history of diabetes.

Being a caregiver for a diabetic child is a major challenge **[31]** Mothers identify a needs for close monitoring and attention to the child's diabetes especially for those at very young age **[32]**.The present study revealed that fathers and mothers education had significant impact on self-care managements and practices of their diabetic children, the present study showed that the majority of the fathers and mothers' had educated.

This may be referred to the relation between the educational level, which increases the background information and awareness of the family about diabetes and its management, which improves self-care practices. **[33]** , study «A therapeutic education program for diabetic children recreational, creative methods, and use of puppets in Patient Education» and reported that education interferes significantly in adherence to treatment of DM, as they may have difficulty to understand treatment recommendations and can interfere with adherence to treatment of caregivers too.

This findings partially disagrees with the study done in India **[34]**, study «Awareness regarding self-care among diabetics in Rural India» and the UAE **[35]**, study *«*Knowledge, attitude and practices of diabetic patients in the United Arab Emirates» , found that the high educational level of fathers was only associated with better self-care practices while the mother's educational level was not significant predictor of self-care of diabetic children; this association can be explained by that the father's educational level was a proxy for income, whereas the mother's educational level was not.

Regarding diabetes related complications; the present study showed that one third of studied children had no diabetic complications and near half of them had short term complications. This finding was in agreement with **[29]** (Wong's Essential care of Pediatric Nursing), reported in diabetes related literature, short term complications of diabetes such as DKA, hypoglycemia and hyperglycemia most common occur in the first

year of diagnosis. Regarding long-term complications of diabetes involve both the microvasculature and the macrovasculature. The principal microvascular complications are nephropathy, retinopathy, and neuropathy. Microvascular disease develops during the first 30 years of diabetes, beginning in the first 10 to 15 years after puberty. Macro vascular disease develops after 25 years of diabetes related to poor diabetic control

This study reported that majority of parent's income were not enough? The present finding were consistent with a German study done by **[36]**,, in study in titled «The association between socio-economic status and diabetes care and outcome in children with diabetes type 1 in Germany» showed a significant association between socioeconomic status and diabetes self-management patterns and glycemic control given that, low socio-economic status is linked to poor diabetes management and glycemic control with higher complications and bad outcomes.

From the researcher point of view patients with low socio-economic status have a high hospital admission rate, reflecting the importance of individual education not only to the routine health education of this vulnerable group. Thus, those families with more financial resources may have been more able to furnish the necessary diabetes supplies for blood glucose monitoring and intensive insulin therapy **[37]** The current study reported that the three fourth of studied children had diabetes type 1 and near one fourth of them had diabetes type 2, this findings agreement with **[38]**, in study in titled *«*Does breast feeding influence the risk of developing diabetes mellitus in children» , who mentioned that type 1 diabetes remains the most prevalent form of diabetes in children. However, type 2 diabetes mellitus is estimated to occur in one to three (20% to 33%) of new diagnoses of diabetes in children today. The rate of type 2 diabetes mellitus in children continues to rise even as the obesity rates have plateaued in these age groups.

Diabetes self-management and education is a dynamic mean for maintaining health. It is a behavior to promote health, prevent illness, treat and cope with health problems. Moreover, it comprises those activities performed independently by the individual to promote and maintain personal well-being throughout life. The effective management of chronic illnesses as diabetes mellitus, is a complex task that touches nearly every important aspect of daily life. It requires significant participation by patients and their families. **" [39], [40] "**.

The findings of the study revealed that total scores of all domains of diabetic self-care management (dietary control, medication adherence, physical activity, health care use) was significantly improved throughout the study, the findings showed that majority of the studied children had poor diabetic self-care management in the preprogram, while in the post-program the majority of the children had good diabetic self-care management.

Moreover, a significant improvement in the mean total scores of diabetic self-care management in post- program (38.73±5.85) compared to (17.80±8.86) in pre- program. It is consistent with the findings of the current study a previous Egyptian study done by **[41]**, in study in titled «Effect of an Intervention Program on Improving Knowledge and Self-Care Practices for Diabetic School-age Children », and reported a significant

improvement in diabetes self-management and practices associated with educational program. Also it comes in concordance with the findings of a study conducted in United States stated by **[42]**, study «New-onset diabetes educator to educate children and their caregivers about diabetes at the time of diagnosis», mentioned 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 point of view it may be due to the studied children at school age and this age more liable to understand and gain information and remain knowledge after program who received

Concerning with total scores of performance of four self-care practice (blood glucose testing, foot care, insulin injection by pen and by syringe), the present study findings showed that in pre-program the all of the studied children had poor performance of this selected four self-care practice, while in post-program the majority of the studied children had good performance, with highly statistically significant difference between pre and post-program mean total scores of all of diabetic self-care practice. The study findings supported by the study done in Egypt by **[25]**, study «Effect of instructions on selected self-care practices among type-1 diabetic children», mentioned no practice of self-care among children and adolescents with T1D before receiving instructions. However, statistically significant improvements were revealed in their performance of the selected self-care practices after receiving related instructions.

Studies from both developed and developing countries have reported that diabetes knowledge is generally poor among diabetic patients. Improving patients' knowledge about diabetes self-care practices allows them to better contribute to their care and is a small investment with a large benefit. **" [43], [44] "**.

From the researcher point of view it may be due to increasing the psychomotor abilities and the more eagerness to be self-dependent in studied children and increasing abilities to assume additional responsibility for their own health, including maintaining health practices, taking prescribed medications, keeping appointments, and performing procedures when necessary. However, statistically significant improvements were reported in all domains (dietary control, medication adherence, physical activity, and health care use) of diabetic self-care management   and their performance of the selected four self-care practices after receiving related stepwise program. This leads to acceptance of the set research hypothesis of effect of a stepwise program on preventing diabetic complications among children suffering from DM. Regarding the relation between demographic characteristics of the studied children and total diabetic self- management scores, the current study shows that no statistical significant relation between diabetic self-management scores and socio-demographic characteristics of the studied children pre and post program.

This was in agreement with the study performed in outpatient diabetes clinic in the UAE **[35]**, study in titled « Knowledge, attitude and practices of diabetic patients in the United Arab Emirates », who reported that there were no statistically significant association

between patients' diabetic self-care management and practice scores and socio-demographic characteristics of the children as number of previous hospitalizations, sex, age and socioeconomic level.

The present study has also identified a positive and significant influence of children's age on their self-care performance scores. The current study showed that statistically significant relation between children age and total self-care practice in pre and post program. In agreement with this **[29]**, (Wong's Essential care of Pediatric Nursing) , emphasized that as school age children and adolescents develop they are able to assume additional responsibility for their own health, including maintaining health practices, taking prescribed medications, keeping appointments, and performing procedures when necessary due to increasing psychomotor and cognitive abilities. Stressed the importance of taking child's age and cognitive development into account in self-care instructional programs the significant and independent positive effect of the stepwise was confirmed through multivariate analysis, which identified it as the main positive predictor of the total performance score. This success could be attributed to more than one reason. First, the program content was easy to be assimilated to children and adolescents and their accompanying mothers. Second, the process of stepwise was in a friendly environment, with small groups acting as encouraging teams for each other. Last, each child was given full opportunity to practice the skill until mastered. Added to these factors is the positive attitude and psychological support provided by the healthcare providers in the study setting. In congruence with this, the benefits of peer-based interventions have been revealed in a recent systematic review **[45]**, Nonetheless, the best approaches in such stepwise program still need further research **[46]**,

Diabetes self-management and education (DSME) is an important component in providing quality care to all diabetics. DSME helps patients develop the knowledge, skills, and abilities necessary for effective self-care. Diabetes programs as a behavioral and psychosocial strategy to facilitate self-care so as to provide better results. Several DSME interventions are capable of providing effective change in promoting behavior change **[47]**, DSME as an effective education, cost protection, can prevent complications. Diabetes self-management is a form of diabetes health education to improve health knowledge and behavior **[48]**, Diet modification, physical activity, stress management, and pharmacological therapy all play a role in achieving the desired outcome for diabetes **[49]**, Diabetes self-management support refers to the support needed to apply and maintain skills and behaviors in a sustainable manner **[50]**,

The findings of the present study draw attention to the importance of gaining adequate understanding of patient's knowledge which will continue to be an important foundational procedure in designing appropriate interventions for this vulnerable group. Patients who are more self-aware about the disease, who have more knowledge and who are regularly involved in self-care practices, achieve better management of the disease. Health education programs proposed should be tailored and individualized to the needs of

patient's. They should be attainable and the patient's should be involved in decision-making, monitoring and evaluation all of which are likely to increase compliance.

CONCLUSION

Stepwise program was prevent diabetic complications among children suffering from diabetes mellitus observed by increased mean total scores of diabetic self-care management and practices post-program

RECOMMENDATIONS

- Promoting diabetes self- care stepwise programs to children with DM to enhance diabetic's self- care practices and prevent diabetes related complications at all children.

- Maintain continuous the stepwise for the families and their children suffering from D M for glycemic control, improved quality of life, prevent diabetes complications and fewer hospital admissions.

- Disseminating of the stepwise for all diabetic children and their families through APPS, Facebook, and other social med

References

1. **Laffel, L., & Svoren, B... (2020):** Epidemiology, Presentation, and Diagnosis of Type 2 Diabetes Mellitus in Children and Adolescents. Http://Www.Uptodate.Com/Contents/Epidemiology-Presentation-And Diagnosis-Of-Type-2-Diabetes-Mellitus-In-Children-And-Adolescents;

2. **International Diabetic Federation. (2020):** Launch of 'Diabetes Action Now'. Saudi Med J. 25(10): P. 1538. Lynn, P.Taylor's Clinical Nursing Skills: A Nursing Process Approach, 3rd Edition, China, Lippincott Williams & Wilkins.

3. **British Medical Association (BMA). (2020):** Diabetes Mellitus: An Update For Healthcare Professionals. London: BMA

4. **Noble, J.A., & Erlich, H.A. (2021):** Genetics of Type 1 Diabetes. Cold Spring Harb Perspect Med 2:1–15. Octubre:20(2): 272-9

5. **Rosenson, R.S., & Herman, W.H. (2021):** Glycated Proteins and Cardiovascular Disease in Glucose Intolerance and Type 11 Diabetes. Curr Cardiovascular Risk Rep.; 2(1):43–46.

6. **Karnik, A.A., Fields, A.V. S, & Hannon RP. (2021):** Diabetic Cardiomyopathy. Curr Hypertens Rep.; 9(6):467–473.

7. **Wilson, D., & Hockenberry, M.J. (2019):** Wong's Clinical Manual of Pediatric Nursing. 8th. Ed. London, UK: Mosby; 1223–1229.

8. **Boman, Å. Bohlin, M., Eklöf, M., Forsander, G., & Törner, M. Boulton, A.J.M., Vinik, A.I., & Arezzo, J.C. L. (2022):** ACIP Adult Immunization Work Group; Centers for Disease Control and Prevention (CDC). American Care 33:676–682

9. **Peters, A., & Laffel, L., (2019):** The American Diabetes Association Transitions Working Group. Diabetes Care for Emerging Adults: Recommendations for Transition from Pediatric To Adult Diabetes Care Systems. Diabetic Care 34:2477–2485.

10. **Hockenberry, M.J, & Wilson, D. (2020):** Wong's nursing Care Of Infants and Children. 9th Ed.

Xi'an Shiyou Daxue Xuebao (Ziran Kexue Ban)/
Journal of Xi'an Shiyou University, Natural Sciences Edition
ISSN: 1673-064X
E-Publication: Online Open Access
Vol: 66 Issue 05 | 2023
DOI 10.17605/OSF.IO/47J8N

Canada: The CV Mosby Company.

11. **Campbell, F., Biggs, K., Aldiss, S.K., O'Neill, P.M., Clowes, M., & Mcdonagh, J.,. (2021):** Transition Of Care For Adolescents From Paediatric Services To Adult Health Services. Cochrane Database Syst Rev 4:CD009794 **Care**; 35:1364–1379.

12. **Kenny, J., & Corkin, D. (2022):** A Children's Nurse's Role in the Global Development of a Child with Diabetes Mellitus. Nurse Child Young People 25:22–25.

13. **Alberti, K.G., Zimme,T P. & Shaw J.,. (2019):** International Diabetes Federation: A Consensus On Type 2 Diabetes Prevention. Diabetes Med; 24:451–463.

14. **Corabian, P., & Harstall, C. (2019):** Patient Diabetes Education in the Management of Diabetes. Alberta: Alberta Heritage Foundation Med Res: IHTA: 23.

15. **Silverstein, J., Klingensmith, G., Copeland, K., Plotnick, L., Kaufman, F., & Laffel. L.,. (2020):** Care of Children and Adolescents with Type 1 Diabetes. Diabetes Care. 28(1):186 – 212.

16. **IDF. (2020):** IDF Diabetes Atlas. International Diabetes Federation. IDF Atlas. Http://Www.Idf.Org/ Diabetes Atlas. Accessed May 25, Cohort Study. Lancet.;371(9626):1777-178

17. **Harjutsalo, V.R., Sjöberg, I.L., & Tuomilehto, P.J. (2019):** Time Trends in the Incidence of Type 1 Diabetes in Finnish Childrenphp? Accionmenu=Hemeroteca.Visualizaarticuloiu.Visualiza&Articulo_Id=11442 Health System for the 21st Century [Internet], Washington

18. **Schmitt ,A , Gahr,A , Hermanns,N , Kulzer,B , Jörg Huber,J , and Haak.T , . (2013)** Health and Quality of Life Outcomes, 11:138http://www.hqlo.com/content/11/1/138* Correspondence: schmitt@diabetes-zentrum.de 1 Research Institute of the Diabetes Academy Mergentheim (FIDAM), German Diabetes Center

19. **Wilson, D., & Hockenberry, M.J. (2014):** Wong's Clinical Manual of Pediatric Nursing. 8th. Ed. London, UK: Mosby; 1223–1229.

20. **Suguna, A., Magal, A. S., Stanyn A. I., Sulekhan T. And Pretheshn, K. (2022):** Evaluation of Self-Care Practices Among Diabetic Patients in a Rural Area of Bangalore District, India. International Journal of Current Research and Academic Review, 3(6), 415-422.

21. **Co, M.A., Maudrene, L.S., Tai, E.S, Griva, K., Amir, M., Chong, K.J., Lee, J., Khoo, E.Y., & Wee, H. (2021):** Factors Associated With Psychological Distress, Behavioral Impact and Health-Related Quality Of Life among Patients with Type 2 Diabetes Mellitus. Journal of Diabetes and Its Complication; 29(3), 378-383**.**

22. **[22] Mbuagbaw, L., Aronson, R., Walker, A., Brown, R. E., & Orzech,N. (2021):** The LMC Skills, Confidence & Preparedness Index (SCPI): Development And Evaluation of A Novel Tool For Assessing Self-Management In Patients With Diabetes. Health and Quality of Life Outcomes, 15(27), 1-9.

23. **Heller, S.R., Gianfrancesco, C., Taylor, C., & Elliott, J. (2020):** What Are The Characteristics Of The Best Type 1 Diabetes Patient Education Programmes (From Diagnosis To Long-Term Care), Do They Improve Outcomes And What Is Required To Make Them More Effective? Diabetic Medicine. Apr; 37(4):545-54.

24. **Arab,, M. (2019):** World Health Statistics Quarterly, Diabetes Mellitus In Egypt. 2019; (45): 334-7.Revealed on May.

25. **Attia, A., Hassan, A. (2020):** Effect of Instructions on Selected Self-Care Practices among Type-1 Diabetic Children. Egyptian Nursing Journal, Vol. 14 No. 2, May-August DOI: 10.4103/ENJ.ENJ_19_17

26. **Abd El Ghfar, AA. (2019):** Factors Affecting Self-Care Practices of Diabetic school Students, Unpublished Master Thesis, Faculty of Nursing, and Alexandria University.

27. **Prasad, K. N. (2021):** A Community Based Study on Perceived Knowledge of Diabetes on Cause, Control, Prevention and Complications among Diabetic Patients in Bengaluru City. International Journal of Community Medicine and Public Health, 4(9), 3416-3423.

28. **Elhawy, L.L, Hussein, Y., H., & Eldeeb, S.M. (2021):** Effect of Caregiver's Health Education on Patterns of Self-Management and Glycemic Control in Pediatric Type 1 Diabetes. Community Medicine, 2 Family Medicine Faculty Of Medicine, Zagazig University The Egyptian Journal Of Community Medicine Vol. 39 No. 2 April 2021

29. **Hockenberry, W.R., Wilson, S, (2019): Wong's Essential Care Of Pediatric nursing 11.Ed ISBN: 978- 0-323-35316-8 Copyright © By Elsevier, Inc. All Rights Reserved.**

30. **Ahmed, M., Degwy, H, Ali, M., & Hegazy, N.H. (2021):** The Effect of Educational Intervention on Knowledge, Attitude and Glycemic Control in Patients with Diabetes Mellitus. Int J Community Med Public Health, 2, 302-307.

31. **Iversen, A.S, Graue, M., Haugstvedt, A., & Råheim, M. (2019):** Being Mothers And Fathers Of A Child With Type 1 Diabetes Aged 1 To 7 Years: A Phenomenological Study Of Parents' Experiences. International Journal of Qualitative Studies on Health and Well-Being. Jan 1; 13(1):1487758.

32. **Sullivan-Bolyai, S., Rosenberg R, & Bayard, M. (2020):** Fathers' Reflections on Parenting Young Children with Type 1 Diabetes. MCN: The American Journal of Maternal/Child Nursing. Jan 1; 31(1):24-31.

33. **Pélicand, J., Gagnayre, R., Sandrin-Berthon, B, & Aujoulat, I. (2021):** A Therapeutic Education Programme For Diabetic Children: Recreational, Creative Methods, And Use of Puppets. Patient Educ Couns.; 60(2):152-63.

34. **Majra, J, P., & Acharya D. (2019):** Awareness Regarding Self-Care among Diabetics in Rural India. Middle East Journal of Family Medicine, (7): 125-37.

35. **Maskari, M., El-Sadig, M., Al-Kaabi, J., Afandi, B., Nagelkerke, N., & Yeatts, K. (2019):** Knowledge, Attitude and Practices of Diabetic Patients in the United Arab Emirates. Plos ONE; 8(1):1-8

36. **Mönkemöller, K., Müller-Godeffroy, E., Lilienthal, E., Heidtmann, B., Becker, M., Feldhahn, L., Freff, M., Hilgard, D., Krone, B., Papsch, M., & Schumacher, A. (2019):** The Association between Socio-Economic Status and Diabetes Care and Outcome in Children with Diabetes Type 1 in Germany: The DIAS Study (Diabetes and Social Disparities). Pediatric Diabetes. Aug; 20(5):637-44.

37. **Konrad, K., Vogel, C., Bollow, E., Fritsch, M., Lange, K., Bartus, B, & Holl, R.W. (2020):** German/Austrian DPV Initiative and the Competence Network Of Diabetes. Current Practice of Diabetes Education in Children and Adolescents with Type 1 Diabetes in Germany and Austria: Analysis Based On the German/Austrian DPV Database. Pediatric Diabetes. Nov; 17(7):483-91.

38. **Pelham, J.H., Hanks, L., Aslibekyan, S., Dowla, S., Ashraf, A.P., Pereira, P.F., Alfenas, R.C., & Araujo, R.M. (2020):** Does Breast Feeding Influence The Risk Of Developing Diabetes Mellitus In Children? A Review of Current Evidence. J Pediatr (Rio J) 90: 7-15.

39. **Clarke L. (2020):** Behavioral Challenges in the Management of Childhood Diabetes. Journal of Diabetes Science and Technology 2020; 5(2): 225-8.

40. **Godfrey, C., Harrison, M., Lysaght, R, Lamb, M., Graham, I., & Oakley, P. (2020):** Care Of Self – Care By Other - Care Of Other: The Meaning Of Self-Care From Research, Practice, Policy And Industry Perspectives. Int J Evid Based Health 2020; 9(1):3-24.

41. **Awad, L.A., Elghadban, F.E., & El-Adham, N.A. (2019):** Effect of an Intervention Program on

Improving Knowledge and Self-Care Practices for Diabetic School-Age Children. American Journal of Nursing. Feb 16; 7(2):199-207.

42. **Bernier, A., Fedele, D., Guo, Y., Chavez, S., Smith, M.D., Warnick, J., Lieberman, L., & Modave, F. (2020):** New-Onset Diabetes Educator To Educate Children And Their Caregivers About Diabetes At The Time Of Diagnosis: Usability Study. JMIR Diabetes. 3(2):E10.

43. **Rdena, G., Paz-Pacheco, E., Jimeno, C., Lantion-Ang, F., & Paterno E. (2021):** Knowledge, Attitudes and Practices of Persons with Type 2 Diabetes in a Rural Community: Phase I of the Communitybased Diabetes Self-Management Education (DSME) Program in San Juan, Batangas, Philippines. Diabetes Res Clin Pract; 90 (2):160–6.

44. **Dinesh, K., Palaian, S., Ravi, S., Mishra, P. (2022):** Knowledge, Attitude and Practice about Diabetes among Diabetic Patients in Western Nepal. Rawal Medical Journal; 33(1): 8 – 11.

45. **Kazemi, S., Parvizy, S., Atlasi, R., & Baradaran, H.R. (2019):** Evaluating The Effectiveness Of Peer-Based Intervention In Managing Type I Diabetes Mellitus Among Children And Adolescents: A Systematic Review. Med J Islam Repub Iran 30:442

46. **Colson S, Côté J, Gentile S, Hamel V, Sapuppo C, Ramirez-Garcia P, Et Al. (2020):** An Integrative Review Of The Quality And Outcomes Of Diabetes Education Programs For Children And Adolescents. Diabetes Educ 42: 549–584.

47. **Miller, K.M., Beck, R.W., & Bergenstal, R, M. (2020):** T1D Exchange Clinic Network. Evidence of a Strong Association between Frequency of Self-Monitoring Of Blood Glucose and Hemoglobin A1c Levels in T1D Exchange Clinic Registry Participants. Diabetes Care; 36.

48. **Liu, Y., Han, Y., Shi, J., Li, R., Li, S., & Jin, N. (2022):** Effect Of Peer Education on Self-Management and Psychological Status in Type 2 Diabetes Patients with Emotional Disorders. J Diabetes Investig.;6(4):479-86.Https://Doi.Org/10.1111/Jdi.12311 Pmid:26221528

49. **Ghafoor, E., Riaz, M., Eichorst, B., Fawwad, A, & Dan Basit, A. (2019):** Evaluation of Diabetes Conversation Maptm Education Tools for Diabetes Self-Management Education. Diabetes Spectr. 28(4):230-235. Https://Doi.Org/10.2337/Diaspect.28.4.230 Pmid:26600723

50. **Powers, M.A., Bardsley, J., Cypress, M., Duker, P., Funnell, M.M, & Fischl,A.H. (2021):** Diabetes Self-Management Education And Support In Type 2 Diabetes: A Joint Position Statement Of The American Diabetes Association, The American Association Of Diabetes Educators, And The Academy Of Nutrition And Dietetics. Diabetes Care. 38(7):1372-82. Https://Doi.Org/10.2337/Dc15-0730 Pmid:26048904