

The Effect of Applying Biopsychosocial Model on Parent's Self Efficacy and Coping Strategies of Children with Diabetes mellitus

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Abstract: Background, Diabetes Mellitus has very serious complications among children and adolescents worldwide. Management of Type 1 Diabetes (T1D) carries numerous challenges, especially for young children and their families. So, the application of the biopsychosocial model was suggested to help in comprehensive diabetes care. The purpose of this study was to assess the effect of the biopsychosocial model on parents' self-efficacy and coping strategies among children with type 1 Diabetes Mellitus. A quasi-experimental research design was used (pre, post, and follow-up tests). The setting, this study was led in private Out-Patient Clinics. Sample, a purposive sample of 60 diabetic children with (type 1 diabetes) and their parents were involved. Three instruments were used: I- structured interviewing questionnaire including (characteristics of children and their parents), Adjustment of children, children's adherence to a diabetes regimen, and parents' knowledge. II- Children's coping strategies inventory. III- Parents' self-efficacy Likert Scale. The results showed that 43.3% and 78.3% of parents had a higher level of knowledge about diabetes and its complications on the post and follow-up tests (respectively) than 13.3% on the pre-test. As well, children had a moderate level of coping on post-test and follow-up. Also, the findings revealed that 86.7% of parents of the studied children had a high level of self-efficacy on post-test and follow-up tests compared to 55.0 % on the pre-test. The study concluded that the implementation of the biopsychosocial model had an important effect on parents' self-efficacy and coping strategies among children with type 1 diabetes mellitus. So, it was recommended that the Biopsychosocial health education model must be applied in all pediatrics departments and pediatric intensive care units to improve the quality of care provided for children having diabetes.

Keywords: Diabetes Mellitus, Coping strategies, Self-efficacy, Biopsychosocial model, Children and Parents

Introduction

Type 1 diabetes (T1D) is one of the most common chronic diseases in

children and adolescents worldwide. Treatment of Type 1 Diabetes (T1D)

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positions several challenges, specifically for young children and their families. Parental care positively impacts the outcomes of children with T1D (Schiaffini et al., 2020). The incidence of type 1 diabetes mellitus (T1DM) enlarged worldwide. Previous studies documented the greatest increase in children aged less than 6 years. The EuroDiab study displayed an annual increase of 3.4% in T1D between 1989 and 2013 among children aged less than 14 years. In the United States, it reported an increase in the annual incidence of 1.8% between 2002 and 2012 (Nevo-Shenker et al., 2020).

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 1 diabetes (T1D) is one of the most common chronic diseases in infancy and the most frequent endocrinopathy in childhood (Schiaffini 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).

The acute manifestations are those related to hyperglycemia which exceeds the renal threshold to result in polyuria, increased thirst, dehydration, electrolyte disturbances, weight loss, and metabolic decompensation, in a dangerous degree known as diabetic ketoacidosis and non-ketotic hyperosmolar coma. The chronic complications include macrovascular (CAD, CVD, amputations) and microvascular (retinopathy, nephropathy, and neuropathy) lesions (Yau, 2021).

Accurate treatment of T1D encompasses frequent blood glucose monitoring, insulin therapy, dietary modifications, and structured physical activity, demonstrating a high burden on young children and their families (Schiaffini et al., 2020). Very young children necessitate only small amounts of insulin owing to their high insulin sensitivity and low body weight. However, several behavioral and developmental factors pertinent to this age group may obstruct the attainment of glycemic control targets (Nevo-Shenker et al., 2020).

Psychosocial factors have been displayed to play a role in both its etiopathogenesis and in disease control. However, recent research has highlighted the importance of directionality in the relationship between T1D and psychosocial well-being. Stressful life events are related to the onset and the progress of T1D in various studies (Turin, 2021).

In the very young age group, it is very important to the parents/caregivers to manage the disease. Obstacles to good control include parental stress, parental guilt that the child is “missing out” on normal age-appropriate activities and has to deal with a chronic illness, and especially, parental fear of hypoglycemia (Nevo-Shenker et al., 2020). Young children depend highly on their parents for disease control and stress regulation. On the other hand, older children and adolescents transition from merely depending on their parents to achieving more independence and autonomy in stress regulation and disease management (Turin, 2021).

Parents play a significant role in the treatment and supervising their children's type 1 diabetes mellitus (T1DM), The ongoing management of T1DM can also be tremendously challenging for parents, as demanding family support for both the physical

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and psychological care of the children. Moreover, parental self-efficacy permits them to overcome the stressors and challenges related to diabetes, thus facilitating better treatment of the children T1DM. Indeed, parents with satisfactorily high self-efficacy can use it to buffer the often-reported high levels of stress, surrounding a disease such as T1DM (Bassi et al., 2021).

Thus, the coping strategies used to manage diabetes play vital roles in the maintenance and psychosocial adjustment to diabetes. Traditionally, two main concepts of coping dimensions have been considered, including a problem-focused coping dimension (making a plan of action) and an emotion-focused coping dimension (seeking emotional support). Problem-focused coping is related to better metabolic control, emotional status, and overall adjustment in patients with diabetes, whereas emotion-focused coping is related to poor adjustment and adherence to health regimens in chronically ill patients (Murakami et al., 2020). Indeed, the implementation of the biopsychosocial model intervention was proposed to help in comprehensive diabetes management.

Purpose

The purpose of this study was to assess the effect of the Biopsychosocial model on parents' self-efficacy and coping strategies among children with type 1 Diabetes Mellitus.

Research Hypotheses

The following Research Hypotheses are expressed to accomplish the purpose of the study:

- Children with type (1) Diabetes Mellitus who receive the Biopsychosocial intervention model will have better biological, psychological, and social coping

strategies on post-test than on pre-test.

- Parents of children with type (1) Diabetes Mellitus who receive the Biopsychosocial intervention model will have higher self-efficacy for disease management on post-test than on pre-test.

Methods

This section illustrates the research design, setting, sampling technique, data collection instruments, data collection procedures, pilot study, and data analysis.

1. Research design:

A Quasi-experimental design (pre-test, post-test, and follow-up) was employed for this study.

2. Research Settings

This study was performed at private Out-Patient Clinics for diabetic children.

3. Sampling:

A purposive sample of 60 diabetic children with type 1 diabetes and their parents who agreed to share in the study and met the criteria of sample selection were included.

Criteria for inclusion:

- Children should have type 1 diabetes and be free from any other chronic health problems.
- Children should range from 6-to 12 years old

4. Instruments

To achieve the purpose of the study, three instruments were utilized for data collection.

Instrument one: A Structured Interview Questionnaire:

It was developed by La Clare, 2013 and adopted by the researchers after permission. It is employed to collect data about children and their parents to

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study the effect of type 1 diabetes on the adjustment of children and their parents and to assess the level of children's adherence to Diabetes regimen It includes three parts:

Part one: Characteristics of children and their parents. It contains:

Part one: Characteristics of children and their parents. It contains:

- A. Characteristic of children with type 1 diabetes: such as age, sex, duration since diagnosis, and weight of children.
- B. Parents' characteristics: It encompasses parents' age, marital status, and level of education, job, and family income.
- C. Parent's knowledge about diabetes: it includes 6 questions what is the meaning of diabetes? What are the manifestations of diabetes? What are the sites of insulin administration? And how can you measure blood glucose levels for your children?

Scoring system:

A scoring system was followed to evaluate Diabetic children and their parent's knowledge about diabetes according to a structured interview questionnaire.

It contains 6 questions and has three-points scores. Score zero was given for incorrect answers while scoring one was provided for the correct but incomplete answer and two was provided for the correct answer.

Total score =12

It was classified into three categories :

- Poor knowledge ≥ 6
- Fair knowledge $7 \geq 9$
- Good knowledge $10 \geq 12$

Part two: Adjustment of children and their parents to diabetes: It contains five open-ended questions to evaluate adjustment of affected children and their parents to type1 diabetes such as I follow instructions while taking insulin, I eat a healthy balanced diet according to the doctor's instruction, I do regular foot care and follow all steps, I play sports and permitted activities and Regular attend to school and participate in students' activities

Scoring system:

A scoring system was followed to evaluate the adjustment of children and their parents to diabetes according to the adjustment questionnaire. The questionnaire covers 5 questions. It has three-point scores. Score one was given for never while scoring two to some extent and score three for always.

Total score =15

It was classified into two categories :

- Poor adjustment ≥ 7
- Good adjustment $8 \geq 15$

Part three: Children's Adherence to diabetes regimen: It incorporates fourteen questions to evaluate diet regimen adherence by children under the effect of their parents such as I visit the doctor regularly according to the follow-up dates , I eat meals and refreshments regularly according to the instruction , I eat a balanced diet using the food change menu ,I eat food that contains fiber such as grain vegetables and fruit daily ,I reduce my intake of salt and processed food , I measure sugar according to the doctor instruction, I check my blood sugar frequently when I experience symptoms of hypoglycemia like a shiver and headache ,I try to keep sugar level in normal range ,I control the amount of meals exercise according to blood sugar level , carry foods such as sweet , sweet drinks

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chocolate for hypoglycemia , maintain the ideal weight by measuring the weight continuously, I carry an insulin ,pen and diabetes when I go to short trip, try to learn about blood sugar control by attending educational program on sugar and I take diabetes medication such as insulin regularly following the dose and time .

Scoring system:

A scoring system was followed to evaluate Children's Adherence to Diabetes regimen according to the diabetic regimen adherence questionnaire. The questionnaire contained 14 questions. it has three-point scores. Score one was given to never while scoring two to some extent and score three for always.

Total score =42

It was clarified into two categories :

- Poor adherence ≥ 21
- Good adherence $22 \geq 42$

Instrument two: Children's Coping Strategies Inventory.

It was developed by Rosenstein and Keefe, 1983 for children and adolescents that were adopted by the researchers after permission. It includes 17-items self-report instrument to evaluate the frequency and effectiveness of coping strategies used by children and adolescents in response to stressful events such as always thinking about things make me happy , I do things that make me happier like watching tv and music , try to think of positive and funny things , deal as I was not a diabetic companion , don't care about diabetes in my life , I always say to myself that diabetes should not affect my enjoyment of my life , I always adapt to any diabetes complication , I cry a lot and prefer isolation and not go to school , I ignore the presence of

diabetes in my life , I practice daily activities and sports normally , I feel unable to continues adapting with diabetes , I have constant anxiety about that diabetes is chronic and doesn't ending , I feel that my diabetes never gets better , I hope that diabetes ending forever , I have confidence in god and god healing , I tell myself I can control and continues with diabetes and I always take with my friends about diabetes as normal for me I can cope with it .

Scoring system:

A scoring system was followed to measure Children's Coping to Diabetes according to the Children's Coping Strategies Inventory. The Inventory was contained 17 questions. It has five-point scores. Score one was given to Never while scoring two to rarely, scoring three to Sometimes, while score four to Often and score five to very often. According to the positive or negative answers of children.

Total score = 135

It was clarified into three categories :

- Low coping ≥ 67
- Moderate coping $68 \geq 99$
- High coping $100 \geq 135$

Instrument three: Parent's Self-Efficacy Likert Scale. It was developed by Ralf & Matthias, 1993 and adopted by the researchers after permission. It involves eight items to evaluate parents' level of self-efficacy regarding the management of diabetes. As I found difficult when dealing with diabetes, I feel fail when I try to solve the problem my child was exposed, take care of my baby and find happiness in it, I feel success when trying to solve any problem he faces, I am carefully the doctor order, be sure to monitor my child condition constantly, I can safely answer my

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child questions about his illness, make sure to improve my child condition mentally and physically and satisfied with my concern and care of my child condition

Scoring system :

A scoring system was followed to assess Parent's Self-Efficacy to Diabetes according to Parent's Self-Efficacy Likert Scale. The Scale contains 8 questions. It has a three-point. Score one was given to disagree while scoring two for Natural and score three for Agree. According to the positive or negative answers of parents.

Total score = 16

It was clarified into two categories :

- Low self-efficacy ≥ 8
- High self-efficacy $9 \geq 16$

4. Reliability:

Reliability of the study instruments was estimated among 10 participants by applying a test-retest method with two weeks apart between them. Then Cronbach's alpha was calculated between the two scores. It was 0.78 which indicates that the instruments were reliable to meet the objectives of the study.

5 .Validity:

For validity assurance, the instruments were submitted to a jury of five experts involving four professors of pediatric nursing, and one professor of pediatrics to evaluate content validity and modify any mandatory items of the instruments. All required modifications were done.

6 .Ethical Consideration:

- Written approval was taken from the ethical research committee of the Faculty of Nursing, Menoufia University.

- Verbal and written consent was taken from the parents of the children.
- The initial interview was conducted with the parents and their children to inform them about the purpose, procedure, and benefits of the study. All participants were told that their participation in the study is voluntary, and they can leave at any time without penalty.
- Privacy and anonymity of parents and children were reassured through coding all data and putting all sheets in a closed cabinet.
- Instruments were fulfilled by participants themselves (instruments 2,3) or through personal interviews (instrument 1) and they were told that the study doesn't cause any physical or emotional harm to them

7 .Pilot study:

It was conducted on 6 children and their parents (10% of the sample) after the instruments were established and before beginning the data collection to test the feasibility, pertinency and to estimate the needed time for data collection. No necessary modifications were done. Therefore, all participants were involved in the total sample.

8 .Procedure:

Before data collection, written permission to perform the study was obtained from the Directors of the outpatient clinics of diabetes after submitting an official letter from the Dean of the Faculty of Nursing at Menoufia University explaining the purpose of the study and methods of data collection. Data collection for this

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study was performed from November 2020 to the end of January 2021. The investigator introduced herself to the children and their parents, who participated in the study, described the purpose of the study, methods of data collection, and the expected outcomes of the study.

The general objective of the biopsychosocial model:

Providing the bio-psycho-social model intervention for children with diabetes and their parents helps in maintaining children's blood sugar at a normal range.

Specific objectives:

1. Identify biological, social, and psychological factors of children with diabetes and how these affect them.
2. Provide bio-psycho-social care for children with diabetes to improve children coping, adjustment, and adherence to the diabetic regimen.
3. Involve parents in the intervention to improve parents' self-efficacy and their children's coping strategies.

Assessment phase:

The structured interview questionnaire was distributed to all participants to collect the data using these instruments. Characteristics of children and their parents and Parent's knowledge about diabetes were assessed using a structured interview questionnaire part one (pre-test), Also assessment of the adjustment of children and their parents to Diabetes was done using a structured interview questionnaire part two (pre-test). Evaluation of Children's Adherence to Diabetes was done using part three (pre-test). Evaluation of children's

coping strategies in response to stressful events induced by diabetes was performed using the Children's Coping Strategies Inventory (instrument 2). Finally, evaluation of the self-efficacy of parents was done by using the Parent self-efficacy Likert scale (instrument 3).

Planning phase:

This phase includes analysis of the assessment phase (pre-test) findings, and the researchers identify the actual needs of the studied children and their parents, set a program to meet all needs of children and their parents depending on all domains of the biopsychosocial intervention model, detect the number of sessions required and time of each session, choosing appropriate topics and methods of teaching and learning for each session and finally select a suitable place for sessions.

Implementing phase :

Children and their parents were divided into ten groups. Each group contains 6 children and their parents. A Bio-psycho-social intervention model was applied to parents and their children in four sessions of intervention. Two sessions were performed per week. Sessions involve oral presentations, small group discussions, feedback, about the nature of the disease, and its proper management based on the Biopsychosocial intervention model. Booklets and scientific brochures were provided. All precautionary actions against the COVID-19 pandemic were taken such as (Wearing masks - spacing distances - using hand sanitizers - reducing the number of groups from 10 to 6 participants within the group)

- The first Session contained theoretical knowledge about the

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nature of the disease and its proper management. Also, insulin administration techniques such as (site, route, and appropriate dose). Social support was provided (peers and family interactions were included). The session lasted for one hour with a break. It was illustrated by using oral presentations, small group discussions, role-play, feedback, booklet, and mannequin for demonstration/ re-demonstration of insulin administration for older children and their parents

- The second session included health education about diet regimen, appropriate exercise, foot care, and eating difficulties. It lasted one hour with a break. It was illustrated by using oral presentations, small group discussions, role-play, feedback, and demonstration/ re-demonstration. using expressive painting
- The third session included issues concerning the proper utilization of stress management techniques and the promotion of coping strategies of children. It lasted for one hour with a break. It was illustrated by using oral presentations, small group discussions, feedback, booklet, and puppet theater
- The fourth session was concerned with the enhancement of parents' self-efficacy. It lasted for an hour with a break. It was illustrated by utilizing an oral presentation, small group discussions, feedback, booklet, and scientific brochures

Evaluation phase:

An immediate post-test was done after completion of the program to:

- Reassessment of the adjustment of children and their parents to Diabetes was done using a structured interview questionnaire part two (post-test).
- Reassessment of Children's Adherence to Diabetes was done using part three (post-test).
- Reassessment of children's coping strategies in response to stressful events produced by diabetes was done using the Children's Coping Strategies Inventory (post-test).
- Reassessment of the self-efficacy of parents was done by using the Parent self-efficacy Likert scale(post-test).

A comprehensive revision session about diabetes treatment, adjustment, promotion of children coping strategies based on of Bio-psychosocial model was applied. After three months, a follow-up test was applied for children and their parents to ensure adherence to the intervention program based on utilization of the Bio-psychosocial model by using the study instruments employed in the pre-test, post-test, and follow-up.

10 -Statistical Analysis:

The data collected were tabulated and analyzed by SPSS (statistical package for the social science software) statistical package version 22 on IBM compatible computer. Graphics were accomplished using the Excel program.

Two types of statistics were done:

1) Descriptive statistics:

Were expressed as mean and standard deviation (X+SD) for quantitative data or number and

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percentage (No & %) for qualitative data.

2) Analytic statistics:

Repeated-Measures ANOVA: is a test of significance used when we had a single line of data for each participant, with the repeated measures entered as separate variables on that same line (used for comparison between more than two related groups of normally distributed quantitative variables).

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.

Results:

Table (1) Shows that 51.7% of children ranged from the age group 6 < 9 years with a mean age $1.78 \pm 8,817$. Regarding the gender of studied children, 58.3% of studied children were females. Concerning the duration of diabetes, 40.0% of studied children had diabetes for more than 5 years. Regarding the weight of children, 48.3% of children weigh 30 < 40 kg.

Table (2) shows that 80.0% of parents were 20 < 40 years old. Regarding the social status of parents, 85.0% of them were married. Concerning parents' level of education, only 8.3% were illiterate. Regarding parents' jobs, 35.0% of the studies were unworked. Concerning the care provider, 51.7% of studied parents were providing care together (father and mother). About parents' family history of diabetes,

41.7% of studied parents had diabetes. Regarding the presence of diabetes in parents, 13.3% of them had diabetes and 62.5% were fathers. Regarding consanguinity between fathers and mothers of children, 86.7% of parents haven't any consanguinity. Concerning parents' awareness about diabetes, 23.3% of parents had some awareness about diabetes.

Table (3) the findings revealed that most parents had a better level of knowledge about diabetes and its complications on the post and follow-up tests than on pre-test. Therefore, there were highly statistically significant differences regarding levels of parents' knowledge on pre, post, and follow-up tests ($P < 0.0001$).

Table (4) displays that most children had a good adjustment to diabetes on post-test compared to pre and follow-up tests (70.0%, 33.3%, and 93.3%) respectively. Therefore, there were highly statistically significant differences between pre, post, and follow-up tests ($P < 0.001$).

Table (5) the findings revealed that most children had good adherence to diabetes on the post-test and follow up compared to pre-test (88.3%, 91.7% & 66.7%) respectively. Therefore, there were highly statistically significant differences between pre-test, post-test, and follow-up regarding children's adjustment ($P < 0.001$).

Table (6) the findings revealed that 78.3% of children had Moderate coping levels on post-test compared to pre-test (70.0%) respectively. Also, 41.7% of children had a high coping level on follow-up compared to pre-test (0.0%) respectively, Therefore, there were highly statistically significant differences between pre, post and follow up tests concerning levels of Coping strategies ($P < 0.0001$).

Table (7) displays levels of parents' self-efficacy in the pre-test, post-test, and follow-up tests. The results

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revealed that the parents of the children had a high level of self-efficacy on the post-test and follow-up test compared to the pre-test (86.7%, & 86.7%,55.0%) respectively. There were highly statistically significant differences between pre and post-tests (P<0.001).

Figure (1) showed the correlation between the Total score of parents' self-efficacy and the total score of parents' knowledge. It reflected that there was a positive correlation between the Total score of Parent Self - efficacy and the total score of parent's knowledge.

Figure (2) revealed the effect size of the Bio-psychosocial program on

children coping, children adjustment, and children adherence to the diabetic regimen on pre, post, and follow-up tests. There was a moderate effect size regarding children's adjustment to diabetes and children's adherence to diabetes regimen. However, a large effect size was found on children's coping with Diabetes.

Figure (3) showed the effect size of the Bio-psychosocial program on parents' knowledge and parents' self-efficacy on pre, post, and follow-up tests. There was a moderate effect size of the Bio-psychosocial program regarding parents' knowledge and a small effect size on parents' self-efficacy.

Table (1) Distribution of studied children according to their characteristics

Items	No (n=60)	%
Age group		
6<9	31	51.7
9≤12	29	48.3
Age		
M±SD	1.78 ±	8,817
Sex		
Male	25	41.7
Female	35	58.3
Duration of diabetes		
<5years	36	60.0
>5years	24	40.0
Weight		
20<30kg	27	45.0
30<40kg	29	48.3
>40 kg	4	6.7
Total	60	100

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Table (2) Characteristic of parents of studied children

Items	No(n=60)		%
Parents age groups			
20<40 years	48		80.0
40<60 years	12		20.0
Social Statues			
Married	51		85.0
Widower	7		11.7
Divorced	2		3.3
Level of education			
Illiterate	5		8.3
Primary education	13		21.7
High school	11		18.3
University	31		51.7
Job			
Worked	39		65.0
Unworked	21		35.0
Care providers			
Mother	29		48.3
Together Father and mother.	31		51.7
Income			
Average	44		73.3
Low	16		26.7
Family history of diabetes			
Yes	25		41.7
No	35		58.3
Does the mother or father suffers from diabetes			
Yes	8		13.3
No	52		86.7
If yes who			
Mother	3		37.5
Father	5		62.5
Is there consanguinity between mothers and fathers			
Yes	8		13.3
No	52		86.7
Have you ever taken any awareness about diabetes			
Yes	14		23.3
No	46		76.7
Total	60		100

Table (3) Levels of parents' knowledge about diabetes on pre, post and follow up tests

Items	Pre(n=60)		Post(n=60)		Follow up(n=60)		X² P1 –value	X² P2 –value
	No	%	No	%	No	%		
levels of knowledge								
Poor knowledge	19	31.7%	8	13.3%	0	0.0%	14.84 ^{HS} P<0.001	18.37 ^{HS} P<0.001
Fair knowledge	33	55.0%	26	43.3%	13	21.7%		
Good knowledge	8	13.3%	26	43.3%	47	78.3%		

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Table (4) Levels of adjustment to diabetes on pre, post and follow up tests

Items	Pre(n=60)		Post(n=60)		Follow up(n=60)		X ² P1 –value	X ² P2 –value
	No	%	No	%	No	%		
levels of Adjustment of children and their parents to Diabetes								
Poor adjustment	40	66.7%	18	30.0%	4	6.7%	16.15 ^{HS}	10.90 ^{HS}
Good adjustment	20	33.3%	42	70.0%	56	93.3%	<i>P<0.001</i>	<i>P<0.001</i>

Table (5) Levels of children regimen adherence of diabetes in pre, post and follow up tests.

Items	Pre (n=60)		Post(n=60)		Follow up(n=60)		X ² P1 –value	X ² P2 –value
	No	%	No	%	No	%		
levels of adherence								
poor adherence	20	33.3%	7	11.7%	5	8.3%	8.07 ^S	.37 ^{NS}
good adherence	40	66.7%	53	88.3%	55	91.7%	.004	.543

Table (6) Levels of coping strategies among studied children with on pre, post, and follow up tests

Items	Pre (n=60)		Post (n=60)		Follow up(n=60)		X ² ₁ and P1 –value	X ² ₂ and P2 –value
	No	%	No	%	No	%		
Low coping	18	30.0%	9	15.0%	0	0.0%	7.28 ^S .026	25.96 ^{HS} <i>P<0.001</i>
Moderate coping	42	70.0%	47	78.3%	35	58.3%		
High coping	0	0.0%	4	6.7%	25	41.7%		

Table (7) Levels of parent's self-efficacy on pre, post and follow up tests

Items	Pre(n=60)		Post(n=60)		Follow up(n=60)		X ² ₁ and P1–value	X ² ₂ and P2 –value
	No	%	No	%	No	%		
Low self-efficacy	27	45.0%	8	13.3%	8	13.3%	14.56 ^{HS}	.000 ^{Ns}
High self-efficacy	33	55.0%	52	86.7%	52	86.7%	<i>P<0.001</i>	1.000

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Figure (1) Pearson correlation between the total mean score of parent's self-efficacy and the total mean score of their knowledge

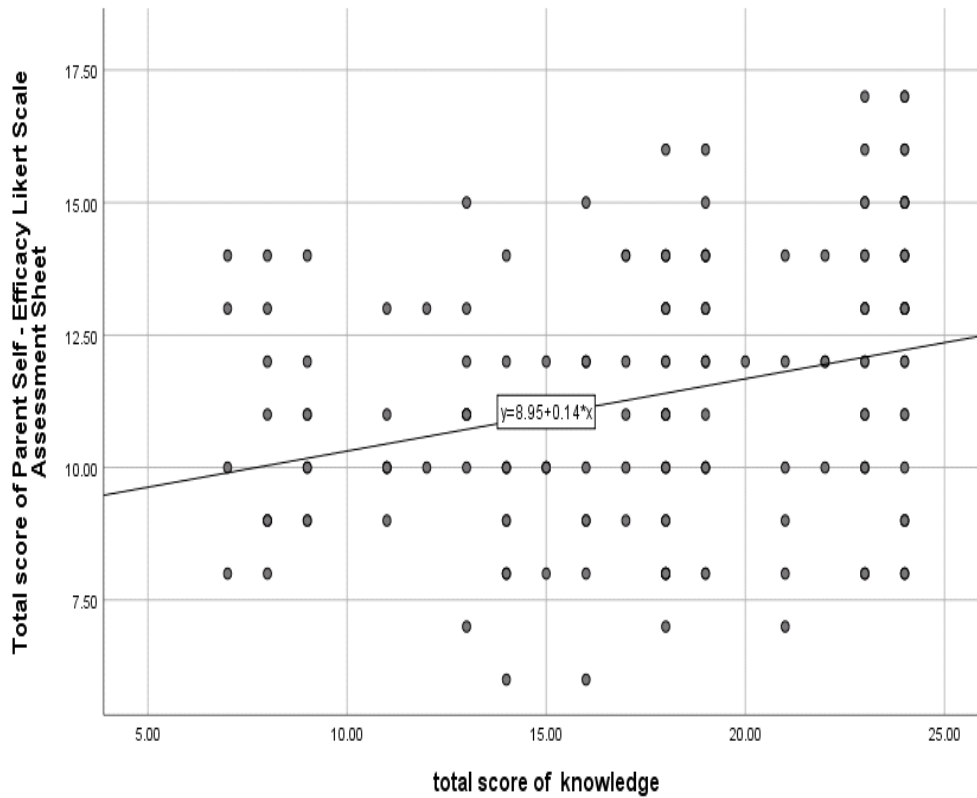
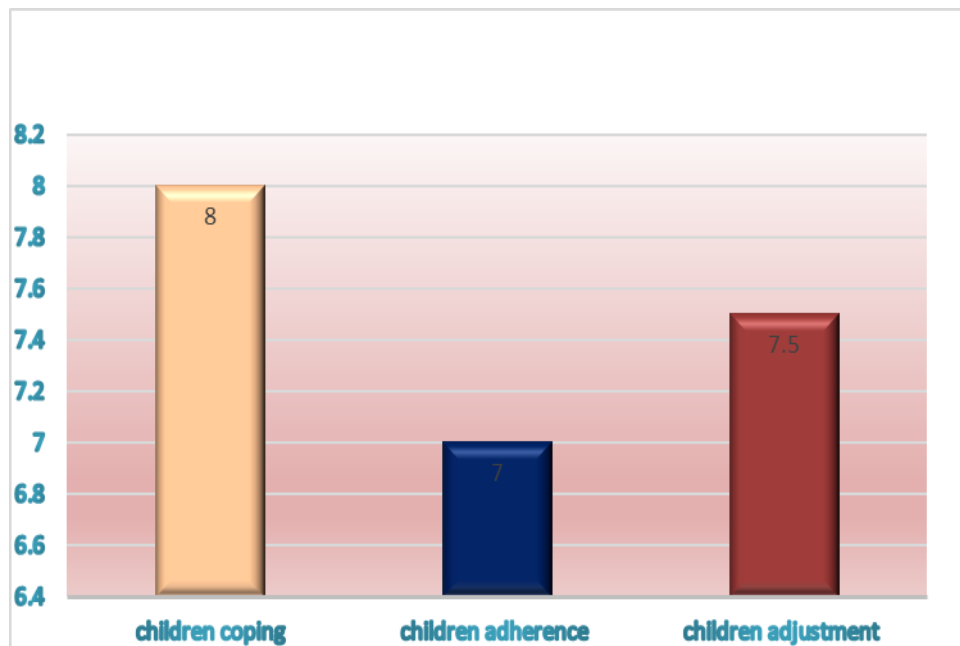
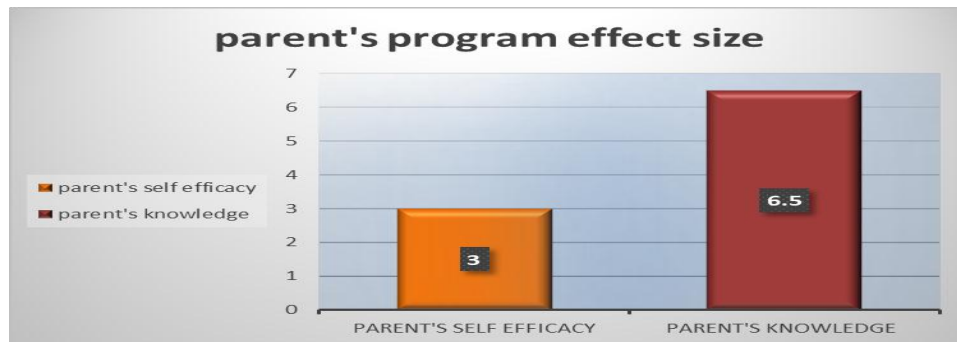


Figure (2) Effect size of the Bio-psychosocial program on children coping, children adjustment, and children adherence to the diabetic regimen on pre, post, and follow-up tests.



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Figure (3) Effect size of the Bio-psychosocial program on parents' knowledge and parents' self-efficacy on pre, post, and follow-up tests.



Discussion

Insulin-dependent diabetes mellitus (type 1 diabetes) is a chronic, life-threatening condition necessitating intensive disease management, behaviors change, and permanent family support. Therefore, it is not unexpected that the diagnosis of type 1 diabetes in children can have a harmful psychological influence on the families. Past studies have revealed that in the period immediately following diagnosis, parents may suffer grief, depression, anxiety, stress, and posttraumatic stress disorder. Children have also displayed evidence of psychological symptoms at diabetes onset, such as depression and other adjustment problems (Smith et al., 2018). The American Diabetes Association recently released a position statement highlighting the importance of psychosocial care for people with diabetes (Ndahura et al., 2021).

As, the crucial goal in treating children and adolescents with type 1 diabetes mellitus (T1DM) is to accomplish optimal glycemic control, avoiding acute, and long-term complications, without compromising age-appropriate development and health-related quality of life (HRQOL) (Mueller et al., 2018). The current study assumed that children with type 1 diabetes mellitus who will receive the bio-psychosocial

model intervention will have better biological, psychological, and coping strategies on post-test than on pre-test. Also, Parents of children with type 1 diabetes mellitus who will receive bio-psychosocial intervention model will have better self-efficacy for disease management on post-test than on pre-test.

Regarding Parents' Knowledge about Diabetes of their children, the current study showed that parents had a better level of knowledge concerning diabetes on the post-test than on the pre-test. This result was consistent with Iversen et al., (2018) who observed that there was a significant difference between parents' knowledge after program implementation than before program regarding diabetes, complications, and management. **From the investigator's point of view parents' knowledge increased due to providing health education about diabetes and its management and facilitating communication with parents as we use online sessions and online communication.**

Concerning hypothesis one: "Children who utilized biopsychosocial model will have good adherence to diet and treatment regimen on the post and follow up tests than on pre-test".

The present study clarified that there was a significant improvement in

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children's adjustment to diabetes, which means that studied children had a higher level of adjustment related to diabetes on the post-test than on the pre-test. This finding was in line with an agreement with Helgeson, (2018) who found that enhancing coping strategies helped in the improvement of adjustment to diabetes. **In the researcher's opinion**, these results can be associated with the effectiveness of social and psychological support. In addition, Neu et al., (2019) conducted a study about "Diagnosis, Therapy, and Follow-Up of Diabetes Mellitus in Children and Adolescents" They support these findings.

In the same context, Decosta, (2020) reported that providing psychosocial support improved children's adjustment.

The present study clarified that there was a significant improvement in children's regimen adherence to diabetes diet and treatment on the post and follow-up tests than on pre-test. This result was consistent in line with Kyokunzire, (2018) who revealed that children who have high biological and social status also have good adjustment.

In addition, Mfilb, (2020) found that improving biological, psychological, and social factors lead to improving a child's regimen adherence to diabetes. **In the researcher's opinion**, this could be related to the effect of the Biopsychosocial educational program on diabetic children that provide emphasis on biological, psychological, and social aspects of child care which in turn reflect on their adherence to the treatment regimen.

Although, The study result was not consistent with Ndahura, (2021) who reported poor adherence of children to the diabetic regimen. **From the investigator's point of view**, the improvement of children's adherence to diabetes is related to building

confidence between children and researchers, using small group discussion and selecting attractive methods of teaching, and continuous online follow-up of children.

Concerning children coping with diabetes on pre, post, and follow-up tests, this study illustrated that there was a significant improvement in the coping of children to diabetes on the post and follow up tests than on pre-program. This finding was consistent with Edraki, (2018) who showed that children had higher coping and higher self-efficacy after the intervention.

In the same context, Wisting, (2021) found that the majority of children had a high level of coping with diabetes immediately after the enhancement of their coping strategies.

In addition, this result comes in a line of agreement with, Scarton, (2021) who showed that there was a strong relationship between psychosocial factors, quality of life, and coping strategies of children with diabetes. From the investigator's point of view, children coping strategies improved related to educating them about how to utilize coping strategies in their life.

he present study showed that there was a negative correlation between children's weight and their regimen adherence to Diabetes. This result was constant with Settineri et al., (2019) who revealed that increased weight of children with diabetes leads to poor regimen adherence.

Concerning hypothesis two: "Parent who received Biopsychosocial model will have highly self-efficacy on the post and follow up tests than on pre-test".

The present study clarified that there was a significant improvement in the self-efficacy of parents to diabetes on the post and follow up tests than on pre-intervention. This result was in line with Thorsteinsson et al., (2017) who found that Self-efficacy and social

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support were significant predictors of quality of life which were achieved by improvement of parents' coping strategies.

In the same context, Etminan, (2021) reported that providing social, psychological, and physical support improved parents' self-efficacy and ability to care for their children.

In addition, Arwen et al., (2021) reported that providing social, psychological support and diabetic education leads to improving parents' quality of care. **This result may be rationalized** to the effectiveness of the health education sessions regarding diabetes care, proper management, the best methods to deal with diabetic children, and the significant improvement in children coping strategies based on the application of the Bio-psychosocial model.

Regarding the effect size of the Biopsychosocial model on children's coping strategies and their parent's self-efficacy, the present study showed that the biopsychosocial model had a significant influence on children's coping strategies (<0.8) and a moderate effect on their parent's self-efficacy (< 0.5) after implementation of Biopsychosocial model. This finding was consistent with Iversen et al., (2018) who showed that children have high coping levels after receiving the intervention.

Also, these results were in a line with Arwen et al., (2021) who revealed that 89% of children have an enhancement in their coping level and their parents have great self-efficacy after receiving the intervention.

This could be related to the effect of the Biopsychosocial model implementation which had a better effect in enhancing children's coping strategies and their parent's self-efficacy. So, the suggested research hypotheses of the current study were accepted.

Conclusion

Based on the findings of the current study, it was determined that applying Bio -the psychosocial model improved parents' self-efficacy and coping strategies of children with type 1 Diabetes Mellitus. Also, it contributed to higher levels of knowledge about diabetes and its management in studied parents.

Recommendations

Based on the conclusion of the current study, the following recommendations can be proposed:

- The biopsychosocial model must be applied in diabetes management in outpatient clinics and care centers of diabetes.
- All parents of children with diabetes should be provided with the required supplies to employ the appropriate up-to-date care for children with diabetes e.g., “digital or electronic blood sugar measurement machine”
- A standardized Biopsychosocial model for children with diabetes should be integrated into the pediatric nursing curriculum.
- Further studies should be implemented on a larger sample of children and their parents in other pediatric departments to ensure the generalizability of the results.

References

- Arwen, Marker, A. M., Monzon, A. D., Goggin, K., Clements, M. A., & Patton, S. R. (2021). Parent Perspectives on Educational and Psychosocial Intervention for Recent-Onset Type 1 Diabetes in Their School-Age Child: A Qualitative Study. *Diabetes Spectrum*, 34(2), 166-174
- Bassi, G., Mancinelli, E., Di Riso, D., & Salcuni, S. (2021). Parental Stress, Anxiety and Depression Symptoms Associated with Self-Efficacy in Paediatric Type 1 Diabetes: A Literature Review.

The Effect of Applying Biopsychosocial Model on Parent's Self Efficacy and Coping Strategies of Children with Diabetes mellitus

- International Journal of Environmental Research and Public Health, 18(1), 152.
- DeCosta, P., Grabowski, D., & Skinner, T. C. (2020). The psychosocial experience and needs of children newly diagnosed with type 1 diabetes from their own perspective: a systematic and narrative review. *Diabetic Medicine*, 37(10), 1640-1652.
- Edraki, M., Zarei, A., Soltanian, M., & Moravej, H. (2018). The Effect of Peer Education on Self-Care Behaviors and the Mean of Glycosylated Hemoglobin in Adolescents with Type 1 Diabetes: A Randomized Controlled Clinical Trial. *International Journal of Community Based Nursing and Midwifery*, 8(3), 209.
- Etminan, F. S., Alizadeh, K. H., & Samavi, S. A. W. (2021). The relationship between emotional self-efficacy, sensation seeking, and the quality of child-parent relationships with quality of life mediated by high-risk sexual behaviors in students. *International Clinical Neurosciences Journal*, 8(2), 90-95.
- Helgeson, V. S., Berg, C. A., Kelly, C. S., Van Vleet, M., Zajdel, M., Tracy, E. L., & Litchman, M. L. (2019). Patient and partner illness appraisals and health among adults with type 1 diabetes. *Journal of behavioral medicine*, 42(3), 480-492.
- Iversen, A. S., Graue, M., Haugstvedt, A., & Råheim, M. (2018). 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*, 13(1), 1487758.
- Katsarou, A., Gudbjörnsdóttir, S., Rawshani, A., Dabelea, D., Bonifacio, E., Anderson, B. J., ... & Lernmark, Å. (2017). Type 1 diabetes mellitus. *Nature reviews Disease primers*, 3(1), 1-17.
- Marchand, L., Pecquet, M., & Luyton, C. (2020). Type 1 diabetes onset triggered by COVID-19. *Acta Diabetologica*, 57(10), 1265-1266.
- MFILB, A., Sidi, H., Ravindran, A., Gosse, P. J., Kaunismaa, E. S., Mainland, R. L., ... & Woon, L. S. (2020). How Much Do We Know about the Biopsychosocial Predictors of Glycaemic Control? Age and Clinical Factors Predict Glycaemic Control, but Psychological Factors Do Not. *Journal of Diabetes Research*, 2020.
- Mueller- Godeffroy, E., Vonthein, R., Ludwig- Seibold, C., Heidtmann, B., Boettcher, C., Kramer, M., ... & German Working Group for Pediatric Pump Therapy (agip). (2018). Psychosocial benefits of insulin pump therapy in children with diabetes type 1 and their families: the pumpkin multicenter randomized controlled trial. *Pediatric Diabetes*, 19(8), 1471-1480.
- Ndahura, N. B., Munga, J., Kimiywe, J., & Mupere, E. (2021). Caregivers' nutrition knowledge and dietary intake of type 1 diabetic children aged 3–14 years in Uganda. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, 14, 127.
- Neu, A., Buerger-Buesing, J., Danne, T., Dost, A., Holder, M., Holl, R. W., ... & Ziegler, R. (2019). Diagnosis, therapy, and follow-up of diabetes mellitus in children and adolescents.

The Effect of Applying Biopsychosocial Model on Parent's Self Efficacy and Coping Strategies of Children with Diabetes mellitus

- Experimental and Clinical Endocrinology & Diabetes, 127(S 01), S39-S72.
- Nevo-Shenker, M., Phillip, M., Nimri, R., & Shalitin, S. (2020). Type 1 diabetes mellitus management in young children: implementation of current technologies. *Pediatric Research*, 87(4), 624-629.
- Ozen, G., Zanfardino, A., Confetto, S., Piscopo, A., Casaburo, F., Tinto, N., ... & Iafusco, D. (2020). The association of autoimmune diseases with type 1 diabetes mellitus in children depends also on the length of the partial clinical remission phase (honeymoon). *International journal of endocrinology*, 2020.
- Scarton, L., Hebert, L. E., Goins, R. T., Umans, J. G., Jiang, L., Comiford, A., ... & Manson, S. M. (2021). Diabetes and health-related quality of life among American Indians: the role of psychosocial factors. *Quality of Life Research*, 1-11.
- Schiaffini, R., Barbetti, F., Rapini, N., Inzaghi, E., Deodati, A., Patera, I. P., ... & Cianfarani, S. (2020). School and pre-school children with type 1 diabetes during Covid-19 quarantine: The synergic effect of parental care and technology. *diabetes research and clinical practice*, 166, 108302.
- Settineri, S., Frisone, F., Merlo, E. M., Geraci, D., & Martino, G. (2019). Compliance, adherence, concordance, empowerment, and self-management: five words to manifest relational maladjustment in diabetes. *Journal of multidisciplinary healthcare*, 12, 299.
- Smith, Fortin, Dwamena, & Frankel. (2019). An evidence-based patient-centered method makes the biopsychosocial model scientific. *Patient Education and Counseling*, 91(3), 265-270.
- Thorsteinsson, E. B., Loi, N. M., & Rayner, K. (2017). Self-efficacy, relationship satisfaction, and social support: The quality of life of maternal caregivers of children with type 1 diabetes. *PeerJ*, 5, e3961.
- Turin, A., & Radobuljac, M. D 2021 Psychosocial factors affecting the etiology and management of type 1 diabetes mellitus: A narrative review. *World Journal of diabetes*.
- Vojislav, C., Natasa, R., Milica, P., Slobodan, A., Radivoj, K., Danijela, R., & Sasa, R. (2020). Incidence trend of type 1 diabetes mellitus in Serbia. *BMC endocrine disorders*, 20(1), 1-7.
- Von Sengbusch, S., Eisemann, N., Mueller- Godeffroy, E., Lange, K., Doerdelmann, J., Erdem, A., ... & Frielitz, F. S. (2020). Outcomes of monthly video consultations as an add- on to regular care for children with type 1 diabetes: A 6- month quasi- randomized clinical trial followed by an extension phase. *Pediatric Diabetes*, 21(8), 1502-1515.
- Wisting, L., Haugvik, S., Wennersberg, A. L., Hage, T. W., Stice, E., Olmsted, M. P., ... & Rø, Ø. (2021). Feasibility of a virtually-delivered eating disorder prevention program for young females with type 1 diabetes. *International Journal of Eating Disorders*, 54(9), 1696-1706.
- Yau, M., Maclaren, N. K., & Sperling, M. A. (2021). Etiology and pathogenesis of diabetes mellitus in children and adolescents.