Effect of Health Belief Model based Educational Package on Lifestyle among Gestational Diabetic Women

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Abstract

Gestational diabetes mellitus (GDM) is associated with potentially harmful effects on the mother and fetus. Thus the identification of GDM offers a chance to improve pregnancy outcomes and identify women to target dietary & lifestyle health promotion. **Aim** of this research was to evaluate effect of health belief model based educational package on lifestyle among gestational diabetic women. **Design:** A quasi experimental design was utilized. **Setting:** This research was conducted in obstetrics & gynecological outpatient clinic and maternity hospital (high risk department) at the Zagazig University Hospital, Sharkia Governorate, Egypt. **Sample:** A purposive sample of (62) randomly women. **Tools:** Data were collected through three main tools: A self-administered questionnaire to assess women's general characteristics and knowledge regarding gestational diabetes mellitus, health belief model scale, and health promoting lifestyle Profile II. **Results:** showed that there was a highly statistically significant difference regarding all knowledge items and total of all items of health belief model before and after GDM educational package implementation (P< 0.000). Moreover, there was a highly statistically significant difference in relation to all items of women's lifestyle regarding GDM (nutrition, physical activity, stress management and health responsibility) before and after GDM educational package implementation (P < 0.001). **Conclusion:** There was a positive statistically significant correlation between total knowledge score, total lifestyle score and total health belief model score before and after GDM educational package implementation (p<0.001). **Recommendations:** Establishing strategies to enhance the women's understanding of healthy lifestyle by applying this model to a large sample in various obstetrics and gynecological outpatient clinics.

Keywords: Gestational diabetes, Health belief model, Educational package

1.2. Introduction:

Health systems face expensive challenges from chronic diseases. The four most prevalent chronic illnesses, according to the World Health Organization, are diabetes, cancer, respiratory illnesses, and cardiovascular illnesses. Additionally, diabetes is directly responsible for 1.6 million fatalities per year **(World Health Organization, 2021)**. One of the most significant metabolic disorders, diabetes which is characterized by a rise in blood glucose levels and an inability of the body to produce or utilize insulin. Diabetes is frequently asymptomatic in the early stages and damages internal organs. Gestational diabetes is one of the main types of diabetes (**Coronado-Vázquez, et al., 2019)**.

The term gestational diabetes mellitus (GDM) refers to varied degrees of glucose intolerance that develops or is first noticed during pregnancy. Gestational diabetes mellitus is a health issue that is spreading throughout the world. It is one of the most common pregnancy issues, and it comes with a high cost for medical care and other expenses **(de Mendonça etal., 2022)**. GDM prevalence ranges from 1% to 28%, based on screening techniques and population parameters. The high maternal age at pregnancy, prior obstetric history of GDM, history of large for gestational age babies, abortions, unexplained stillbirths in previous pregnancies, family history of both GDM and type two DM, obesity, twins, polycystic ovarian syndrome, sleep problems, and sedentary lifestyle are some of the factors that contribute to the high prevalence rate of GDM. **(Nigatu et al., 2022**).

In pregnant women, abnormal blood glucose levels can have an immediate and long-term impact on both the mother's and the fetus's health. GDM has an impact on both the current and the following generations. **(Alayoub et al., 2018)**. Preeclampsia,

macrosomia, shoulder dystocia, birth injuries, a higher risk of caesarean delivery, hypoglycemia, neonatal jaundice, respiratory distress syndrome, polycythemia, and hypocalcemia in newborns are complications that are linked to GDM that increase the risk of both maternal and neonatal complications **(Gharachourlo et al., 2018)**. Future type 2 diabetes and obesity are risks for both the GDM mother and her child. Mothers with gestational diabetes had a 50% chance of developing overt diabetes within 20 years **(Alejandro et al., 2020)**.

To establish sufficient glycemic control, pregnant women with GDM must be able to maintain a proper balance between various components of a comprehensive treatment. To improve their health, pregnant women must establish and follow a GDM treatment regimen on a regular basis. It consists of five parts: adhering to a food plan, frequent exercise, self-monitoring blood glucose (SMBG), using insulin, and taking care of one's feet **(McIntyre et al., 2020)**. The degree to which pregnant women adhere to their treatment plan for GDM affects how well they live overall. It frequently poses a significant problem for both patients and medical providers. Various studies have shown that diabetes compliance is not a homogeneous concept and instead differs across various elements of the regimen. Lack of information, regimen complexity, perceptions of benefit, side effects, expense of medication, and emotional well-being are some of the factors that affect compliance with the GDM regimen. **(Anjana et al., 2019)**.

The patient's impression of the severity of the illness process, perception of the advantages of adhering to therapy, and perceptions of obstacles to disease control are referred to as health beliefs. Health belief model was created to explain behaviors related to preventive health rather than those during disease **(Said & Aly, 2019)**. This model's goal is to make people more aware of a health concern and to influence their behaviour in favour of health. This model is a complete and accurate pattern that depicts the relationship between beliefs and behaviours; it has been widely applied to a variety of health behaviours, including improved nutritional knowledge, blood glucose testing, glucose control, lowering the need for insulin, and carbohydrate consumption reduction. It is also thought that with the appropriate education, up to 80% of diabetes may be prevented. Therefore, knowing people's perspectives and attitudes is crucial for creating diabetes management methods **(Daniati et al., 2021)**.

A platform for recognizing patient compliance with healthy habits is the Health Belief Model (HBM) which focuses on two elements of how someone conceptualizes and practices health. Five elements influence it: **Susceptibility** is the first component, and it affects the adoption of healthy habits by referring to the feeling of vulnerability to diabetes and its complications. The perception of diabetes as a serious condition, ranging from perceiving minimal consequences to considering diabetes as a life-threatening disease, is the second component, **severity**. The third factor, **benefits**, refers to the belief that the regimen is successful because the person feels better physically after responding and believes that the suggested method will lessen the risk of disease. The health advantages for GD will stop future pregnancy issues, adverse effects on the foetus, and DM in her children. The perceived expenses of maintaining the regimen are the subject of the fourth element, **barriers**. The person compares the advantages and disadvantages, and may arrive at the decision that the disadvantages exceed the advantages. Finally, it is necessary to change affecting factors including age, education, and the number of pregnancies **(Anuar et al., 2020)**.

In order to better understand pregnant women's danger perceptions and to apply methods that motivate them to implement healthy lifestyle changes that will help them adhere to their treatment plan and avoid further complications and consequences of gestational diabetes. Nurses can do this by using the Health Belief Model. **(Saboula et al., 2018)**. It's likely that every one of the five dimensions performs separately, and a lack in any one of them could result in failure to engage in healthy behaviors. It's also feasible that interactions between the various components affect how at-risk a diabetic pregnant woman feels. **(Mohamed et al., 2020)**.

Significance of the study

Among the main issues with GDM is that it has minimal manifestations and that most pregnant women are not aware they have it until it is discovered during a normal prenatal screening. It is considered as one of the most reliable indicators of type 2 diabetes. Women who have had GDM don't understand they're at risk of getting type 2 diabetes **(Hailu et al., 2019)**. As a result, GD women should implement healthy behaviour methods to stop or delay DM. It should be mentioned that understanding what factors may affect mothers' opinions of their HBM is crucial to determining the appropriate level of care and support. So many morbidities may be avoided, and mothers' experiences at this sensitive time could be enhanced.

1.3.Aim of the current study:

The aim of the present study was to evaluate effect of health belief model based educational package on lifestyle among gestational diabetic women.

Hypothesis:

The following research hypotheses were developed in order to accomplish the goal of this study:

H1. Receiving health belief model based educational package will improve the knowledge of pregnant mothers with GDM.

H2. Pregnant GDM women who get the educational package will demonstrate higher HBM scores.

H3. The health belief model-based educational package will help pregnant women with GDM maintain a healthy lifestyle throughout their pregnancies..

2. Subjects and methods:

The operational definition of the health belief model assumes that health behaviors are motivated by six structures, including perceived sensitivity, a person's belief in the perception of being in a particular situation, perceived severity, a person's opinion of how serious these conditions are, perceived benefits, a person's opinion of the effectiveness of suggested activities to reduce the risk of the effect, perceived barriers, and belief about the potentiation of the situation, cues to action, accelerated factors that spur an individual's demand for action, self-efficacy, and assurance in her capacity to adhere to a behavior

2.1. Design of the Study: The research with a pre/post program was carried out using a quasi-experimental research design.

2.2. Study setting:

The study was carried out in the Zagazig University Hospital, Sharkia Governorate, Egypt, at the obstetrics and gynecology outpatient clinic and maternity hospital (high risk department).

This has a room that is divided into a diagnostic and an examining space. Additionally, the researcher interviewed the selected women to apply the GDM instructional package at the women's admissions waiting area. This clinic offers services for family planning counseling, obstetrics and gynecological treatment, as well as any outpatient procedures, and is open from 9.00 AM to 2:00 PM. The antenatal care section comprises cases that require a hospital stay.

2.3. Sample Type*:*

A purposefully selected group of 62 women made up the study's sample.

2.4. Sample Size:

Ability of women to do stress management before intervention was 22.9 % enhanced to be 48.4% after intervention program, **(Said and Aly, 2019)** confidence level is 95% two side with power of study 80%, Sample size calculated using Open Epi, is 62 patients. Open Epi, Version 3, open source calculator—SSPropor

2.5. Inclusion criteria:

- Pregnant women who have GDM and consent to take part in the study.
- Been between the ages of 20 and 35.
- Between 24 and 28 weeks gestation.
- A woman can read and write.

- Pregnant women who are healthy and have no medical conditions.

2.6.Exclusion criteria:

Women who have any other illnesses (e.g. diabetes, asthma, epilepsy, hypertension, thyroid dysfunction, anemia, respiratory, and cardiac diseases and psychological complications).

Recruitment of the sample

In this study, 62 GD-pregnant women participated. Six groups were formed and assigned to them. Each of the five groups included ten women, and one group had twelve. Five women dropped out of the study because they couldn't make it to the forthcoming sessions, and all of them were replaced by the next prospective women. The flowchart of the studied sample is presented in **Figure 1**.

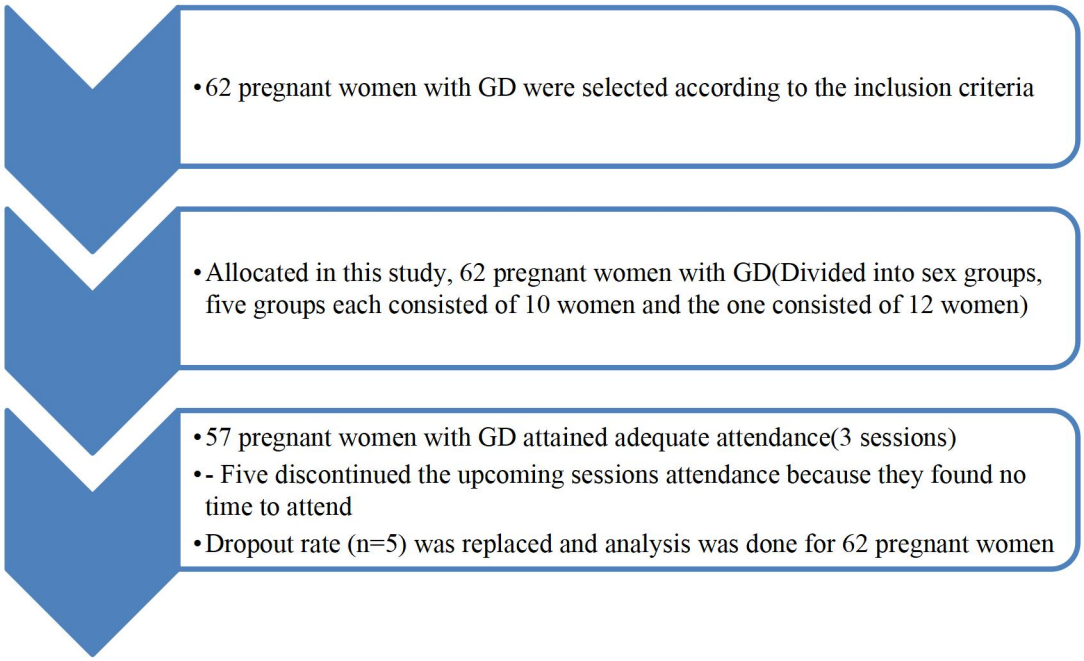

Figure 1: Flowchart of the study sample

2.7. Tools of data collection:

Three main instruments were utilized to gather data for this study in order to achieve its goal:

Tool (I). A self-administered questionnaire: The researchers created it after reading pertinent material **Javid et al (2015).** It was composed of two parts and prepared in Arabic as closed-ended questions under the supervision of the authorities.

Part 1- Personal data of women included the following (age, residence, level of education, occupation and income).

Part 2- The women's obstetric history included (gestational age, number of pregnancies, deliveries and history of abortion and present clinical condition).

Part 3: Women's knowledge regarding GDM:

The researchers translated the women's knowledge questionnaire from English into Arabic after adapting it from **Bhavadharini et al., (2017)**. A seven-item questionnaire was used to gauge pregnant women's understanding about GDM. The seven closed-ended questions address the following topics: known risk factors for GDM; effects of GDM on future type 2 diabetes mellitus; effects of GDM on pregnancy; long-term health effects for children born to GDM mothers; blood sugar test performed after delivery for GDM mothers; and how long the blood sugar test should be performed after delivery.

Scoring:

For each item, a score of (2) was provided when the response was entirely accurate, a score of (1) was given when the response was only partially accurate, and a score of (0) was given when the response wasn't known. Participants who checked one of the items (yes) were given (2), those who checked one of the items (no) were given (1), and those who checked one of the items (don't know) were given (0). The following categories applied to the overall knowledge score of women:

Cut off value of knowledge

Lower tertile: poor

Middle tertile: fair

Upper tertile: good

Tool (II). Health Belief Model Scale (HBM Scale):

The researchers translated **Hurley's (1990)** health belief model into Arabic after adapting it. The HBM scale was created to assess women's psychological readiness to combat diabetes. Comprising six constructs (28 statements). It contained cues to action (5 items), perceived benefits (3 items), perceived benefits, perceived barriers, perceived susceptibility (3 items), perceived severity (5 items), and self-efficacy (7 items).

Scoring:

The HBM scoring system divided each response's interpretation into three categories: agree, neutral, and disagree. Two points were given for agreement, one point for neutrality, and zero points for disagreement. If the statement was negative, SPSS's scoring method was reversed; agreeing received a score of 0, neutral received a mark, and disagreeing received a score of 2. Since each component was calculated separately, each patient received six different scores. By adding all the results, the construct's mean scores were determined. A higher score indicated a more positive attitude toward type 2 diabetes mellitus in terms of health beliefs. The possible total score range was (28-56 marks).

Cut off value of health belief model:

Mean of each subscale
disagree 1-1.66
neutral :1.67-2.33
agree: 2.34-3

Tool (III). Health-Promoting Lifestyle Profile II

(HPLPII): The researchers translated the health-promoting lifestyle into Arabic after adapting it from **Walker, Sechrist, and Pender's, (1995)** work. It assesses the frequency of self-reported healthy behavior's with a focus on four key areas: nutrition, physical exercise, stress management, and health responsibility. There are four subscales in the 34-item questionnaire, each of which focuses on a different aspect of lifestyle behaviour. Nutrition (1–9 items) refers to choosing and consuming a nutritious diet that complies with the food guide pyramid's recommendations, which are crucial for one's health and well-being, whereas physical exercise (10–17 items) refers to engaging in regular activity. Stress management (18–25 items), which is the identification and application of measures to control or relieve stress, is another component of this instrument. The health responsibility subscale, which comprises 26–34 items, is the last one on this tool. It measures an individual's belief that they are responsible for their own health and well-being and can do so by becoming educated, paying attention to their own health, and being informed when seeking professional help.

Scoring:

A three-point Likert-type scale with the HPLPII has the following values: Never (1), Sometimes (2), and Always (3). Calculating the average of the responses to all items yields the health-promoting lifestyle's overall score. Additionally, the mean for each set of items on the subscale is used to determine the subscale scores. The following categories apply to the overall lifestyle score for women:

Cut off value of life style:

Each subscale
Never 1-1.66
Often :1.67-2.33
Always: 2.34-3

Validity:

Three experts in obstetrics and gynecological nursing reviewed the tools for clarity, relevance, applicability, comprehensiveness, comprehension, and simplicity of execution before establishing it for face and content validity. They also included minor revisions as they saw fit.

Reliability:

Table (1): Test of reliability of study tools by Cronbach's Alpha

Tool	Cronbach's Alpha	N of Items
patients' knowledge	0.98	7
belief model	0.963	28
of life style	0.984	34

Ethical Considerations:

To acquire their consent for data collection, the relevant authorities for the study setting were sent an official letter from the Faculty of Nursing, which served as an official authorization.

All ethical considerations were taken into account at every stage of the study, and the subjects' anonymity and confidentiality were upheld. Before each woman agreed to participate, the researchers introduced themselves and gave a brief explanation of the study's nature and goal. Women were then enrolled freely following the oral informed consent process. Women were also informed that the information gathered would be kept private and would only be utilized for research.

A pilot study:

A pilot research was conducted. It tested the accuracy and applicability of the research tools as well as the estimation of the time required to complete the questionnaire using 10% of the entire sample (6 women). Women who participated in the pilot study are included in the study.

The findings of the pilot study revealed that:

-The tools were applicable and understandable; however a few words were changed;

- The tools were pertinent and reliable.

-No issue that could have prevented the collecting of data was found.

- The tools were made ready for usage after this pilot study.

Field of the work:

The following steps were taken in order to accomplish the research's goal. Phases of assessment and interviewing, planning, implementation, and evaluation. These phases took place over a five-month period, commencing at the beginning of May 2022 and ending at the end of October 2022. The researchers spent three days every week (Sunday, Tuesday, and Thursday) in the aforementioned location from 9.00 AM to 2.00 PM.

I- Interviewing Phase& assessment phase:

The researchers greeted the women, introduced themselves, discussed the goal of the study, and gave the women all the details of the study, including its aim, duration, and activities, and obtained the women's verbal consent to participate in the study before the interview even began. The researcher gathered data by having each woman complete the self-administered questionnaire, the Health Belief Model Scale, the Health-Promoting Lifestyle Profile II, and the Women's Knowledge regarding GDM Sheet. Each woman's interview took about the same amount of time to complete on average (25-30 minutes). Every day, an average of (1-3) women were collected. In six groups of 10 to 12 women, they received three theoretical and practical education sessions on gestational diabetes, one session every two weeks (at the women's admissions waiting room and at high risk pregnancy room)

II-Planning Phase:

The GDM teaching package was created using the outcomes of the assessment phase. The number of sessions, their content, the various teaching strategies, and the instructional media were chosen in accordance with the intervention group. The overall goal of the GDM educational package initiative was to increase women's essential knowledge of GDM and promote healthy lifestyles.

III-The intervention phase: The educational intervention was implemented over an eight-week period. Data were gathered three days

per week. The hospital personnel provided the pregnant women with usual treatment, and they also took part in the GDM educational program during three scheduled sessions. Each session lasted around (45–60) minutes and was carried out in accordance with the date determined by the women during her pregnancy follow-up. Women were introduced to the GDM instructional package's contents at the start of the first session. At the conclusion of the session, each woman was given information on the start time of the following one. The next session began with a review of the previous session and an explanation of the goals of the current session in simple Arabic to better fit the comprehension of the female audience. Mothers' queries were addressed to clear up any misunderstandings at the conclusion of each session. **The first session**, which started on the women's first visit after the interviewing phase, covered definition, risk factors, and how pregnancy affected DM. The **second session**, which started during the women's second visit after the interviewing phase, focused on the impact of DM on pregnancy and the long-term health effects for the offspring of GDM moms. **The third session** began at the third visit after the interviewing process for the women, and it covered the importance of leading a healthy lifestyle in managing gestational diabetes. Each subgroup of (1-3) women received these sessions once more. Several instructional techniques were employed, including brainstorming, discussion, and initial and repeated demonstrations. All enrolled women in the study were given teaching materials, including videos, to help the study's goals be met. These materials were focused on mothers' healthy lives about GDM and contained all of the session's content**.**

An Arabic booklet developed by the researchers using simple Arabic language to suit women' level of understanding that includes definition, risk factors and the effect of pregnancy on DM, the effect of DM on pregnancy and long-term health consequences for the children born to GDM mothers, and how to improve lifestyle and management . The researchers followed the women and talked on the phone with them while collecting data.

V- Evaluation phase:

Using the same set of tools that were used during the evaluation phase, the GDM educational package's efficacy was assessed four weeks after the implementation phase. The researcher telephone-tracked women at nearly the appointed time. Additionally, in accordance with study ethics rules, the researcher created a GDM instructional package for the women after conducting an evaluation.

Statistical Analysis

All data were collected, tabulated and statistically analyzed using IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. Quantitative data were expressed as mean and standard deviation, (range), and qualitative data were expressed as number & (percentage). Paired t test was used to compare between paired of normally distributed variables. .Percent of categorical variables were compared using, Chi square test. Pearson's correlation coefficient was calculated to assess relationship between various study variables, (+) sign indicate direct correlation & (-) sign indicate inverse correlation, also values near to 1 indicate strong correlation & values near 0 indicate weak correlation. All tests were two sided. P-value < 0.05 was considered statistically significant, p-value ≥ 0.05 was considered statistically insignificant.

Limitation of the research study:

Because of the loudness and interruptions from other people, the sessions occasionally lasted too long, and the researchers overcome this is limitation by interviewing the women before visitors come to their women's.

Results

Table (2) shows the general characteristics of the pregnant women. It is clear from this table that, 56.5% of the pregnant women aged > 30 years with mean ± SD 30.1±5.2and 41.9% of them had secondary education.

69.4% of women weren't working and 62.9% of them were from rural origin.

Table (3) illustrates distribution of studied sample regarding obstetrics history. The mean gestational age was 28.7±2.4 among the studied group and the mean of BMI were .Concerning frequency of pregnancy, it was obvious that 51.6% were pregnant for three times or more. Regarding number of delivery, 25.8% of them were delivered for two times. As regards history of abortion, it was found that; 69.4% hadn't history of abortion and 67.7% had family history of diabetes. Moreover 74.2% of women were previously diagnosed with GDM.

Regarding women's knowledge about Gestational diabetes **table 4** demonstrated that, There was a highly statistically significant difference regarding all knowledge items before and after GDM educational package implementation (P< 0.000).The mean of total knowledge were5.9 ±3.5 pre intervention compered to8.9±3.1 post intervention.

Table (5) demonstrates that ,there was a highly statistically significant difference regarding all items of health belief model (total perceived seriousness, total perceived benefits, total perceived barriers and total self-efficacy) before and after GDM educational package implementation (P< 0.000). In perceived susceptibility value was observed with a mean of 6.5±1.7 post intervention compared with a mean of 5.7±2.2 pre-application of the HBM intervention With respect to perceived severity, post HBM intervention application, were10.3±2.9 compared with a mean of 9.1±3.2 pre intervention of HBM. Regarding perceived benefits post HBM application, were 6.6±1.4compared with a mean of 5.7±2 pre-intervention.

Concerning perceived barriers post-HBM application, were 11±2.6 compared with a mean of 9.5±2.5pre-intervention. With respect to cues to action post-application of HBM, were 10.7±2.6 compared with a mean of 9.3±3.2pre-intervention. As regards self-efficacy post-application of HBM, were 15.3±3.2 compared with a mean of 13.6±4pre-intervention.

Figure 1 illustrates the total constructs of the health belief model. It obvious that high HBM scores toward GDM before GDM educational package implementation, compared to post intervention.

Table (6) shows that, there was a highly statistically significant difference in relation to all items of women's lifestyle regarding GDM (nutrition, physical activity, stress management and health responsibility) before and after GDM educational package implementation (P < 0.001). Moreover the total mean of Health-Promoting Lifestyle was73.3±18.4 post intervention compared to 64.9±24 pre intervention.

Figure (3) reveals that there were improvement in lifestyle among studied women after implementation of GDM educational package and the women follow healthy lifestyle.

Table (7) reveals that there was a positive relationship between total health belief model score and lifestyle profile after implementation of the educational GDM package(P < 0.001).

Table 2: Demographic characteristics of studied women (n=62).

variables		n	Percent
Age	<30 years	27	43.5
	≥30 years	35	56.5
	Mean ± SD	30.1±5.2	
	Range	20-40	
Residence	Urban	23	37.1
	rural	39	62.9
Occupation	housewife	43	69.4
	working	19	30.6
Education	Read and write	20	32.3
	Secondary school	26	41.9
	University	16	25.8
Income	Indept	10	16.1
	Just meet life expenses	24	38.7
	insufficient	28	45.2

SD: Standard deviation

Table 3: Obstetric history of studied women (n=62).

		n	Percent
Gestational age	<30 weeks	36	58.1
	≥30 weeks	26	41.9
	Mean ± SD	28.7±2.4	
	Range	25-33.	
Gravidity	G1	14	22.6
	G2	16	25.8
	Three times or more	32	51.6
Parity	P1	15	24.2
	P2	16	25.8
	Three times or more	23	37.1
History of abortion	No	43	69.4
	Yes	11	17.7
Family history of diabetes	Yes	42	67.7
	No	20	32.3
Diagnosed gestational diabetes	Yes	46	74.2
	No	16	25.8

Tables 4: Patients' knowledge about Gestational diabetes throughout study phase (n=62).

Domains		Study phase				Paired t	p-value
		Pre intervention		Post Intervention			
		No.	%	No.	%		
Patients' knowledge about	Mean ±SD	5.9 ±3.5		8.9±3.1		5.38	0.0001
Gestational diabetes(14)*	Good	8	12.9	30	48.4		
	Fair	38	61.3	23	37.1		
	Poor	16	25.8	9	14.5		

Paired t test of significant , p>0.05 no significant , *p<0.05 significant

Table 5: Patients' health belief throughout study phase (n=62).

Domains		Study phase				Paired t	p-value
		Pre intervention		Post Intervention			
		No.	%	No.	%		
Perceived severity(15)*	Mean ±SD	9.1±3.2		10.3±2.9		5.1	0.0001
	agree	14	22.6	23	37.1		
	neutral	27	43.5	25	40.3		
	disagree	21	33.9	14	22.6		
Perceived susceptibility (9)	Mean ±SD	5.7±2.2		6.5±1.7		5.69	0.0001
	agree	14	22.6	15	24.2		
	neutral	27	43.5	30	48.4		
	disagree	21	33.9	17	27.4		
Perceived barriers(15)*	Mean ±SD	9.5±2.5		11±2.6		5.91	0.0001
	agree	13	21.0	18	29.0		
	neutral	27	43.5	38	61.3		
	disagree	22	35.5	6	9.7		
Perceived benefits(9)*	Mean ±SD	5.7±2		6.6±1.4		6.8	.000
	agree	9	14.5	12	19.4		
	neutral	34	54.8	36	58.1		
	disagree	19	30.6	14	22.6		
Cue to action(15)*	Mean ±SD	9.3±3.2		10.7±2.6		5.75	0.0001
	agree	13	21.0	21	33.9		
	neutral	29	46.8	31	50.0		
	disagree	20	32.3	10	16.1		
Perceived self-efficacy (21)*	Mean ±SD	13.6±4		15.3±3.2		6.35	0.0001
	agree	11	17.7	19	30.6		
	neutral	31	50.0	37	59.7		
	disagree	20	32.3	6	9.7		
Patients' health belief (84)*	Mean ±SD	54.4±16.6		59±11.9		6.1	0.0001
	agree	14	22.6	23	37.1		
	neutral	27	43.5	31	50.0		
	disagree	21	33.9	8	12.9		

Paired t test of significant , p>0.05 no significant , *p<0.05 significant

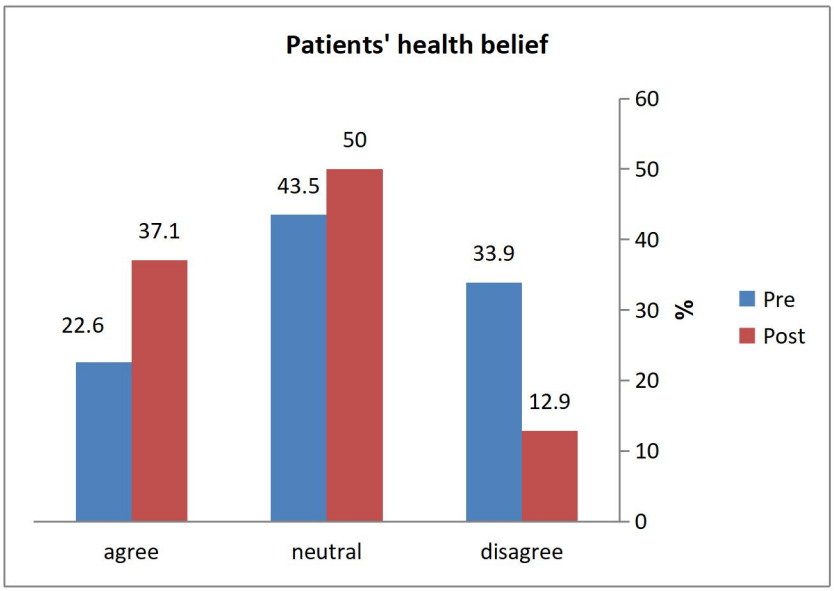

Figure 2; Percent of total patients' health belief throughout study phase (n=62).

Tables 6: Patients' health-promoting lifestyle profile throughout study phase (n=62).

Domains		Study phase				Paired t	p-value
		Pre intervention		Post Intervention			
		No.	%	No.	%		
Nutrition(27)*	**Mean ±SD**	**17.6±6.1**		**20.2±4.7**		6.59	0.0001
	always	12	19.4	21	33.9		
	Often	31	50.0	35	56.5		
	never	19	30.6	6	9.7		
Physical Activity(24)*	Mean ±SD	15 ±5.9		16.7±4.9		5.53	0.0001
	always	9	14.5	14	22.6		
	Often	32	51.6	33	53.2		
	never	21	33.9	15	24.2		
Stress Management(24)*	Mean ±SD	15.1±6		17.1±5.1		4.68	0.0001
	always	6	9.7	22	35.5		
	Often	35	56.5	28	45.2		
	never	21	33.9	12	19.4		
Health Responsibility(27)*	Mean ±SD	17.2±6.1		19.2±4.8		6.4	0.0001
	always	12	19.4	15	24.2		
	Often	29	46.8	40	64.5		
	never	21	33.9	7	11.3		
Health-Promoting Lifestyle (102)*	Mean ±SD	64.9±24		73.3±18.4		7.1	0.0001
	always	11	17.7	20	32.3		
	Often	30	48.4	31	50.0		
	never	21	33.9	11	17.7		

Paired t test of significant, p>0.05 no significant, *p<0.05 significant

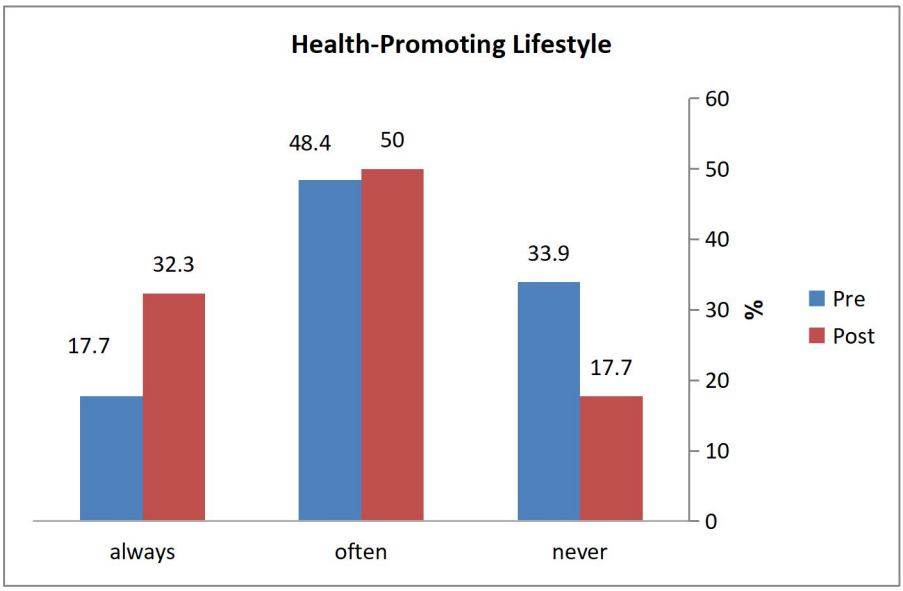

Figure 3: Percent of total patients' Health-Promoting Lifestyle throughout study phase (n=62).

Table 7: Correlation matrix between, knowledge, Health belief model, lifestyle profile of studied patients throughout study phases (n=62).

Parameters		Health belief model score		lifestyle profile score	
		(r)	P	(r)	P
Pre	Health belief model	1			
	lifestyle profile	0.4*	0..001	1	
	knowledge score	.019	0.88	0.014	0.91
Post	Health belief model	1			
	lifestyle profile	0.901*	0.0001	1	
	knowledge score	0.27*	0.034	0.386*	.002

(r) correlation coefficient **p<0.05 significant**

Discussion

Diabetes mellitus is a serious public health problem that is linked to high rates of illness, mortality, use of healthcare resources, and expenses. It is also correlated to possibly negative effects on the mother and the fetus, which can potentially jeopardize both of their health. Additionally, one model that is frequently utilized as a framework for interventions involving health behavior, particularly GDM behavior, is the Health Belief Model **(Tavakkoli et al., 2018)**.

People need to have strong health values if they intend to improve their behavior. They should be aware of health dangers, recognize how serious they are, and recognize the advantages of changing their behavior. The level of health belief and its components can be used to assess if it is possible to enhance health behavior in a population group **(Mohebbi et al., 2019)**. This model is a systematic pattern that illustrates the relationship between beliefs and behaviors; it has been extensively used for a variety of health behaviors, particularly screening behavior patterns, and it is essential for disease prevention **(Mahmoud et al., 2018)**.

The present study found that, the mean gestational age of the studied group was 28.7±2.4 week. More than half of the women had pregnancy three times or more. More than two third of them had no history of abortion, nearly three fourth of them had history of gestational diabetes. These finding consistent with **El-Ansary & Fouad, (2020)** study in Egypt about Effect of Educational Sessions on Knowledge, Attitude and Self-Care Practices among Pregnant Women with Gestational Diabetes who found the same results.

The current study findings showed that, there was a highly statistically significant difference regarding all knowledge items before and after GDM educational package implementation (P<0.000) (as knowledge had been markedly increased post intervention; just less than one sixth of the studied women had good knowledge score pre-intervention compared to nearly half of them post-intervention. Because exact knowledge is thought to be the fundamental basis of positive attitude and better self-care practices, this substantial improvement is extremely valuable. However, the women still require follow-up care for a period of time in order to change their behaviors and make the right decisions. This is supported by the **Mohamed &Ahmed, (2019)** study in Egypt about the effect of educational program on maternal and fetal outcomes for pregnant women with gestational diabetes which reported a statistical significant difference regarding score of knowledge pre and post the educational program. Similar results were reported by **El-Ansary & Fouad, (2020)**.

The study findings is matching with study conducted by **Saboula, Ahmed & Rashad (2018)** who evaluated how nursing intervention affected Egyptian women with gestational diabetes' knowledge, attitudes, and self-care practices. They reported that after the intervention, pregnant diabetic women's overall knowledge score had significantly increased.

According to the present study findings, there was a highly statistically significant difference regarding total of all items of health belief model (perceived severity, perceived susceptibility, perceived benefits, perceived barriers, cue to action and perceived self-

efficacy) pre and post GDM educational package education. Based on these results, it can be concluded that the educational intervention program was successful in improving diabetes knowledge of studied women. These results were, in turn, consistent with the study by **Mohebbi et al., (2019)**, who found that, after intervention, perceived susceptibility, severity, barriers, benefits and self-efficacy revealed significant differences in the intervention group compared with controls (P = 0.001). In addition, a study by **El-Ansary & Fouad, (2020)** documented that, there was a highly statistically significant difference regarding all items of health belief model (total perceived seriousness, total perceived benefits, total perceived barriers and total self-efficacy) before and 4 weeks after GDM educational package implementation (P< 0.000).

With respect to this, the study by **Tavakkoli et al., (2018)** who studied the effect of educational intervention based on the Health Belief Model on quality of life among women with gestational diabetes and demonstrated that the intervention group's mean scores on knowledge, benefits, obstacles, dangerousness and seriousness, performance, cues to action, and behavior significantly enhanced following the educational program. This might be because health-based education has a good impact on pregnant diabetic women's lifestyles. The present study demonstrated that there was a highly statistically significant improvement in all items of women's lifestyle (nutrition, physical activity, stress management and health responsibility) before and after GDM educational package implementation (P<0.001) and the women follow healthy lifestyle.

The right education that has raised women's knowledge and enhanced their healthy practices may be responsible for this change in their lifestyle. The expectant mother used her education and experience as a resource to properly manage her health. Self-care habits and adherence to treatment regimens are generally influenced by one's attitude, knowledge, resources, and cultural background. These findings are similar to **El-Ansary & Fouad, (2020)** study who found that most of women had low level of self-care practices pre intervention that improved post intervention and most of them had good total self-care practices score.

Overall, the study's findings showed that educating pregnant women about gestational diabetes and emphasizing a balanced diet, physical activity, and weight management improved their knowledge, attitude, and self-care behaviors. Such enhancement may be attributable to the researchers' effective communication abilities and the women's active participation. Women's engagement encourages them to alter their lifestyles in an attempt to increase their desire to gain knowledge about the management of gestational diabetes. Women must receive consistent education to modify their lifestyles and avoid the development of type 2 diabetes mellitus.

Also the present study showed a positive statistically significant correlation between total knowledge score, total lifestyle score and total health belief model score before and after GDM educational package implementation (p<0.001) which highlighted that increased knowledge level leads to improving one's lifestyle. These results are in the same line with **El-Ansary & Fouad, (2020)** study who reported similar findings.

Similarly, the study of **Gharachourloi et al., (2018)** found that, three weeks following the intervention, substantial differences in the mean scores for lifestyle and health literacy; indicating a positive impact of a health literacy approach to counseling on the lifestyle of women with gestational diabetes.

Conclusion

Based on the results of the current study, the tested hypotheses that gestational diabetes awareness among pregnant women would improve after the implementation of training sessions were approved. Before and after the implementation of the GDM teaching package, all components of the health belief model (perceived severity, perceived susceptibility, perceived advantages, perceived barriers, cue to action, and perceived self-efficacy) showed statistically significant variations (P 0.000). Before and after the implementation of the GDM educational package, there was a highly

statistically significant difference in connection to all GDM-related lifestyle factors for women (nutrition, exercise, stress management, and health responsibility) (P 0.001).

Recommendations:

Based on the research findings, the following was recommended:

1. Raising mothers' understanding of the value of leading a healthy lifestyle to decrease GDM problems.
2. The Health Belief Model should be a crucial component of GDM management.
3. By applying this model to a large sample in various obstetrics and gynecological outpatient clinics, solutions are being established to improve the women's awareness of healthy lifestyles.

Future researches:

1. In order to better their understanding and treatment of GDM, all nurses working in obstetrics and gynecological outpatient clinics should receive the key Health believe model information.

Strength and limitations of the study:

In this study, the HBM model was employed to look into the variables crucial to comprehending self-management behaviours in a group of Egyptian women with gestational diabetes.

The study did have several shortcomings, though. The self-report approach used to assess self-care behaviors depended on patients' memory of their routines and medication administration procedures, which opened the door to overestimation and measurement bias.

Acknowledgments:

The study's participants and all those who participated are heartily acknowledged by the researchers for their kind cooperation and tolerance.

Funding: For this study, there was no outside financing.

Disclosure: None to declare.

References

Alayoub, H., Curran, S., Coffey, M., Hatunic, M., & Higgins, M. (2018). Assessment of the effectiveness of group education on knowledge for women with newly diagnosed gestational diabetes. *Irish Journal of Medical Science (1971-)*, *187*(1), 65-68. https:// doi. org/ 10. 1007/ s11845- 017-1609-9.

Alejandro, E. U., Mamerto, T. P., Chung, G., Villavieja, A., Gaus, N. L., Morgan, E., & Pineda-Cortel, M. R. B. (2020). Gestational diabetes mellitus: a harbinger of the vicious cycle of diabetes. International journal of molecular sciences, 21(14), 5003. https://doi. org/ 10. 3390/ ijms21145003.

Anjana, R. M., Vijayalakshmi, P., Bhavadharini, B., Gayathri, R., Lakshmipriya, N., Uthra, S. & Sudha, V. (2019). Association of whole grains, dairy and dietary fibre with neonatal outcomes in women with gestational diabetes mellitus: The WINGS project (WINGS–12). Journal of Diabetology, 10(3), 127. http://dx.doi.org/10.4103/jod.jod_2_19.

Anuar, H., Shah, S. A., Gafor, H., Mahmood, M. I., & Ghazi, H. F. (2020). Usage of Health Belief Model (HBM) in health behavior: a systematic review. Malaysian Journal of Medicine and Health Sciences, 16(11), 2636-9346.

Bhavadharini, B., Deepa, M., Nallaperumal, S., Anjana, R. M., & Mohan, V. (2017). Knowledge about gestational diabetes mellitus amongst pregnant women in South Tamil Nadu. Journal of Diabetology, 8(1), 22.

Coronado-Vázquez, V., Gómez-Salgado, J., de los Monteros, J. C. E., Fajas, C. C., & Botaya, R. M. (2019). Equidad y autonomía del paciente en las estrategias de atención a personas con enfermedades crónicas en los servicios de salud de España. Gaceta Sanitaria, 33(6), 554-562. https://doi: 10.1016/j. gaceta. 2018. 05. 008.

Daniati, N., Widjaja, G., Olalla Gracìa, M., Chaudhary, P., Nader Shalaby, M., Chupradit, S., & Fakri Mustafa, Y. (2021). The Health Belief Model's Application in the Development of Health Behaviors. Health Education and Health Promotion, 9(5), 521-527.

de Mendonça, E. L. S. S., Fragoso, M. B. T., de Oliveira, J. M., Xavier, J. A., Goulart, M. O. F., & de Oliveira, A. C. M. (2022). Gestational Diabetes Mellitus: The Crosslink among Inflammation, Nitroxidative Stress, Intestinal Microbiota and Alternative Therapies. Antioxidants, 11(1), 129. https://doi.org/10.3390/antiox11010129.

El-Ansary, E. S., & Fouad, S. (2020). Effect of Educational Sessions on Knowledge, Attitude and Self-Care Practices among Pregnant Women with Gestational Diabetes. Egyptian Journal of Health Care, 11(3), 275-291.

Gharachourlo, M., Mahmoodi, Z., Kamrani, M. A., Tehranizadeh, M., & Kabir, K. (2018). The effect of a health literacy approach to counselling on the lifestyle of women with gestational diabetes: A clinical trial. *F1000Research*, *7*. https:// doi. org/ 10. 12688%2 Ff1000 research. 13838.1.

Hailu, F. B., Moen, A., & Hjortdahl, P. (2019). Diabetes self-management education (DSME)–Effect on knowledge, self-care behavior, and self-efficacy among type 2 diabetes patients in Ethiopia: A controlled clinical trial. *Diabetes, metabolic syndrome and obesity: targets and therapy*, *12*, 2489. https://doi.org/10.2147%2FDMSO.S223 123.

Hurley, A. C. (1990). The health belief model: evaluation of a diabetes scale. The Diabetes Educator, 16(1), 44-48.

Javid, F.M., Simbar, M., Dolatian, M., and Majd, H.A., (2015). Comparison of Lifestyles of Women with Gestational Diabetes and Healthy Pregnant Women. Global Journal of Health Science; 7(2): 1916-9736.

Mahmoud, N. M., yousef Mohammed, N., & Essa, R. M. (2018). The relationship between health belief model and compliance with therapeutic regimen among diabetic pregnant women. International Journal For Research In Health Sciences And Nursing, 4(2), 40-63. https:// doi. org/ 10. 53555/ hsn.v4i2.259.

McIntyre, H. D., Kapur, A., Divakar, H., & Hod, M. (2020). Gestational diabetes mellitus—innovative approach to prediction, diagnosis, management, and prevention of future NCD—mother and offspring. Frontiers in endocrinology, 11, 614533. https:// doi. org/ 10. 3389/ fendo.2020.614533.

Mohamed Abd-Elhakam E, Abozied Ramadan E , El- Houfey A and Abd El haliem Said s (2020). Effect of an Educational Program Based on Health Belief Model on Prevention of Preterm Birth among Newly Pregnant women, International Journal of Management, 11 (10), 2020, pp. 1029-1045.

Mohamed S & Ahmed A. (2019). Educational program for health literacy among pregnant women with gestational diabetes: its effect on maternal & fetal outcomes. International Journal of Nursing Didactics, 9(4).

Mohebbi, B., Tol, A., Sadeghi, R., Mohtarami, S. F., & Shamshiri, A. (2019). Self-management Intervention Program Based on the Health Belief Model (HBM) among Women with Gestational Diabetes Mellitus: A Quazi-Experimental Study. *Archives of Iranian Medicine (AIM)*, *22*(4).

Nigatu, B., Workneh, T., Mekuria, T., Yifter, H., Mamuye, Y., & Gize, A. (2022). Prevalence of Gestational Diabetes Mellitus among pregnant women attending antenatal care clinic of St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia. Clinical diabetes and endocrinology, 8(1), 1-6. https://doi.org/10.1186%2Fs40842-022-00139-w.

Saboula, N. E., Ahmed, N. A., & Rashad, R. H. (2018). Effect of nursing intervention on knowledge, attitude and self-care activities among gestational diabetic women. *International Journal of Novel Research in Healthcare and Nursing*, *5*(2), 135-146.

Said A & Aly F. (2019). Effect of the educational package based on health belief model regarding lifestyle among women with gestational diabetes. International Journal of Nursing Science, 9(2): 41-52. http://doi: 10. 5923/ j. nursing. 20190902.03.

Tavakkoli, R., Mahmoodi, M., & Attarian, S. (2018). Study the effect of educational intervention based on the health belief model (HBM) on quality of life among women with gestational diabetes. *Journal of Research in Medical and Dental Science*, *6*(2), 245-252.

Walker, S. N., Sechrist, K., & Pender, N. (1995). Reproduction without the author's express written consent is not permitted. Permission to use this scale may be obtained from: Susan Noble Walker, College of Nursing, University of Nebraska Medical Center, Omaha, NE 68198-5330.

World Health Organization, (2021). A healthy lifestyle. World Health Organization. Retrieved july 15, 2021, from https://www. euro. who. int/ en/ healthtopics/ diseaseprevention/nutrition /a- healthy-lifestyle