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"Green nursing profession: Education, Practice, Evaluation and Research"

Effect of an Educational Program based on PRECEDE-PROCEED Model on Knowledge and Health Behaviors among Women with Gestational Diabetes

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Abstract:

Gestational diabetes mellitus is an increasing health issue globally and may cause severe complications for both the mother and the fetus. It is defined by reduced glucose tolerance resulting in hyperglycemia that starts during pregnancy and ceases after delivery. Health behaviors modifications play important role in management of GDM ***AIM:*** evaluate the effect of an educational program based on PRECEDE- PROCEED model on knowledge and health behaviors among women with gestational diabetes. ***DESIGN:*** A Quasi-experimental design. ***SETTING:*** Obstetrics and gynecological outpatient clinic, Benha University Hospital. ***SAMPLE:*** A Purposive sample was used to conduct the study, included 140 pregnant woman who fulfill inclusion criteria. ***TOOLS:*** three tools were used. Tool (1); A self-administered questionnaire that includes: general characteristics of the studied women, history of gestational diabetes and Obstetric history. Tool (2): The PRECEDE-PROCEED model construct (enabling, predisposing and reinforcing factor). Tool (3): Health Behavior profile-II***.*** ***RESULTS:*** The results indicated that at pre-intervention phase, there were no statistical significant difference in the average scores of knowledge, attitude, enabling factors, reinforcing factors, and health behaviors between both groups. However, statistical significant difference was noted at post-intervention phase (p<0. 001). Moreover, there was a highly statistically significant positive correlation between total health-promoting lifestyle and (total knowledge, attitude, enabling factors and reinforcing factors) among both study and control groups at pre and post intervention phase (P <0.001**). ***CONCLUSION:*** The utilization of the PRECEED-PROCEED model had a significant effect in the improvement of the knowledge, attitude, and health behaviors of pregnant women diagnosed with gestational diabetes. ***RECOMMENDATION:*** Applying educational programs and counseling tips in gestational diabetic women discharge teaching plan to maintain healthy life style and maximum glycemic control prior to a future conception.

Key words: Gestational diabetes, Educational program, PRECEDE-PROCEED Model.

Introduction:

Gestational diabetes mellitus (GDM) is high blood sugar (glucose) or any degree of dysglycemia that develops during pregnancy and usually disappears after giving birth. GDM can happen at any stage of pregnancy, but is more common in the second or third trimester. GDM is one of the leading causes of morbidity and mortality for both the mother and the infant worldwide **(Wicklow, 2024).**

Gestational diabetes mellitus is the most important health-related concern in pregnancy in the 21st century. In latest years, the occurrence of GDM has expanded around the world with its incidence varying from 1.4% to 18.5% in different countries (**Ahmed et al., 2022).**

Gestational diabetes happens when body can't make enough insulin during pregnancy. Insulin is a hormone made by pancreas. It acts like a key to let blood sugar into the cells in body for use as energy. During pregnancy, body makes more hormones and goes through other changes, such as weight gain. These changes cause body's cells to use insulin less well, a condition called insulin resistance. Insulin resistance increases body's need for insulin **(Jing et al., 2024).**

The risk factors for gestational diabetes mellitus are age more than 30 years, family history of diabetes mellitus, obesity, history of macrosomia, glycouria, previous unexplained neonatal death, unexplained recurrent abortion, previous congenital malformations, history of polyhydramnios, history of stillbirth, history of gestational hypertension, polycystic ovarian syndrom and history of preeclampsia **(Salem et al., 2022).**

Life style comprises the routine daily life activities that affect the individual's health. According to WHO, 60% of an individual's quality of life and state of health depends on behaviors and lifestyle. So healthy life style can enhance the wellbeing and help to live a more productive life. Lifestyle is defined as distinct and identifiable behavioral patterns which drive from interaction between personality traits, social relationship, environmental condition and socioeconomic status **(Adrian, 2022).**

The PRECEDE-PROCEED model is a planning, participatory, and community-based model widely used in planning and changing behavior and its purpose is to attract people's partnership, to utilize the specialist's view on planning, and to have a comprehensive look at the behavioral and non-behavioral determinants **(Ghaffari et al., 2021)**.

Nurse enhance awareness through a health counseling plan for a healthy lifestyle that includes diet, exercise, oral glucose tolerance test awareness, a 'standard glucose tolerance test' for earlier diabetes detection, self-

monitoring, and weight loss to high-risk GDM women, along with diabetes prevention education program and postpartum screening of glucose levels to prevent this chronic illness **(Karavasileiadou et al., 2022).**

Significant of the study:

Worldwide, gestational diabetes is common, and about 3% - 7% of women report having gestational diabetes depends on population studies ***(Jennifer, et al., 2022)***. In Egypt, the prevalence of gestational diabetes is about18% of adult women during the life ***(*Khalil*, 2021).***

Women who have gestational diabetes will have many health problems that affect women and newborn. Untreated gestational diabetes can lead to additional health problem. Problem that affect newborn include: excessive birth weight, early (preterm) birth, serious breathing difficulties, low blood sugar (hypoglycemia), obesity and type 2 diabetes later in life and stillbirth. Problem that affect women include: high blood pressure and preeclampsia**,** having a surgical delivery (Cesarean section) and future diabetes ***(Johnset al., 2021).***

Subjects and Method:

Research Design: A quasi-experimental design was used to fulfill this study.

Research setting:

The study will be conducted at obstetrics and gynecological outpatient clinic in Benha university hospital which includes one room divided into diagnostic and examination areas. As well as, waiting area for women admission where the researcher interviewed the recruited women to implement educational program based on PRECEDE- PROCEED model.

Sampling:

Sample type: A purposive sample was used.

Sample size:

- 140 pregnant women were selected. The sample size was estimated by using 10% of the previous year hospital census report of Benha university (BUH statistical center at 2022) (N= 1400 pregnant women). Women were divided randomly into two equal groups. The study group was include 70 women who received the educational program based on PRECEDE model in additional to the routine hospital care, the control group was include 70 women who received the routine hospital care only.

Inclusion criteria:

- Women with gestational diabetes
- Women between 26-28 weeks gestational age.
- Free from any medical or obstetrical complication.
- Willing to participate in the study.
- Women who read and write.

Tools of data collection

Three tools were used for collecting data.

<u>Tool I: A structured self-administered questionnaire</u>: it was constructed and

translated into Arabic language by the researcher after reviewing a related literatures ***(Buckner, 2020; Callis,2020).*** It included three parts:

Part (1): General characteristics of the studied women as (age, level of education).

Part (2): History of gestational diabetes such as (history of gestational diabetes, family history of gestational diabetes mellitus).

- **Part (3):** Obstetric history such as (gestational age, gravida, parity).

Tool II: The PRECEDE-PROCEED model construct: the questions designed according to educational-ecological assessment phase after reviewing related literatures **(Gamal et al.,2021, Kim et al., 2021 and Eisapareh et al., 2023)**. It included three parts:
Predisposing, Enabling and Reinforcing factors.

1. Predisposing factors which included 2 sections:

A. **Section (I) knowledge assessment sheet:**

Scoring system:

Every item received a score (2) for correct answer and a score (1) for incorrect answers. The sum of the scores for correct answers determined the total knowledge score. Higher scores indicated a greater understanding of GDM.

Total knowledge score was classified as following:

- Satisfactory knowledge: when the total knowledge score was ≥ 60%
- Unsatisfactory knowledge: when the total knowledge score was < 60%

B. **Section (II) Attitude assessment sheet**:

Scoring system:

The attitude assessment sheet had three point as Likert-type scale ranging from Disagree (1), Neutral (2) and Agree (3).

Women' total attitude score was classified as the following:

- Low attitude when the total score was < 60%
- Moderate attitude when the total score was 60 % to < 75%.
- High attitude when the total score was ≥ 75%.

2- Enabling factors: it included (6) questions for assessing women's social activities regarding gestational diabetes.

Scoring system:

The enabling factor sheet had three points as Likert-type scale (no (1), sometimes (2) and yes (3).

Women' total enabling factors score was classified as the following:

- Low social activities was < 60%.
- Moderate social activities was 60% to < 75%.
- High social activities was ≥ 75%.

3- Reinforcing factors: it included (5) questions to measure women's support and encouragement of peer, family and heath care staff regarding gestational diabetes.

Scoring system:

The reinforcing factor sheet had three points as Likert-type scale (no (1), sometimes (2) and yes (3).

Women' total reinforcing factors score was classified as the following:

- Low support and encouragement was > 60%.
- Moderate support and encouragement was 60% < 75%.

High support and encouragement was ≥ 75%.

Tool III: Health Promoting Lifestyle profile-II:

Health Promoting Lifestyle profile-II (HPLP II) was adapted from English version ***(Walker et al., 1987)*** and Arabic version ***(Abo- Ali,2021)*** to measure health-promoting behaviors of the pregnant women. It contained of 41 items and five subscales as follow; health responsibility (eight items), physical activity (seven items), nutrition (eleven items), interpersonal relationships (seven items), and stress management (eight items).

Scoring system:

The Health Promoting Lifestyle profile-II (HPLP II) had three points as Likert-type scale (never (1), sometimes (2) and always (3)). The total score of each dimension was computed by calculating the mean of responses to all that the dimensions items 41 items. The overall score was obtained by calculating the mean of response to overall HPLP- II score ranged from 41 – 123, higher score showed more health promoting behaviors.

Women's total lifestyle score was classified as the following:

- Poor lifestyle behaviors, when the total score was < 60%.
- Moderate lifestyle behaviors, when the total score was 60 < 75%.
- High lifestyle behaviors, when the total score was ≥ 75%.

Tools validity:

The tools of data collection were thoroughly reviewed by three experts, in Obstetrics & Gynecological health nursing to test the content validity. Modifications were carried out according to the panel' judgments on clarity of sentences and the appropriateness of content. Example Women self-care activities are more valuable in management of gestational diabetes.

Tools Reliability:

Reliability of tools was tested by using Cronbach's alpha coefficient test, which revealed that the tools consisted of relatively homogenous items as showed by the moderate to high reliability of each tool.the interanal consistency of knowledge assessment sheet was (α = 0.83), attitude likert scale was (α = 0.86), enabling factors sheet was (α = 0.76), reinforcing factors sheet was (α = 0.73), and finally health promoting lifestyle questionnaire was (α = 0.84) and it was ranged from 0.79 to 0.87 for the six subscales .

Ethical considerations:

Ethical aspects was considered before starting the study as the following:

Approval of faculty ethics committee for scientific research was obtained for fulfillment of the study. The aim of the study was explained to each woman before applying the tools to gain confidences and trust. An informed consent was obtained from each woman to participate in the study and withdrawal when she needs. The study was not having any physical, social, or psychological risk on the participant. The data was collected and treated confidentially.

Each women was informed about time throughout the study. The educational booklet was provided to pregnant women in the control group at the end of study to benefit in the subsequent pregnancies.

Pilot stud

The pilot study was conducted on 10 % of the total sample (14 women). It was conducted to test the simplicity, feasibility, clarity and applicability of the developed tool, also to find out the possible obstacles and problem that face the researcher and interfere with data collection. According to the result of the pilot study, required modification was done example when is the gestational diabetes test done, modified to in which trimester gestational diabetes is diagnosed. The pilot sample was excluded from the study.

Operational Design:

Field work:

Upon obtaining official permission from director of Benha university hospital, data was collected through five phases. The following phases were adopted to fulfill the aim of the current study: preparatory, interviewing, planning, implementation and evaluation phases. The field work of the current study was carried out from beginning of April 2023 to the end of March 2024 covering one year. The researcher visited Benha University Hospital three days/ week (Saturday, Monday and Wednesday.(

Preparatory phase:

The preparatory phase was the first phase of the study. The study was carried out through reviewing of past and current literature covering the various aspect of the problem using books, articles, magazines and network about studies related to effect of an educational program based on PRECEDE- PROCEED model on knowledge and health behaviors among women with gestational diabetes.

Interviewing and assessment phase:

- The researcher welcomed with the participant woman and introduced herself to the women. The researcher was explained the purpose of the study and provide the woman with all information about the study such as (purpose, duration and activities) and the process of the study was explained to the participant women to gain confidence and trust, then the researcher was taken informedconsent from all participant women were participate in the study. The researcher was provided appropriate place for the participant in this study to maintain the privacy and confidentiality of the study.

- **Planning phase:**

Based on the baseline data obtained from pre-program assessment and the existing relevant scientific resources (

Eberle et al., 2022 and Ghaffari et al., 2021), the researcher designed a booklet in Arabic language supported by figures and based on women's knowledge deficit about gestational diabetes mellitus, health promoting lifestyle and health adaptive measures regarding gestational diabetes and sexual function. The educational program was developed using PRECEEDE- PROCEED model as guideline then the researcher was designed 6 scientific sessions as the following 4 theoretical session and 2 practical session.

Implementation phase

❖ The researcher was provided health education program to the participant women about gestational diabetes through applying the precede proceed model. The researcher was visited the previous mention setting three days per week (Saturday, Monday and Wednesday). The researcher was interviewed and assessed the participant woman and distributed tool I, II, III and IV to all the participant woman according to each group. The researcher was applied precede proceed model through interactive 5 session for 3 days per weeks for eight consecutive week. 4 theoritical and 1practical.

❖ **Evaluation phase:**

❖ After 4 weeks post intervention data was collected to be compared with pre- intervention data using the same pre-assessment tools to evaluate the effect of an educational program based on PRECEDE- PROCEED model on sexual function and health behaviors among women with gestational diabetes. Evaluation started first with control group then with study group to avoid bias. The educational booklet was provided to women in the control group to benefit in subsequent pregnancies.

Statistical design:

- Data were verified prior to computerized entry. The statistical package for social sciences (SPSS Version 0.22) was used for that purpose, followed by data tabulation and analysis. Descriptive statistics were applied (e.g., mean, standard deviation, frequency and percentages). Chi-square tests, independent T- test and person correlation coefficients were used. Nonsignificant level value was considered when $p > 0.05$. A significant level value was considered when $p \leq 0.05$. And a highly significant level value was considered when $p \leq 0.001$.

Results:

Part I: General characteristics of the studied groups

Table (1): Distribution of control and study groups according to personal characteristics (n=140).

No statistical significant difference (p > 0 .05) t= independent t test

Group / Socio-demographic characteristics	Control group (n=70)		Study group (n=70)		X^2	P - value
	No.	%	No.	%		
Age (years)						
< 20	15	21.4	18	25.7	0.855	0.836
20 - < 25	8	11.4	7	10.0		
25 - < 30	20	28.6	16	22.9		
≥ 30 years	27	**38.6**	29	**41.4**		
Mean ± SD	**27.68 ± 6.51**		**27.98 ± 7.13**		**t=0.260**	**0.795**
Residence						
Rural	41	**58.6**	45	**64.3**	0.482	0.487
Urban	29	41.4	25	35.7		
Educational level						
Read and write	2	2.9	5	7.1	2.238€	0.536
Basic education	12	17.1	14	20.0		
Secondary education	36	**51.4**	29	**41.4**		
High education	20	28.6	22	31.4		
Occupation						
Employee	26	37.1	20	28.6	1.166€	0.280
Not employee	44	**62.9**	50	**71.4**		

€ Fisher Exact Test

Table (2): Distribution of the studied women in both groups according to anthropometric measurements (n=140).

Group / Anthropometric items	Control group n= 70		Study group n=70		X^2	P-value
	No.	%	No.	%		
Weight (kg)						
55 - < 75	12	17.1	10	14.2	0.516	0.735
75 - < 95	39	**55.8**	37	**52.9**		
≥ 95	19	27.1	23	32.9		
Mean ± SD	**81.48 ± 12.34**		**83.24± 13.54**		**t= -0.802-**	**0.424**
Height (cm)						
155 - < 160	13	18.6	11	15.7	0.373	0.830
160 - < 165	35	**50.0**	34	**48.6**		
≥165	22	31.4	25	35.7		
Mean ± SD	**162.97 ± 2.85**		**163.91 ± 3.33**		**t= -1.796-**	**0.075**
Body Mass Index (BMI) (kg/m²)						
Normal 18.5-24.9	9	12.9	6	8.6	0.682	0.711
Overweight 25.0 – 29.9	29	41.4	31	44.3		
Obese Above 30.0	32	**45.7**	33	**47.1**		
Mean ± SD	**29.12 ± 3.50**		**29.95 ± 3.23**		**t= -1.466-**	**0.145**

t= independent t test No statistical significant difference (p > 0 .05)

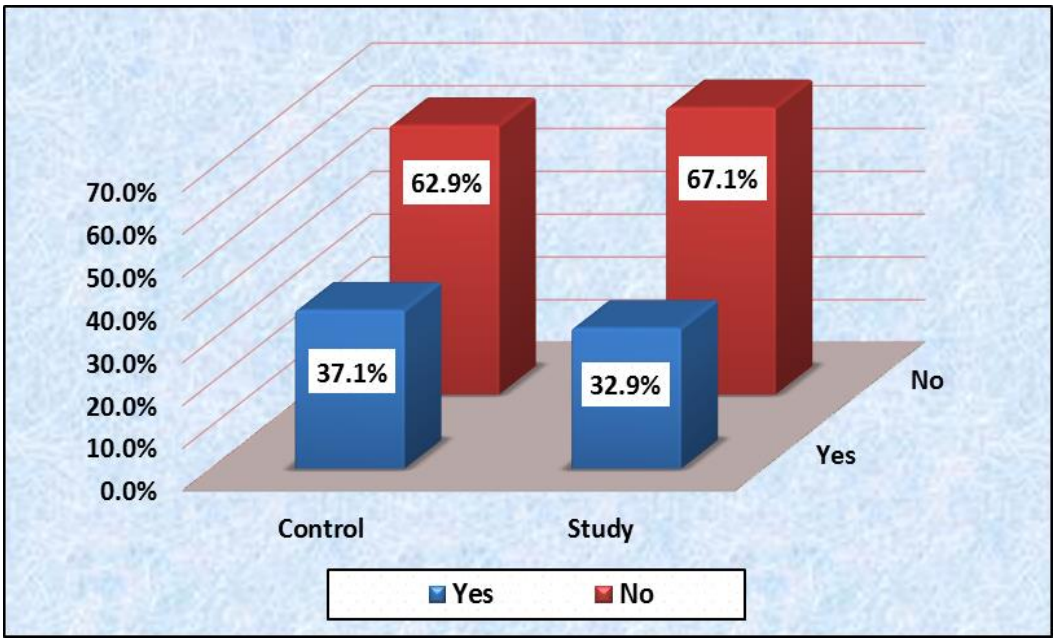

Figure (1): Distribution of the studied women in both groups in relation to family history of gestational diabetes (n=140).

Table (3): Distribution of the studied women in both groups according to obstetrical history (n=140):

Group / Obstetrical history	Control group (n=70)		Study group (n=70		X^2	P - value
	No.	%	No.	%		
Gestational age (weeks)						
- 26 - 27 - 28	18 32 20	25.7 **45.7** 28.6	15 41 14	21.4 **58.6** 20.0	2.441	0.295
Mean ± SD	**27.02 ± 0.74**		**26.98 ± 0.64**		**t =0.364**	**0.716**
Gravidity						
Primi gravida Multi gravida	22 48	31.4 **68.6**	27 43	38.6 **61.4**	0.785	0.376
Parity						
Non Primi parous Multi parous	22 28 20	31.4 **40.0** 28.6	27 25 18	38.6 **35.7** 25.7	0.785	0.675
Suffered from abortion before						
Yes No	5 65	7.1 **92.9**	2 68	2.9 **97.1**	1.353	0.245
Previous gestational diabetes	**(n=48)**		**(n=43)**			
Yes No	10 38	20.8 79.2	7 36	16.3 83.7	0.310	0.578

t= **independent t test** **No statistical significant difference (p > 0 .05)**

Table (4): Distribution of the studied women in both groups according to knowledge regarding gestational diabetes at pre and post intervention phases of precede proceed model (n=140).

Knowledge items	Pre-intervention					Post-intervention				
	Control group n=70		Study group n=70		X2 p-value	Control group n=70		Study group n=70		X2 p-value
	No.	%	No.	%		No.	%	No.	%	
The meaning of gestational diabetes										
Correct answer	26	37.1	18	25.7	2.12	29	41.4	48	68.6	10.41
Incorrect answer	44	62.9	52	74.3	0.145	41	58.6	22	31.4	0.000**
Women are at high risk for developing gestational diabetes										
Correct answer	20	28.6	28	40.0	2.02	23	32.9	48	68.6	17.86
Incorrect answer	50	71.4	42	60.0	0.154	47	67.1	22	31.4	0.000**
Causes of gestational diabetes										
Correct answer	14	20.0	22	31.4	2.39	30	**42.9**	56	**80.0**	20.37
Incorrect answer	56	80.0	48	68.6	0.122	40	57.1	14	20.0	0.000**
Risk factors that increase the possibility of developing gestational diabetes										
Correct answer	21	30.0	30	42.9	2.49	**25**	**35.7**	**59**	**84.3**	34.40
Incorrect answer	49	70.0	40	57.1	0.114	45	64.3	11	15.7	0.000**
Symptoms of gestational diabetes										
Correct answer	23	32.9	14	20.0	2.97	27	38.6	54	77.1	31.27
Incorrect answer	47	67.1	56	80.0	0.085	43	61.4	16	22.9	0.000**
Effect of gestational diabetes on the baby										
Correct answer	13	18.6	21	30.0	2.48	32	**45.7**	57	**81.4**	19.27
Incorrect answer	57	81.4	49	70.0	0.115	38	54.3	13	18.6	0.000**
Effect of gestational diabetes on the mother										
Correct answer	28	40.0	22	31.4	1.12	28	40.0	52	74.3	16.80
Incorrect answer	42	60.0	48	68.6	0.290	42	60.0	18	25.7	0.000**
Methods of diagnosing gestational diabetes										
Correct answer	15	21.4	20	28.6	0.952	26	37.1	55	78.6	24.63
Incorrect answer	55	78.6	50	71.4	0.329	44	62.9	15	21.4	0.000**
Trimester of developing gestational diabetes										
Correct answer	17	24.3	20	28.6	0.331	29	**41.4**	57	**81.4**	23.63
Incorrect answer	53	75.7	50	71.4	0.565	41	58.6	13	18.6	0.000**
Treatment methods for gestational diabetes										
Correct answer	19	27.1	24	34.3	0.839	21	**30.0**	56	**80.0**	35.35
Incorrect answer	51	72.9	46	65.7	0.360	49	70.0	14	20.0	0.000**
Ways to control gestational diabetes										
Correct answer	21	30.0	28	40.0	1.53	27	38.6	53	75.7	19.71
Incorrect answer	49	70.0	42	60.0	0.215	43	61.4	17	24.3	0.000**

No statistical significant difference (p > 0 .05) **** Highly Statistical Significant (P≤0.001)**

Table (5): Comparison of the mean scores of educational and ecological assessment phase structures of PRECEDE - PROCEED model of the studied women in both groups at pre and post intervention phases (n=140).

Items	Pre-intervention			Post-intervention		
	Control group n=70 Mean ± SD	Study group n=70 Mean ± SD	t test p-value	Control group n=70 Mean ± SD	Study group n=70 Mean ± SD	t test p-value
• **Predisposing factors (Driving Forces)**						
Knowledge	14.64 ± 1.83	14.35 ± 1.71	0.953 0.342	**14.92 ± 1.89**	**17.85 ± 2.21**	-8.413- 0.000**
Attitude	21.38 ± 4.16	20.68 ± 4.07	1.00 0.316	**21.94 ± 3.81**	**28.62 ± 5.46**	-8.389- 0.000**
• **Enabling factors**	10.00 ± 2.25	9.54 ± 2.59	1.111 0.268	**10.57 ± 2.18**	**13.88 ± 2.60**	-8.153- 0.000**
• **Reinforcing factors**	8.44 ± 2.26	8.18 ± 2.32	0.662 0.509	**9.10 ± 2.18**	**11.92 ± 2.12**	-7.765- 0.000**

No statistical significant difference (p > 0 .05) **A high statistical significant difference (P ≤ 0.001)
t= independent t test

Table (6): Comparison of the total mean scores of health promoting lifestyle behaviours regarding gestational diabetes in both groups at pre and post intervention phases (n=140).

Dimensions	Range of possible score	Control group Mean ±SD	Study group Mean ±SD	t test	P value
Total health responsibility					
Pre-intervention	8-24	12.25±4.51	11.97±4.42	0.37	0.70 ns
Post-intervention		15.40±3.78	18.72±7.34	3.37	0.000**
Total physical activity					
Pre-intervention	7-21	10.28±3.99	10.12±4.02	0.23	0.81 ns
Post-intervention		12.81±3.38	16.51±6.50	4.22	0.000**
Total nutrition					
Pre-intervention	11-33	15.87±6.10	15.70±6.16	0.16	0.86 ns
Post-intervention		20.40±5.31	26.05±10.27	4.09	0.000**
Total interpersonal relations					
Pre-intervention	7-21	9.80±3.42	9.84±3.41	0.07	0.94 ns
Post-intervention		12.77±3.32	16.47±6.47	4.25	0.000**
Total stress management					
Pre-intervention	8-24	11.10±4.11	10.97±4.02	0.18	0.85 ns
Post-intervention		14.30±4.57	18.94±7.46	4.43	0.000**
Overall score					
Pre-intervention	41-123	**59.31±21.81**	**58.61±21.88**	0.19	0.85 ns
Post-intervention		**75.44±19.59**	**96.71±38.02**	4.16	0.000**

Ns No statistical significant difference (p > 0 .05) **A high statistical significant difference (P ≤ 0.001)
t= independent t test

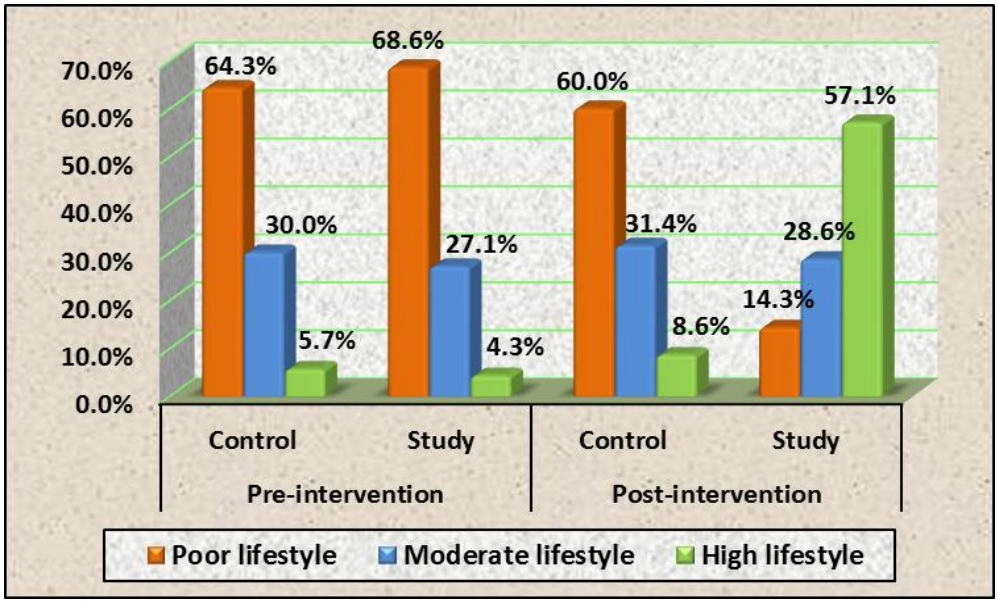

Figure (5): Distribution of studied women' total lifestyle behaviours score at pre and post intervention phases (n=140).

Table (7): Correlation between total health-promoting lifestyle score and educational and ecological assessment phase structures of PRECEDE – PROCEED model of both groups at pre and post intervention phases (n=140).

Variables	Total health-promoting lifestyle score							
	Control group n=70				Study group n=70			
	Pre-intervention		Post-intervention		Pre-intervention		Post-intervention	
	r	P-value	r	P-value	r	P-value	r	P-value
Predisposing factors								
Total knowledge score	0.583	0.000**	0.539	0.000**	0.499	0.000**	0.548	0.000**
Total attitude score	0.487	0.000**	0.467	0.000**	0.541	0.000**	0.651	0.000**
Enabling factors	0.556	0.000**	0.621	0.000**	0.574	0.000**	0.632	0.000**
Reinforcing factors	0.422	0.000**	0.453	0.000**	0.494	0.000**	0.593	0.000**

****A high statistical significant difference (P ≤ 0.001).**

Discussion:

Gestational diabetes mellitus is a type of glucose intolerance that develops during pregnancy and normally goes away after the baby is born. It is diagnosed during pregnancy that does not type 1 or 2 diabetes. It is diagnosed in the second or third trimester. It is a common medical complication in pregnancy that has been rapidly increasing worldwide **(American Diabetes Association, 2020)**

The current study aimed to evaluate the effect of an educational program based on PRECEDE- PROCEED model on Knowledge and health behaviors among women with gestational diabetes. This aim was significantly achieved through a quais-expermintal design. The finding of this study were accepted the research hypotheses which were, **H1:** Gestational diabetic women who will receive an educational program based on PRECEDE - PROCEED model will engage in health behaviors than those who don't recived. **H2:** Gestational diabetic women who will receive an educational program based on PRECEDE - PROCEED model will exhibit better Knowledge than those who don't recived.

Regarding personal characteristics of studied sample, the result of the present study revealed that there was no statistically significant difference between the control and study group regarding demographic data. Also, the results revealed that more than one third of both control group & study group aged ≥ 30 year with Mean ± SD 27.68 ± 6.51 for control group and 27.98 ± 7.13 for study group, Furthermore, more than half of control group & more than two thirds of study group lived in rural area, Moreover, more than half of control group & more than one third of study group had secondary education. Regarding occupation, less than two thirds of control group & less than three quarters of study group were not employee.

These results are in accordance with a study of the prevalence and risk factors for gestational diabetes according to diabetes in the pregnancy study group in India in comparison to the international association of diabetes and pregnancy study group in El Minya, Egypt by **Elsagheer & Hamdi (2018)** and found that more than half of women aged from 18 years to 42 years with mean age (26.5. ±5.5). From the researcher's point of view, this age group represents the most prevalent reproductive age group and reflects the fact that women were likely to be in middle age groups and this may be one of the knowledge deficit and resource deficiency in rural area than in urban area.

The result of current study disagreed with **El-Ansary & Fouad (2020)** who studied effect of

educational sessions on knowledge, attitude and self -care practices among pregnant women with gestational diabetes and in Egypt illustrated that most of pregnant women whose age ranged between 20> 30 years with a mean ± SD of 23.14 ± 4.68, less than one third of them had primary education. Meanwhile, it is pointed out that more than two thirds of pregnant women were not working, less than two thirds of pregnant women lived in rural areas and more than one third of them were from urban areas.

Concerning the studied women in both groups in relation to family history of gestational diabetes, the current study reported that less than two thirds of control group and more than two thirds of study group had no family history of gestational diabetes. On the other hand, more than one third of control group and less than one third of study group had family history of gestational diabetes.

These findings are congruent with **Mahmoud et al., 2024)**, who achieved a study to explore the effect of instructional package on knowledge and attitudes among gestational diabetic women in Egypt. The results showed that the majority of studied sample hadn't family history of diabetes mellitus.

Meanwhile, this result congruent to **Tora and Vahitha, (2021)** who studied effect of structured teaching program on knowledge regarding self-care management of gestational diabetes mellitus among gestational diabetic women" found that nearly two thirds of mothers had family history of diabetes and nearly one third had no such history.

On the contrast, these results are in disagreement with, **Mohamed et al., (2021)** who carried out a study to evaluate effect of educational program about gestational diabetes mellitus on knowledge and reported practice among women at Assiut city in Egypt and found that most of the studied pregnant women had history of gestational diabetes.

Referring to the studied women in both groups according to obstetrical history, the actual study reveal that less than half of control group and more than half of study group had gestational age of 27 week. Furthermore, two thirds of both control group and study group were multigravida. Moreover, more than one third of control group and study group were primi-parous. Increasingly the majority of control group and study groups hadn't abortion before. Also, more than three quarters of control group and most of study group hadn't gestational diabetes before. From the researcher point of view this reflect that gestational diabetes is more common in women

whose gestational age more than 27 weeks and in multigravida women.

In this respect, this result partially agreed with **El-Ansary et al., (2020)** who reported that more than three quarters of the pregnant women were multigravida and more than two thirds were multipara. Among pregnant women, less than one quarter had personal history of gestational diabetes. Women disagree with the average gestational age of the current pregnancy was 31.9 ±3.5. This result may be due to early detection of gestational diabetes during antenatal care and periodic examination.

The present finding are supported by **Khalil et al., (2017)** who carried out a study to apply screening for gestational diabetes among pregnant women attending a rural family health center-Menoufia governorate-Egypt, showed that less than two-fifths of the pregnant women were multigravida and more than half of them were multipara. Concerning mean gestational age among the studied pregnant women was 26.34 ± 3.56. This explained the similarity in characteristics of studied sample.

Lack of women's knowledge about gestational diabetes causes inadequate understanding of the medical information, which in turn leads to limited adherence to dietary and lifestyle changes and exposes both woman and fetus to more serious complications **(El-Ansary et al., 2020).**

Concerning the studied women's knowledge regarding gestational diabetes at pre and post intervention phases, present study shows that there was no statistically significant difference between the study and control group regarding knowledge about gestational diabetes at pre intervention phase whenever, there was a highly statistically significant difference between the study and control group at post intervention phase. According to the studied women's total knowledge score regarding gestational diabetes at pre and post intervention phases, present study findings cleared that more than one quarter of control group and less than one third of study group had satisfactory knowledge regarding gestational diabetes at pre-intervention phase. Meanwhile, more than one third of control group and more than three quarters of study group had satisfactory knowledge regarding gestational diabetes at post-intervention phase.

This significant improvement is very valuable, because acquisition of accurate knowledge is considered the basis for and linked to positive attitude and better self-care practice but the women need follow up for some time to change behaviors and make correct decisions. These result may be due to implementing intervention based on PRECEDE model was effective in improving knowledge regarding gestational diabetes.

This result is in line with **Ugwu and Ene, (2020)** who studied effect of diabetes education program on gestational diabetes mellitus knowledge among diabetic pregnant women clarified that more than three quarters of control group and more

than one quarter of study group had unsatisfactory knowledge regarding gestational diabetes at pre- diabetes education program. Meanwhile, more than one third of control group and more than three quarters of study group had satisfactory knowledge regarding gestational diabetes at post- diabetes education program. Similar finding was reported in a quasi-experimental study by **Mohamed and Ahmed (2019**) to assess the effect of educational program on maternal and fetal outcomes for 50 pregnant women with gestational diabetes at Assiut city, Upper Egypt. They reported a statistical significant difference between knowledge score pre and post the educational program.

These findings were congruent with the study of **Said and Aly (2019)** that was conducted in Benha, Egypt on 70 gestational diabetic women to investigate the effect of educational package regarding lifestyle and clarified that there was a highly statistically significant difference regarding knowledge before and four weeks after the educational intervention, less than one third of study group had satisfactory knowledge regarding gestational diabetes at pre-intervention phase. Meanwhile, more than three quarters of them had satisfactory knowledge regarding gestational diabetes at post-intervention phase.

Also, **Saboula, et al., (2018)** who assessed the impact of nursing intervention on knowledge, attitude and self-care activities among gestational diabetic women in Shebin Elkom, Egypt. They concluded a significant increase in the total knowledge score of gestational diabetic women post-intervention

In relation to comparison of the mean scores of educational and ecological assessment phase structures of PRECEDE - PROCEED model of the studied women in both groups at pre and post intervention phases, the present study illustrated that there was no statistically significant difference between Mean ± SD of both study and control groups regarding (knowledge, attitude, enabling factors and reinforcing factors) at pre-intervention. Whenever, there was a highly statistically significant difference between Mean ± SD of both study and control group at post intervention phase.

This is reflect the good effect of introducing the intervention based on PRECEDE model. Similary, **Asker et al., (2021)** who studied effect of educational intervention based on PRECEDE Model on preventive behaviors among high-risk individuals for diabetes type 2 in Egypt found that the mean knowledge, enabling, and reinforcing factors scores regarding diabetes were decreased pre-educational intervention implementation. While there was an increase in the mean scores of knowledge, enabling and reinforcing factors score with statistical significance immediately and after three months of nursing intervention implementation.

Also, the results are supported by **Moshki et al., (2017)** who conducted a

study titled with "Effect of Precede–Proceed Model on Preventive Behaviors for Type 2 Diabetes Mellitus in High-Risk Individuals" and reported that PROCEED model was very effective in improving and promoting knowledge, attitude and reinforcing factors for type 2 DM among high-risk patients.

Concerning comparison of the total mean scores of health promoting lifestyle behaviors regarding gestational diabetes in both groups at pre and post intervention phases, it was showed that there was no statistically significant difference in the mean score of the overall health promoting lifestyle behaviours and its dimensions between the both study and control groups in the pre-intervention phase. However, post intervention, the mean difference score for overall and dimensions of health promoting lifestyle behaviors in the study group was higher than the control group scores.

This result may be explained by the educational session provided in a suitable manner to be effective in improving all items related to health promotion lifestyles among studied women.

In the same context, **Mohammed et al., (2021)** showed that there was no statistically significant difference in all women's lifestyle elements regarding GDM before the execution of GDM educational sessions in both urban and rural groups (nutrition, physical activity, stress management, health responsibility, spiritual growth, and interpersonal relations). Otherwise, four weeks after providing GDM educational sessions in both urban and rural groups, all women's lifestyle items have improved in terms of GDM (nutrition, physical activity, stress management, health responsibility, spiritual growth, and interpersonal relations.

Concerning the studied women' total lifestyle behaviors score at pre and post intervention phases, the present study revealed that the minority of control group and study group had high lifestyle behaviors regarding gestational diabetes at pre-intervention phase. Whilst, the minority of control group and more than half of study group had high lifestyle behaviors regarding gestational diabetes at post-intervention phase. This finding agreed with **Zakaria et al., (2023)** at a study about the role of lifestyle interventions in the prevention and treatment of gestational diabetes mellitus which discussed that most of the studied subjects reported healthy lifestyle post intervention compared to the minority of them pre-interventions.

Similar to previous result of our study, **Mohsenzadeh-Ledariet al., (2022)** at a study to evaluate the effect of caring

intervention (physical activity, diet and counseling) on gestational diabetes for pregnant women with metabolic syndrome in United Arab Emirates and reported there was no significant difference in total lifestyle regarding GD between the intervention and control group pre-interventions while more than two thirds of intervention group had good lifestyle behaviors regarding gestational diabetes at post-intervention phase compared to control group.

For correlation between total health-promoting lifestyle score and educational and ecological assessment phase structures of PRECEDE – PROCEED model of both groups at pre and post intervention phases, the current results demonstrated that there was a highly statistically significant correlation between Total health-promoting lifestyle score and predisposing factors (total knowledge, attitude, enabling factors and reinforcing factors).

These results may be due to with enhancing awareness about factors that predispose to GD, leading to maintain the healthy preventive behavior to avoid complications and maintain healthy pregnancy. These results were consistent with **Zandinava, et al, (2019)** who studied the effect of educational packages on self-care Behavior, quality of life, and blood glucose levels in pregnant women with gestational diabetes found that, there was a statistically significant relationship between knowledge, enabling factors, and reinforcing factors scores and gestational diabetes and life style behavior practices scores of the pregnant women throughout the intervention phases group.

Also, These results are similar to **Barasheh, et al, (2018)** who studied the effect of an education program on improving self-care management behaviors in diabetic patients, found that there was a statistically significant relationship between enabling factors, reinforcing factors scores, knowledge and gestational diabetes life style of the pregnant women throughout the intervention phases.

Conclusion

In the light of the results of the study, it can be concluded that:

Based on the finding of the current study, it was concluded that study hypotheses were supported and the application of PRECEED-PROCEED model was effective in the improvement of knowledge, attitude and health behaviors among pregnant women with gestational diabetes with a highly statistically significant difference between pre and post intervention ($p \leq 0.001$).

Recommendations

Based on the results of the current study the recommendations were:

- Development of training program for maternity nurses and evidence based interventions to provide a better view of the women health promotion stratigies related to gestational diabetes.
- Provide outpatient clinic as well as maternal and child health centers with Arabic booklets and posters of health behaviors modification regarding gestational diabetes.
- Application of the educational program based on precede- proceed model regarding gestational diabetes in the routine care in antennal care clinics and continuously implemented to increase women's knowledge and improve their attitude about gestational diabetes as well as health behaviors and sexual health.
- Assessment of risk factors of gestational diabetes should be included in routine care that is provided at the outpatient clinics and maternal and child health centers.
- Applying educational program and counsling tips in gestational diabetic women discharge teaching plan to maintain healthy life style and maximum glycemic control prior to a future conception.

Further research:

- Investigate the impact ofgestational diabetes educational program on women's quality of life.
- Training courses and workshops about gestational diabetic care and management for health care providers at antenatal clinics should be conducted at regular intervals.

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