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Lifestyle Behavior Modification of Mothers of Diabetic Children's through Application of Trans-theoretical Model of Change

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Abstract

Background: Diabetes self-management is defined as a set of skilled behaviors one engages in to manage one's own illness. The Transtheoretical Model (TTM, stage-based model) is one of the six most commonly cited behavior change models frequently assumed to be more effective than a control situation.

Aim: This study was conducted in order to investigate the lifestyle behavior of mothers of diabetic children's before and after implementation of intervention strategies incorporating the Transtheoretical Model of Change.

Setting: The study was conducted in the Diabetic center in EL Mogamaa EL Teby AL Shamal at Shebin El-kom that serves Menoufyia Governorate.

Design: The experimental pre-post-test design was used in carrying out the study. Sample: The study used simple random sample of 100 mothers of diabetic children's who were enrolled in the computerized program for diabetic children registration.

Instruments: a) Trans-theoretical model of change for child questionnaire, b). Transtheoretical model of change for mother questionnaire.

The main results: The experimental group, reported that 18.0% not having complications as a result of diabetes at the pre intervention phase, increased to 64.0% at the post intervention phase. Also the results of the studied mothers revealed that there was statistically significant difference between experimental and control groups within the baseline, the first and the second intervention regarding stages of change for dietary management, blood glucose monitoring by using the home device and preparation and insulin administration behaviors.

Conclusion: The implementation of the Trans-theoretical Model of change- based behavioral intervention brought a positive change in stages of mothers' behaviors related to dietary management, blood glucose monitoring by using the home device and preparation and insulin administration.

Recommendation: Encourage primary care nurse practitioner to use the Transtheoretical Model of change or other health promotion models to enhance patient care, and adoption of healthy behavior. Copies of stage-matched intervention materials should be distributed at diabetic clinics.

Keywords: Lifestyle behavior; Behavior modification; Trans-theoretical; Model of change

Introduction

Today, more than 240 million people worldwide are living with diabetes mellitus. Within the next 20 years, this number is expected to grow to 380 million. Children are not spared from this global epidemic, with its debilitating and life-threatening complications. Type 1 diabetes is growing by 3% per year in children and adolescents, and at an alarming 5% per year among pre-school children. It is estimated that 70,000 children under 15 years old develop type 1 diabetes each year (almost 200 children a day). Of the estimated 440,000 cases of type "1" diabetes in children worldwide, more than a quarter live in South-East Asia and more than a fifth in Europe [1]

Over half of the children with diabetes develop complications within 15 years old. Type "2" diabetes in children is becoming a global public health issue with potentially serious outcomes. Type 2 diabetes affects children in both developed and developing countries [2]. Also, the International Diabetes Federation (2010) added that, in 2010, number of children with type 1 diabetes (thousands) is 54.4 aged 0-14 years, and number of newly-diagnosed cases per year (thousands) is 9.1 in The Middle East and North African Region. Also, six countries in The Middle East and North African Region are among the world's 10 highest for diabetes prevalence. These countries are Bahrain, Egypt, Kuwait, Oman, Saudi Arabia and United Arab Emirates. By far, the largest contribution to the total number of children with type 1 diabetes

aged 0-14 years comes from Egypt, whose estimate in thousands is 25.447 [3].

A cornerstone of diabetes management is attention to lifestyle. Lifestyle modification, although different, is an equally integral part of type 1 diabetes management. Patients with type 1 diabetes need insulin, so they must learn to count or at least closely estimate the amount of carbohydrate they consume to help regulate their blood glucose levels and adjust their insulin doses. Failure to do so can lead to dangerous hyperglycemia or hypoglycemia [4]. Intensive modifications to lifestyle means structured education designed to facilitate change in behavior. Such education programes are used in type 1 and type "2" diabetes and in prevention of diabetes in people with impaired glucose tolerance [5].

The Transtheoretical Model of Behavior Change (TTM) provides new and helpful insights for health education [5]. Also, it is a model

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that explains the process of how people attempt to modify health-risk behaviors. It is based on 20 years of research and has been successfully applied to a variety of health behavior areas, including smoking cessation, weight control, sunscreen use, dietary change, exercise acquisition, and stress management. Within this model, there are sets of common principles that explain why people succeed and fail in changing their behavior. Research has provided strong support for the reliability and validity of the model's core constructs, including stages of change, processes of change, decisional balance, and self-efficacy. The TTM theorizes help individuals to move through a series of stages of readiness in the adoption of a healthy behavior or cessation of an unhealthy behavior [5].

The school nurse is the most appropriate person to coordinate care for students with diabetes. Each student with diabetes should have a written plan, developed by the school nurse, incorporating physician orders, parent requests, and tailored to the specific developmental, physical, cognitive, and skill ability of the child. The nurse will conduct a nursing assessment of the student and develop a nursing care plan, taking into consideration the child's cognitive, emotional, and physical status as well as the medical orders contained in the Diabetes Medical Management Plan.

Significance of the study

The number of children who were registered in the computerized program for diabetic children and visited the Diabetic center in EL Mogamaa EL Teby AL Shamal, for Follow up at the beginning of the present study (the first of July 2009) were about 600 children (1 day to 16 years old). Mothers of Diabetic children should have a more positive role in caring for their children if equipped with the needed stage matched educational intervention that can promote their children's health and wellbeing.

Aim of the study

The aim of this study was to investigate the lifestyle behavior of mothers of diabetic children's before and after the implementation of intervention strategies incorporating the Trans-theoretical Model of Change.

Research hypotheses

Mothers of diabetic children's will improve their lifestyle behaviors in knowledge and practices toward diabetes mellitus in posttest than pretest.

Diabetic children whose mothers receive intervention strategies will have better health status than diabetic children whose mothers did not receive intervention strategies.

Diabetic children will have better health status after intervention strategies than before implementation of intervention strategies.

Subject and Method

Design: - A quasi experimental; pre- test and post-test design was used to test the study hypotheses.

Setting:-This study was conducted in the Diabetic center

Sample: A simple random sample of 100 diabetic children and their mothers (100) who were enrolled in the computerized program for diabetic children registration. Mothers were selected according to the following criteria: The mothers didn't attend any pediatric diabetic educational program before the study.

Selection of Sample Size

Yamane (1967) provides a simplified formula to calculate sample sizes. A 95% confidence level and p=0.5 are assumed for:-

Sample:

$$n = \frac{N}{1 + N(e)^2}$$

tn=Sample size N=Population size

e=Level of precision=0.05

$$n = \frac{135}{1 + 135(0.05)^2}$$

n=100 children

Instruments for Data Collection

The data collection instrument was developed by the researcher after reviewing literature related to the model.

Constructed interviewing questionnaire including the following

Part one: - including the following

a- Demographic data of the mothers such as; age, education and occupation.

b- Diabetic child investigation results from his medical reports.

c- Diabetic complications that the child suffers from as; visual coma, skin, and ect.

d- Questions about practicing sports

Part two: - The Transtheoretical Model of Behavior Change Questionnaire: This questionnaire covered the Transtheoretical Model of Behavior change. It contained: -The following forms were used for the mother:-

A: - Mother's Stage of Change related to Diet, Blood Glucose Monitoring and preparation and Insulin Administration

The five-item Stage of Change was designed to assess mother's readiness for change. The mother was asked to select the most applicable response and was assigned to one of the 5 stages of change [(pre-contemplation=1, contemplation=2, preparation=3, action=4, maintenance=5)].

B: - The Diabetes Management Self-efficacy Scale related to Diet, blood glucose monitoring and preparation and insulin administration: - The scale contained eight sentences. All items were scored according to three point Likert scale. The scores were:

Items Score

I have no confidence in myself 1

I have moderate confidence in myself 2

I have great confidence in myself 3

Total score 24

The results were categorized as the following:

• From 1- <8 lower management self-efficacy

• From 9 - <16 moderate management self-efficacy

- From 17- <24 higher management self-efficacy

Diabetes Management Decisional Balance Scale related to Diet, blood glucose monitoring and preparation and insulin administration

Eight items decisional balance scale was used in this study. There were four «pros» and four «cons» items on the measure and each item was rated using a 3-point Likert scale ranging from 1 (not important) to 3 (very important).

Processes of Change Questionnaire related to Diet, blood glucose monitoring and preparation and insulin administration

It measured the two processes of change (experiential and behavioral). Total scores of ten items were used to assess the processes of change. The 3-point Likert scale ranked from 1=never happen, to 3=happen a lot.

The Trans-theoretical Model of Change-Based-Behavioral Intervention's Educational Materials

o Cartoon videos about diabetes: Cartoon videos were adopted from *Egyptian Diabetic Youth Care Association site, (2010)*. (http://www.diabetes-eg.net/diabetes-cartoon.htm).

o Developed Stage-matched Intervention Materials. They included the following: - contemplation, preparation, action and maintenance stage-matched intervention materials. It was given to mothers according to the stage of change.

Method

Approval: An official letters were issued from the Faculty of Nursing, Menofia University, to the directors of EL Mogamaa EL Teby AL Shamal and Diabetic Center to get their permission for data collection. The aim of the study was explained to diabetic center's doctors and nurse.

Ethical considerations: Before data collection, the children and their mothers were informed about the aim of the study. They were given an opportunity to refuse or to participate. Also they were assured that, their information would remain confidential and used for the research purpose only. Then their consent to participate was obtained.

Reliability of the tools: It was applied for testing the internal consistency of the tool, by administration of the same tools to the same subjects under similar conditions on one or more occasions. Answers from repeated testing were compared (Test-re-test reliability).

Validity of the tools: They were tested for content validity by jury of four experts in the field of Community Health Nursing and Pediatric Specialty to ascertain relevance and completeness, it was done after the pilot study.

Pilot Study: It was carried out on 10 diabetic children and their mothers to test practicability of the tools. Based on the findings of the pilot study, the necessarily modifications were done accordingly. They were excluded from the study sample.

Data Collection: Data were collected during the period of time from first of July 2009 to the end of December 2010.

Both groups experimental and control group were taken copies from General Information Package about diabetes. Whereas, experimental group were given an additional copies from stage-matched intervention materials according their stages of change. The control group of mothers received usual care from the Diabetic Center and was asked to fill the first questionnaire.

According to follow up visits' time schedule of children, participants were interviewed in a private room at diabetic center in the morning before diabetic children's follow up was started. The questionnaire related application of the Transtheoretical Model of Change took about 30 minutes.

The obtained information (pre-test) of the second questionnaire

Stage of change for dietary management behavior	Experimental Group(n=50)		Control Group (n=50)		Total (n=100)		P-Value
	No.	%	No.	%	No.	%	
Baseline							
Pre contemplation	0	0.0	20	40.0	20	20.0	$x^2=34.6$
Contemplation	15	30.0	20	40.0	35	35.0	p=0.000
Preparation	35	70.0	10	20.0	45	45.0	
p_1 group	0.000		1.0				
First Intervention							
Pre contemplation	0	0.0	20	40.0	20	20.0	$x^2=75.4$
Contemplation	0	0.0	20	40.0	20	20.0	p=0.000
Preparation	16	32.0	10	20.0	26	26.0	
Action	34	68.0	0	0.0	34	34.0	
p_2 group	0.000		0.85				
Second Intervention							
Pre contemplation	0	0.0	19	38.0	19	19.0	$x^2=92.8$
Contemplation	0	0.0	17	34.0	17	17.0	p=0.000
Preparation	0	0.0	12	24.0	12	12.0	
Action	16	32.0	2	4.0	18	18.0	
Maintenance	34	68.0	0	0.0	34	34.0	
p_3 group	0.000		0.81				
Total	50	100.0	50	100.0	100	100.0	

(*) statistically significant at p<0.05
p_1 group=Comparison between the baseline and the first intervention data within each group (experimental or control)
p_2 group=Comparison between the first intervention and the second intervention data within each group (experimental or control)
p_3 group=Comparison between the baseline and the second intervention data within each group (experimental or control)
p value=Comparison between experimental and control groups within data within each group the first and the second intervention data

Table 1: Classification of stages of change for dietary management behavior among the studied mothers groups over time.

Stage of change for Blood Glucose Monitoring behavior	Experimental group(n=50)		Control group(n=50)		Total (n=100)		P-Value
	No.	%	No.	%	No.	%	
Baseline							
Pre contemplation	0	0.0	20	40.0	20	20.0	x^2=34.6 p=0.000
Contemplation	15	30.0	21	42.0	36	36.0	
Preparation	35	70.0	9	18.0	44	44.0	
p₁ group	0.000		1.0				
First Intervention							
Pre contemplation	0	0.0	20	40.0	20	20.0	x^2=77.0 p=0.000
Contemplation	0	0.0	21	42.0	21	21.0	
Preparation	15	30.0	9	18.0	24	24.0	
Action	35	70.0	0	0.0	35	35.0	
p₂ group	0.000		0.62				
Second Intervention							
Pre contemplation	0	0.0	19	38.0	19	19.0	x^2=92.0 p=0.000
Contemplation	0	0.0	17	34.0	17	17.0	
Preparation	0	0.0	12	24.0	12	12.0	
Action	15	30.0	2	4.0	17	17.0	
Maintenance	35	70.0	0	0.0	35	35.0	
p₃ group	0.000		0.65				
Total	50	100.0	50	100.0	100	100.0	

(*) statistically significant at p <0.05
p_1 group=Comparison between the baseline and the first intervention data within each group.
p_2 group= Comparison between the first intervention and the second intervention data within each group
p_3 group= Comparison between the baseline and the second intervention data within each group
p value=Comparison between experimental and control groups within the baseline, the first and the second intervention data

Table 2: Classification of stages of change for blood glucose monitoring by using the home device behavior among the studied groups of mothers over time.

Stage of change for Preparation and Give Insulin Injection Behavior	Experimental group(n=50)		Control group(n=50)		Total (n=100)		P-Value
	No.	%	No.	%	No.	%	
Baseline							
Pre contemplation	0	0.0	20	40.0	20	20.0	x^2=34.6 p=0.000
Contemplation	15	30.0	21	42.0	36	36.0	
Preparation	35	70.0	9	18.0	44	44.0	
p₁ group	0.000		1.0				
First Intervention							
Pre contemplation	0	0.0	20	40.0	20	20.0	x^2=76 p=0.000
Contemplation	0	0.0	21	42.0	21	21.0	
Preparation	16	32.0	9	18.0	25	25.0	
Action	34	68.0	0	0.0	34	34.0	
p₂ group	0.000		0.62				
Second Intervention							
Pre contemplation	0	0.0	19	38.0	19	19.0	x^2=90.0 p=0.000
Contemplation	0	0.0	17	34.0	17	17.0	
Preparation	0	0.0	12	24.0	12	12.0	
Action	15	30.0	2	4.0	17	17.0	
Maintenance	35	70.0	0	0.0	35	35.0	
p₃ group	0.000		0.65				
Total	50	100.0	50	100.0	100	100.0	

(*) statistically significant at p<0.05
p_1 group= Comparison between the baseline and first intervention data within each group
p_2 group= Comparison between the first and second intervention data within each group
p_3 group= Comparison between the baseline and second intervention within each group
p value= Comparison between experimental and control groups within the baseline, the first and the second intervention data

Table 3: Classification of stages of change for preparation and insulin administration behavior among the studied mothers groups over time.

related to the application of the Transtheoretical Model of behavior change served as baseline assessment of the diabetic child's mother. According to the results of the pre-test assessment, the researcher implemented the first Transtheoretical Model of change-based behavioral intervention and gave mother's stage-matched intervention materials with explanation for them. The same maneuver (first intervention's post-test) was obtained after two months from immediate post-test of the first questionnaire to evaluate the success rate of the first Transtheoretical Model of Change- based behavioral intervention on improvement of behaviors and lifestyle modification related diabetes management.

According to the first intervention's post-test's results, the researcher implemented the second Transtheoretical Model of Change-based behavioral intervention and gave mothers stage-matched intervention materials. The same maneuver (second intervention's post-test) was obtained after two months from first intervention's post-test to evaluate the success rate of the first Transtheoretical Model of Change- based behavioral intervention on progress of behavior change and lifestyle modification related diabetes management. The follow up was done through telephone counseling 10-30 minutes every two weeks.

Evaluation was applied by comparing behavior change and lifestyle

Variable	PC	C	P	A	M	P-Value
Self-efficacy Baseline 1st Intervention 2nd Intervention	- - -	n=15 7.7 ± 1.1 - -	n=35 10.4 ± 1.2 n= 16 15.5 ± 1.5 p_4=0.000 -	- - n=16 18.4 ± 1.5 p_5=1.0	- - n= 34 19.6 ± 1.7	t_1=55 p_1=0.000 t_2=134.5 p_2=0.000 t_3=8.5 p_3=0.005*
Pros Baseline 1st Intervention 2nd Intervention	- - -	n=15 6.3 ± 0.7 - -	n=35 9.3 ± 0.9 n=1 7.4 ± 0.7 p_4=0.001* -	- n=34 10.4 ± 1.2 n=16 10.3 ± 1.1 p_5=0.8	- - n= 34 11.5 ± 0.6	t_1=136.4 p_1=0.000 t_2=79.6 p_2=0.000 t_3=29.6 p_3=0.000
Cons Baseline 1st Intervention 2nd Intervention	- - -	n=15 6.3 ± 0.7 - -	n=35 5.6 ± 0.6 n=16 5.6 ± 0.6 p_4=1.0 -	- n=34 4.9 ± 0.6 n=16 4.8 ± 0.4 p_5=0.9	- - n=34 4.3 ± 0.4	t_1=12.4 p_1=0.001* t_2=16.8 p_2=0.000 t_3=17.3 p_3=0.000
Cognitive process Baseline 1st Intervention 2nd Intervention	- - -	n=15 6.4 ± 0.8 - -	n=35 7.2 ± 0.4 n=16 10.1 ± 1.8 - p_4=0.001*	- n=34 13.0 ± 0.7 n=16 13.9 ± 1 p_5=0.09	- - n= 34 14.8 ± 0.4	t_1=18.7 p_1=0.00 t_2=64 p_2=0.000 t_3=17 p_3=0.000
Behavioral process Baseline 1st Intervention 2nd Intervention	- - -	n=15 5.3 ± 0.6 - -	n =35 6.5 ± 1.0 n=16 10.9 ± 2.1 p_4=0.000 -	- n=34 13.9 ± 1.0 n=16 14.6 ± 0.5 p_5=0.02*	- - n =34 14.5 ± 0.5	t_1=16.7 p_1=0.000 t_2=45 p_2=0.000 t_3=0.3 p_3=0.6

Pre contemplation (PC), contemplation (C), Preparation (P), Action (A), Maintenance (M) (*) statistically significant at p <0.05
t_1= Comparison between contemplation and preparation stages within each baseline data for mother's dietary management for her child
t_2=Comparison between preparation and action stages within each first intervention data for mother's dietary management for her child
t_3=Comparison between action and maintenance stages within each second intervention data for mother's dietary management for her child
p_1=p value of comparison between contemplation and preparation stages within each baseline data for mother's dietary management for her child
p_2=p value of comparison between preparation and action stages within each first intervention data for mother's dietary management for her child
p_3=p value of comparison between action and maintenance stages within each second intervention data for mother's dietary management for her child
p_4=p value of comparison between baseline and first intervention data within each stage of change for mother's dietary management for her child
p_5=p value of comparison between first and second intervention data within each stage of change for mother's dietary management for her child
t_1=Comparison between contemplation and preparation stages within each baseline data for mother's blood glucose monitoring
t_2=Comparison between preparation and action stages within each first intervention data for mother's blood glucose monitoring
t_3=Comparison between action and maintenance stages within each section intervention data for mother's blood glucose monitoring
p_1=p value of comparison between contemplation and preparation stages within each baseline data for mother's blood glucose monitoring
p_2=p value of comparison between preparation and action stages within each first intervention data for mother's blood glucose monitoring
p_3=p value of comparison between action and maintenance stages within each second intervention data for mother's blood glucose monitoring
p_4=p value of comparison between baseline and first intervention data within each stage of change for mother's blood glucose monitoring
p_5=p value of comparison between first and second intervention data within each stage of change for mother's blood glucose monitoring
Table 4: Mean Scores of Self Efficacy, Pros, Cons, Cognitive Processes and Behavioral Processes Distributed by Mother's Stages of Change for Dietary Management Behavior for their children (Baseline, First Intervention and Second Intervention) among the Experimental Group=50).

modification before and after TTMBI. This was done through reusing the same tools after three months from the first TTMBI. Another three months from the second TTMBI for intervention group. Also, the control group of mothers was asked to fill the second questionnaire. This was done through the pre- and post- analysis of data.

Statistical Analysis

Data was analyzed by using SPSS version 13. Graphics were done using Excel program. Quantitative data were presented by mean and standard deviation. It was analyzed using student t- test for comparison between two means, and ANOVA (F) test for comparison between more than two means. Qualitative data were presented in the form of frequency distribution tables, number and percentage. It was analyzed by chi-square ($\chi 2$) test. However, if an expected value of any cell in the Table was less than 5, Fisher Exact test was used. Level of significance was set as P value <0.05 for all significant tests.

Results

Table 1: As noticed the baseline; most of the experimental group was at the preparation stage (70.0%), at the first intervention 68.0% were at the action stage and at second intervention 68.0% were at the maintenance stage. While in the control group, at the baseline and the first intervention less than half (40.0%) were at the pre-contemplation and contemplation stages.

Table 2: illustrated that at the baseline most of the experimental group (70.0%) were at the preparation stage, while at the first intervention most (70.0%) were at the action stage where p1= 0.001.

Table 3: illustrated that, at the baseline most of the experimental group were at the preparation stage 70.0%, while at the first intervention 68.0% were at the action stage and at the second intervention most (70.0%) were at the maintenance stage.

Table 4: illustrated that, there was statistically increased in the mean scores of mothers' self-efficacy regarding dietary management behavior throughout stages of change at all three time points as a result of the intervention.

Table 5: revealed that there was statistically increased in the mean

Variable	PC	C	P	A	M	P-Value
Self-efficacy Baseline 1st Intervention 2nd Intervention	- - -	n=15 7.1 ± 1.3 - -	n=35 9.5 ± 1.2 n=15 10.8 ± 0.8 p_4=0.11 -	- - n=16 18.4 ± 1.5 p_5=1.0	- - n=35 14.4 ± 1.1	t_1=33.8 p_1=0.000 t_2=150 p_2=0.000 t_3=1.6 p_3=0.2
Pros Baseline 1st Intervention 2nd Intervention	- - -	n=15 5.7 ± 1.3 - -	n=35 6.7 ± 1.0 n=15 7.3 ± 1.0 p_4=0.24 -	n=35 9.3 ± 0.9 n=15 9.9 ± 1.3 p_5=0.11 -	- n=35 10.9 ± 0 -	t_1=6.6 p_1=0.01* t_2=38 p_2=0.000 t_3=9.3 p_3=0.004*
Cons Baseline 1st Intervention 2nd Intervention	- - -	n=15 6.8 ± 1.1 - -	n=35 6.3 ± 0.7 n=15 5.7 ± 0.6 p_4=0.37 -	- n=35 5.3 ± 0.6 n=15 4.7 ± 0.7 p_5=0.19	- - n=35 4.1 ± 0.2	t_1=1.4 p_1=0.07 t_2=2.9 p_2=0.12 t_3=21.8 p_3=0.000
Cognitive process Baseline 1st Intervention 2nd Intervention	- - -	n=15 6.4 ± 0.8 - -	n=35 7.2 ± 0.4 n=15 11.1 ± 0.8 p_4=0.04* -	- n=35 12.9 ± 0.5 n=15 14.2 ± 0.7 p_5=0.08	- - n=35 14.8 ± 0.4	t_1=18.7 p_1=0.000 t_2=74.2 p_2=0.000 t_3=13 p_3=0.000
Behavioral process Baseline 1st Intervention 2nd Intervention	- - -	n=15 5.5 ± 0.6 - -	n =35 6.3 ± 0.7 n=15 11.4 ± 0.8 p_4=003* -	- n=35 13.8 ± 1. n =15 14 ± 0.9 p_5=0.29	- - n=35 14.7 ± 0.4	t_2=64 p_2=0.000 t_3=13.4 p_3=0.001*

Pre contemplation (PC), contemplation (C), Preparation (P), Action (A), Maintenance (M) (*) statistically significant at p <0.05
t_1=Comparison between contemplation and preparation stages within each baseline data for mother's blood glucose monitoring
t_2=Comparison between preparation and action stages within each first intervention data for mother's blood glucose monitoring
t_3=Comparison between action and maintenance stages within each section intervention data for mother's blood glucose monitoring
p_1=p value of comparison between contemplation and preparation stages within each baseline data for mother's blood glucose monitoring
p_2=p value of comparison between preparation and action stages within each first intervention data for mother's blood glucose monitoring
p_3=p value of comparison between action and maintenance stages within each second intervention data for mother's blood glucose monitoring
p_4=p value of comparison between baseline and first intervention data within each stage of change for mother's blood glucose monitoring
p_5=p value of comparison between first and second intervention data within each stage of change for mother's blood glucose monitoring

Table 5: Mean Scores of Self Efficacy, Pros, Cons, Cognitive Processes and Behavioral Processes Distributed by Mothers' Stages of Change for Blood Glucose Monitoring (Baseline, First Intervention and Second Intervention) among the Mothers Experimental Group (n=50).

scores of mothers' self-efficacy regarding blood glucose monitoring by using the home device behavior throughout stages of change at all three time points as a result of the intervention where p_1=0.000, p_2=0.000.

Table 6: presented there was statistically increased in the mean scores of mothers' self-efficacy regarding preparation and insulin administration behavior throughout stages of change at all three time points as a result of the intervention where p_1=0.000, p_2=0.000.

Table 7: presented that in the experimental group for fasting blood sugar, 90.0% had abnormal fasting blood sugar at the pre intervention phase, decreased to 54.0% at the post intervention phase.

Table 8: presented that in the experimental group, 18.0% reported not having complications as a result of diabetes at the pre intervention phase, increased to 64.0% at the post intervention phase.

Figure 1: showed that the majority of the control group had abnormal fasting blood sugar; abnormal postprandial blood sugar and poor diabetic control after the intervention.

Figure 2: showed practicing sports among the studied children groups after intervention. It indicated that the majority of the experimental group reported practicing sport after the intervention.

Discussion

The Transtheoretical Model (TTM) is based on the premise that people are at different stages of readiness for engaging in health behaviors, and that intervention approaches are likely to be most helpful when they are matched to the individual's current stage of change. Many people need to bring about dramatic lifestyle changes to achieve ideal diabetes control after diagnosis [6,7].

The aim of the present study was to investigate the lifestyle behavior of diabetic children's mothers before and after the implementation of intervention strategies incorporating the Transtheoretical Model of Change.

Concerning classification of stages of change for dietary management behavior among the studied mother groups over time, the present study findings revealed that, in the experimental group, there was statistical significant forward stages progression at all three time points. While, in the control group, at the baseline, of the first and the second intervention, there was no statistical significant forward stages progression at all three time points. Additionally, there was statistical significant difference between experimental and control groups at all three time points regarding stages of change for dietary management behavior (Table 1). This finding comes in agreement with Bradbury et al. who reported that, the American intervention participants were significantly more likely to move into action or maintenance related to fruit and vegetables consumption than the control participants [8].

Meanwhile, the present results are in congruence with Johnson et al. who mentioned that, the African-American intervention participants were more likely than the control group participants to move into action or maintenance and remain there for the duration of the study, regardless of their stages at the baseline. This means that implementation of the Transtheoretical model of change- based behavioral intervention brings a positive change in stages of behavior related to dietary management [9].

Regarding comparison of the mean scores of self-efficacy, pros, cons,

TTM Construct	PC		P	A	M	P-Value
Self-efficacy Baseline 1st Intervention 2nd Intervention	- - -	(n=15) 6.8 ± 0.9 - -	(n=35) 10.0 ± 1.2 (n=16) 10.3 ± 1.9 - p_4=0.81	- (n=34) 13.9 ± 1.0 (n =15) 14.8 ± 1.8 p_5=0.15	- - (n=35) 15.3 ± 1.5	t_1=80.3 p_1=0.000 t_2=75 p_2=0.000 t_3=0.8 p_3=0.3
Pros Baseline 1st Intervention 2nd Intervention	- - -	(n=15) 7.1 ± 0.7 - -	(n=35) 7.6 ± 0.8 (n=16) 7.3 ± 0.8 - p_4=0.92	- (n=34) 9.3 ± 1.1 (n=15) 9.6 ± 1.1 p_5=0.21	- - (n=35) 11.3 ± 0.7	t_1=4.5 p_1=0.03* t_2=42 p_2=0.0000 t_3=38.7 p_3=0.000
Cons Baseline 1st Intervention 2nd Intervention	- - -	n=15) 6.9 ± 0.7) - -	n=35) 5.9 ± 0.5 (n=16) 5.6 ± 0.6 - p_4=0.61	- (n=34) 5.3 ± 0.5 (n=15) 4.9 ± 0.5 p_5=0.26	- - (n=35) 4.4 ± 0.4	t_1=23.4 p_1=0.000 t_2=2.2 p_2=0.14 t_3=10.7 p_3=0.002*
Cognitive process Baseline 1st Intervention 2nd Intervention	- - -	n=15) 6.3 ± 0.7) - -	(n=35) 7.5 ± 0.5 (n=16) 11.3 ± 1.3 - p_4=0.06	- (n=34) 12.9 ± 0.7)n=15) 14.4 ± 0.5 p_5=0.31	- - (n=35) 14.8 ± 0.4	t_1=45.7 p_1=0.000 t_2=30.2 p_2=0.0000 t_3=8.7 p_3=0.005*
Behavioral process Baseline 1st Intervention 2nd Intervention	- -	(n=15) 5.3 ± 0.6 - -	(n =35) 5.7 ± 1.1 (n =16) 11.3 ± 0.3 - p_4=0.02*	- (n=34) 13.9 ± 1.1 (n =15) 14.3 ± 0.9 p_5=0.18	- - (n =35) 14.6 ± 0.4	t_1=1.7 p_1=0.1 t_2=34.8 p_2=0.000 t_3=1.6 p_3=0.2

Pre contemplation (PC), contemplation (C), Preparation (P), Action (A), Maintenance (M) (*) statistically significant at p <0.05
t_1=Comparison between contemplation and preparation stages within each baseline data for mother's preparation and insulin administration for her child behavior
t_2=Comparison between preparation and action stages within each first intervention data for mother's preparation and insulin administration for her child behavior
t_3=Comparison between action and maintenance stages within each second intervention data for mother's preparation and insulin administration for her child behavior
p_1=p value of comparison between contemplation and preparation stages within each baseline data for mother's preparation and insulin administration for her child behavior
p_2=p value of comparison between preparation and action stages within each first intervention data for mother's preparation and insulin administration for her child behavior
p_3=p value of comparison between action and maintenance stages within each second intervention for mother's preparation and insulin administration for her child behavior
p_4=p value of comparison between baseline and first intervention data within each stage of change for mother's preparation and insulin administration for her child behavior
p_5=p value of comparison between first and second intervention data within each stage of change for mother's preparation and insulin administration for her child behavior

Table 6: Comparison of the Mean Scores of Self Efficacy, Pros, Cons, Cognitive Processes and Behavioral Processes Distributed by Mothers' Stage of Change for Preparation and Insulin Administration Behavior for their Children (Baseline, First Intervention and Second Intervention among the Mothers Experimental Group. (n=50).

cognitive and behavioral processes related to dietary management for the experimental group, the present study findings revealed that, there was statistical increased in mothers' self-efficacy scores throughout stages of change at all three time points. On the same line, there was statistical improvement of dietary management pros. Also, there was statistical improvement of mothers' use of cognitive and behavioral processes of change. While, there was statistical decreasing of dietary management cons (Table 4). This foregoing present study results is in congruence with Ma et al. who indicated that American female's self-efficacy of fruit and vegeTable intake increased in a linear pattern from precontemplation to maintenance. Also, fruit and vegeTable consumption pros increased while cons decreased across the five stages in a predicTable manner.

Also, the present study finding comes in agreement with Tassell & Flett who mentioned that self-efficacy for maintaining a healthy diet was significantly higher, across stages for fruit and vegeTable consumption [10]. Moreover, Riebe et al. found that, regular exercise and maintenance of a healthy diet were associated with greater use of processes of change. Exercise was also associated with higher confidence. In addition, a healthy diet was associated with lower temptation scores [11].

Likewise, the present study finding comes in agreement with Rakowski who reported that forward stages progression led to higher pros scores and lower cons scores [12]. Also, intention to have a future mammogram was more significant than previous mammography in relation pros and cons scores. Additionally, the present results are in congruence with Frenn & Malin who found that participants' use of the processes of change related to a low-fat diet increased across stages [13]. Also, participants' use of the processes related to exercise increased significantly across stages. These changes as a result of implementation of the Transtheoretical model of change- based behavioral intervention.

Classification of stages of change for blood glucose monitoring by using the home device behavior among the studied mother groups over time, the present study revealed that, in the experimental group, there was statistical significant forward stages progression at all three time points. While, in the control group, at the baseline, of the first and the second intervention, there was no statistical significant forward stages progression at all three time points. Additionally, there was statistical significant difference between experimental and control groups at all three time points regarding stages of change for blood glucose monitoring by using the home device behavior (Table 2). This present findings come in agreement with Norris et al. who showed that, there was significantly more stages progression in the intervention group compared with the control group [14]. Additionally, Shirazi et al. found that after the education program related to increase exercise to prevent osteoporosis, the training group of Iranian women had a larger percentage of participants in the preparation and action stages than the control group and a larger percentage of the control group participants in pre-contemplation and contemplation [15]. Also, there were high statistically significant differences between the training group and the

Laboratory Data	Experimental Group (n=50)		Control Group (n=50)		Total (n=100)		P-Value
	No.	%	No.	%	No.	%	
Fasting Blood Sugar: **Before Intervention:** • Normal • Abnormal high • Mean ± SD mg/dL	5 45 165.7 ± 28	10.0 90.0	0 50 156.1 ± 42	0.0 100.0	5 95	5.0 95.0	x^2=5.3 p=0.02* t_1=5.7 p_1=0.001*
After Intervention: • Normal • Abnormal high • Mean ± SD mg/dL	23 27 121.6 ± 31	46.0 54.0	2 48 145.2 ± 47	4.0 96.0	25 75	25.0 75.0	x^2=23 p=0.000 t_2=9.1 p_2=0.000
P paired	0.000	0.12					
P group	0.000	0.09					
Postprandial Blood Sugar: **Before Intervention:** • Normal • Abnormal high • Mean ± SD mg/dL	0 50 241.2 ± 55	0.0 100.0	0 50 320.5 ± 85	0.0 100.0	0 100	0.0 100.0	t_1=5.5 p_1=0.0001*
After Intervention: • Normal • Abnormal high • Mean ± SD mg/dL	17 33	34.0 66.0	2 48	4.0 96.0	19 81	19.0 81.0	x^2=14.6 p=0.000 t_2=8.9 p_2=0.000
P paired	0.000	0.12					
P group	0.000	0.08					
Glycosylated Hb: **Before Intervention:** • Poor diabetic control • Fair diabetic control • Good diabetic control • Mean ± SD mg/dL	41 5 4 9.5 ± 1.6	82.0 10.0 8.0	49 1 0 11 ± 2.2	98.0 2.0 0.0	90 6 4	90.0 6.0 4.0	x^2=7.4 p=0.03* t_1=6.3 p_1=0.0001*
After Intervention: • Poor diabetic control • Fair diabetic control • Good diabetic control • Mean ± SD mg/dL	11 14 25 7 ± 1.6	22.0 28.0 50.0	43 3 4 10.9 ± 2.7	86.0 6.0 8.0	54 17 29	54.0 17.0 29.0	x^2=41.3 p=0.000 t_2=6.3 p_2=0.0001*
P paired	0.04*	0.2					
P group	0.000	0.3					
Total	50	100.0	50	100.0	100	100.0	

(*) statistically significant at p<0.05
t^1= Comparison between X & SD of pre intervention of experimental & control group
p_1=p value of comparison between X & SD of pre intervention of experimental and control group
t_2=Comparison between X & SD of post intervention data of experimental group and control group
p_2=p value of comparison between X & SD of post intervention of experimental and intervention. control group
P paired= Comparison of paired t test between each group either before and after
P group=Comparison (using x^2 test) between each group either (experimental or control) before and after intervention
Table 7: Distribution of the Laboratory Data of the Studied Children Sample before and after the Intervention.

control group. This means that implementation of the Transtheoretical model of change- based behavioral intervention brings a positive change in stages of behavior related to blood glucose monitoring by using the home device.

Concerning comparison of the mean scores of self-efficacy, pros, cons, cognitive and behavioral processes related to blood glucose monitoring by using the home device behavior for the experimental group, the present study findings indicated that there was statistical increase in mothers' self-efficacy scores throughout stages of change at all three time points, blood glucose monitoring behavior pros and use of the cognitive and behavioral processes of change. While, there was statistical decreasing of blood glucose monitoring behavior cons (Table 5). This finding is supported by Patterson et al. who found that, the intervention participants were more likely to report increases in dietary self-efficacy [15]. These changes as a result of implementation of the Transtheoretical model of change- based behavioral intervention.

The present study is supported by Plotnikoff et al. who indicated a significant increase in self-efficacy in the intervention group compared to the control group [16].

Concerning classification of stages of change for preparation and insulin administration behavior among the studied mother groups over time, the present study findings revealed that, in the experimental group, there was statistical significant forward stages progression at all three time points. While, in the control group, at the baseline, of the first and the second intervention, there was no statistical significant forward stages progression at all three time points. Additionally, there was statistical significant difference between experimental and control groups at all three time points regarding stages of change for preparation and insulin administration behavior (Table 3). The present study findings come in agreement with and Barthollomew et al. who mentioned that there was significant increase in stages for readiness to meet the 5-A-Day criteria for fruits and vegetables consumption for the

Health Status Exercising	Experimental group(n =50)				Control group(n =50)				P-Value	
	No.	%	No.	%	No.	%	No.	%	Before Inter-vention	After Inter-vention
Health status (Presence or absence of complications):										
• Absence of complications	9	18.0	32	64.0	5	10.0	6	12.0	$x21=1.3$ p1= 0.2	$x22= 28$ p2= 0.00
• Visual complications	5	10.0	6	12.0	3	6.0	3	6.0		
• Coma	23	46.0	5	10.0	29	58.0	28	56.0		
• Combined complications	13	26.0	7	14.0	13	26.0	13	26.0		
P	0.001*	0.72								
Practicing sports (Exercising):										
• No	36	72.0	5	10.0	33	66.0	33	66.0	$X2\ 1=4.2$ p1= 0.12	$x22= 33$ p2= 0.00
• Walking	6	12.0	24	48.0	3	6.0	3	6.0		
• Football	5	10.0	17	34.0	12	24.04.0	12	24.0		
• Swimming	3	6.0	4	8.0	2		2	4.0		
P	0.001*	0.72								

P_1=Comparison between experimental group and control group before intervention
P_2=Comparison between experimental group and control group after intervention
P=Comparison between each group (either experimental or control) before and after intervention

Table 8: Distribution of the Studied Children Sample in relation to Health Status Presence or absence of complications) and Practicing Sports (Exercising) before and after the Intervention.
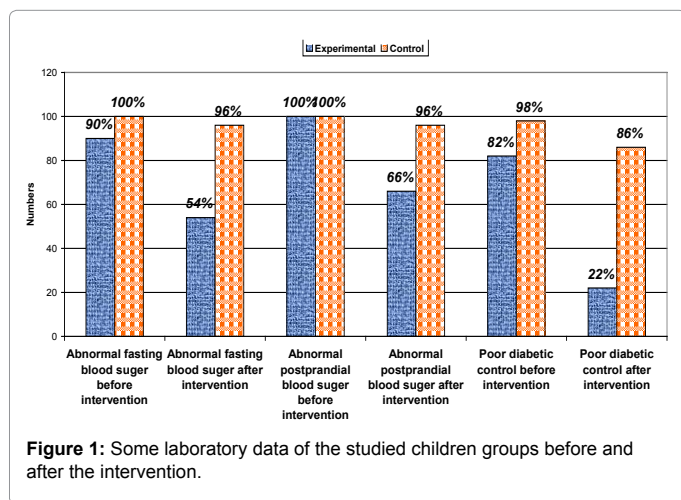

Figure 1: Some laboratory data of the studied children groups before and after the intervention.
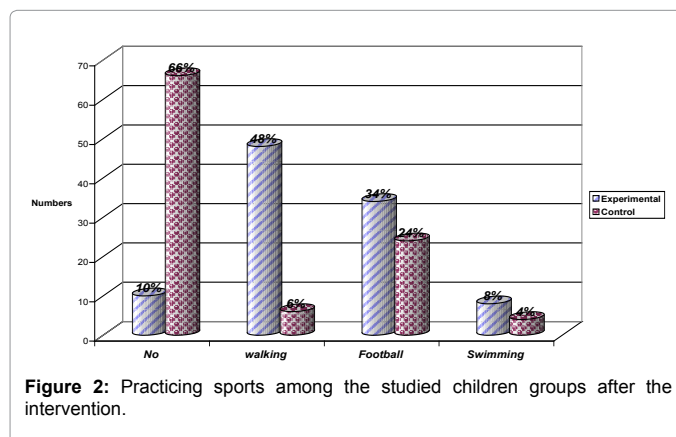

Figure 2: Practicing sports among the studied children groups after the intervention.

intervention group of American women, while the comparison group reported no change.

Also, there was a marked increase in the proportion of American patients in the behavioral intervention group in the action/maintenance stage after 4 months and 12 months related to stage of change for physical activity. While, there was less observed increase among mothers in the control group. This means that the implementation of Transtheoretical model of change- based behavioral intervention brings a positive change in stages of behavior related to preparation and insulin administration.

Concerning comparison of the mean scores of self-efficacy, pros, cons, cognitive and behavioral processes related to preparation and insulin administration behavior for the experimental group, the present study findings indicated that, there was statistical increase in mothers' self-efficacy scores throughout stages of change at all three time points, preparation and insulin administration behavior pros and mothers' use of the cognitive and behavioral processes of change. While, there was statistical decrease of preparation and insulin administration behavior cons (Table 6). This present study findings come in agreement with

Henry et al. who mentioned that, self-efficacy for dietary behavior has been increased through improvements in knowledge, training, experience, and familiarity with a task. These changes as a result of implementation of the Transtheoretical model of change- based behavioral intervention. This present study comes in agreement with Plotnikoff et al. who reported that the intervention group reported increased participants' self-efficacy and higher intention for physical activity participation, whereas the control group reported decreased self-efficacy and lower intention. Moreover, the intervention group perceived more pros and fewer cons of physical activity participation, whereas the control group reported no changes in these variables. Additionally, the intervention group reported more use of the processes of change, while the control group reported no changes in these variables [17].

Regarding laboratory data (fasting blood sugar, post prandial blood sugar and Glucosylated HB) of the studied children, the present study revealed that the values of those laboratory data dropped down in the experimental group after the intervention with statistical significant difference (Table 7 and Figure 1). This result was in accordance with the studies carried out by Anderson et al. who stated that there was significant reduction in the mean serum HBAIC concentrations after the intervention period and also reduction in mean serum of fasting and

post prandial blood sugar concentrations after the intervention period. This means that implementation of the educational intervention was effective and brought improvements in health outcomes [18].

Regarding children's health status "presence or absence of complications", the findings of the current study clarified that, the intervention was effective in reducing the complications where the highest percentage of the experimental group have no complications as a results of diabetes at the post intervention phase compared to the pre intervention phase where a statistical significant improvement was found. While the highest percentage of the control group have complications as a results of diabetes at the post intervention phase because they receive the routine diabetic care (Table 6). This finding comes in agreement with Crowley, in London and Majaliwa et al. in Tanzania, who mentioned that their intervention had significant improvement for patients with diabetes. In addition, the present study was also supported by Jones et al. concluded that health behavior change intervention had the potential of positively impacting the health status of broad populations of individuals with diabetes in Canada [19].

Regarding practicing of sports among the studied children before and after the intervention, Table 8 and Figure 2 presented that, there was statistically significant difference between pre and post intervention phases in the experimental group. In the same line with the present finding was the study carried out by Mehana & Kilani, in Omanand Chavez in USA, who reported that increasing knowledge of children about importance of physical activity improved their participation in sports [20].

Conclusion

The results provide important evidence that the implementation of the Transtheoretical Model of change-based behavioral intervention improved the self-management practices and well-being of children with type I diabetes. Also, the findings supported the importance of the Transtheoretical Model as a useful framework for promoting changes and evaluating participants' progress.

Recommendations

Encourage primary care nurse practitioner to use the Transtheoretical Model of change or other health promotion models to enhance patient care, and adoption of healthy behavior. Also distribute copies of stage-matched intervention materials at diabetic clinics.

Further research is needed to refine the constructs of the Transtheoretical Model of change and compare its effectiveness with other behavioral models.

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