Effect of Self-Care Guidelines on Knowledge and Practice of Pregnant Women with Gestational Diabetes Mellitus

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ABSTRACT

Context: Gestational diabetes mellitus (GDM) is a kind of hyperglycemia and one of pregnancy's most common health problems. It affects 1%-28% of pregnancies worldwide, representing approximately 18 million births annually. It is considered a major cause of prenatal morbidity and mortality.

Aim: The present study aims to construct and evaluate the effect of self-care guidelines on the knowledge and practice of pregnant women with gestational diabetes mellitus.

Methods: Quasi-experimental (one group pre/post-test) design was utilized to achieve the aim of this study. The study subjects consisted of 200 pregnant women recruited from the antenatal clinic. The data collection tools include a structured interviewing questionnaire to assess the pregnant women's characteristics, obstetric history, and women's knowledge regarding gestational diabetes mellitus. The second tool was women-reported self-care practice checklists of pregnant women with diabetes mellitus (pre/post-self-care guidelines).

Results: A women's mean age of 29.7±5.8 and 1.97±0.91 was the mean gravidity. The majority (96%) of studied women had unsatisfactory knowledge, only 4% of them had satisfactory knowledge about GDM, and 95% of them had unsatisfactory practice about GDM. Only 5% of them had satisfactory practice about GDM before self-care guidelines implementation compared to 90% and 94% satisfactory knowledge and practice, respectively, with a highly statistically significant difference between the two phases (P<0.001).

Conclusion: The study concluded a positive effect of the self-care guidelines in improving women's knowledge and self-care practices regarding GDM. The study recommended regular and continuous health educational programs to enhance women's knowledge and self-care practices regarding GDM with further application of self-care guidelines in different settings.

Keywords: Self-care guidelines, knowledge, practices, gestational diabetes, pregnant women

1. Introduction

Gestational diabetes mellitus (GDM) is a carbohydrate or glucose intolerance of variable severity that has its onset during pregnancy. GDM is a prevalent pregnancy complication that seriously endangers mothers' and babies' health. Gestational diabetes mellitus is a kind of hyperglycemia and one of pregnancy's most common health problems. It is diagnosed through laboratory screening, using a pregnancy oral glucose tolerance test between 24- and 28-weeks' gestation *(Harrison, 2018).* In this regard, insulin resistance development in pregnancy is known as "gestational diabetes mellitus" *(Cunningham, 2018).*

The global prevalence of GDM varies widely from 1% to 28%, depending on population characteristics, screening methods, and diagnostic criteria *(Muche et al., 2019).* According to *the International Diabetes Federation (IDF, 2017)*, GDM affects approximately 16.2% of women with hyperglycemia during pregnancy. Its prevalence in Bahrain was 13.5%, 20% in the United Arab Emirates (UAE), 5% in Iran, and a high prevalence rate of 12.5% to 17% was observed in Saudi Arabia. Besides, higher rates were reported in Australia at 15%, Chinese 13.9%, and 14.3% in the USA *(Hossein-Nezhad et al., 2007; Lindsay, 2017; Cheung & Moses, 2018).*

The risk factors for GDM include high maternal age, parity, diet, pregnancy obesity, ethnicity, family history of diabetes, history of GDM in a previous pregnancy, delivery of an infant with macrosomia, essential hypertension, or pregnancy-related hypertension, history of spontaneous abortions, and unexplained stillbirths. GDM results in adverse neonatal outcomes that include congenital disabilities, retinopathy, nephropathy, central nervous system, cardiac problems, increased fat mass, respiratory distress, respiratory asphyxia, prematurity, and macrosomia *(Plows et al., 2018).* GDM increases the risk of preeclampsia, induced labor, cesarean delivery, diabetic ketoacidosis, and future type II diabetes. Despite little attention paid to GDM in low- and medium-income countries, it contributes to maternal mortality and morbidity *(Mukona, 2017).*

According to *World Health Organization (2014)*, self-

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care means the ability of individuals, families, and communities to improve health, prevent diseases, maintain health, and adapt to illness and disability with or without the support of healthcare providers *(Kolivand, 2018)*. The self-care education has changed from a purely educational and passive approach to awareness, decision-making for empowerment, and self-care. Self-care education and self-care support are two essential elements of diabetes care and should be provided as soon as diabetes is diagnosed *(Kusemwa et al., 2019)*.

All pregnant women need to acquire knowledge about GDM, its causes, manifestations, complications, and prevention *(International Diabetes Federation, 2017)*. So, the nursing role is very important in managing gestational diabetes. The nurse is responsible for teaching the patient how to self-monitor and record glucose and ketones at home. During prenatal visits, the nurse reviews the blood glucose and diet logs to make recommendations about monitoring, medication administration, and providing a healthy, well-balanced eating plan for women taking into consideration carbohydrate intake and physical activity if women are unable to manage gestational diabetes with diet and activity alone *(American Diabetes Association, 2014)*. Addressing GDM issues also addresses the third and fourth objectives of the sustainable development goals that seek to reduce maternal, neonatal, and child morbidity and mortality rates by 2030 *(Jolivet, 2018)*.

2. Significance of the study

Elnashar's study at Benha University *(2014)* clarified that the prevalence of GDM in Egypt gestational diabetes is ranged between 4-14%. Also, the study done by *El Sagheer and Hamdi (2018)* clarified that the prevalence of GDM was 8.8%. Early recognition of GDM and self-care practices is essential to prevent maternal morbidity and mortality. There are deficient studies in Mansoura city, so the present study will assess knowledge and self-care practices and enhance women's self-care practice regarding gestational diabetes mellitus.

3. Aim of the study

This study aims to construct and evaluate the effect of self-care guidelines on the knowledge and practice of pregnant women with gestational diabetes mellitus through:
- Exploring the knowledge and self-care practices utilized by pregnant women with gestational diabetes mellitus.
- Designing and implementing self-care guidelines for pregnant women with gestational diabetes mellitus.
- Evaluate the effect of self-care guidelines on the knowledge and self-care practice of pregnant women with gestational diabetes mellitus.

3.1. Research hypothesis

The self-care guidelines will positively affect the knowledge and practice of women with gestational diabetes mellitus.

4. Subjects & Methods

4.1. Research design

Quasi-experimental (one group pre/post-test) design was utilized for pregnant women with diabetes mellitus. The quasi-experimental research design (also called a non-randomized controlled trial (RCT) involves the manipulation of independent variables. However, it lacks randomization of participants in experimental groups, which is one of the essential characteristics of the RCT. In addition, some quasi-experimental even lack a control group for comparison.

In other words, quasi-experimental designs are generally used to establish the causality (effect of the independent variable on the dependent variable) in situations where researchers are not able to randomly assign the subjects to groups or, for various reasons in certain situations, cannot have a control group for comparison in an experimental study *(Sharma, 2018)*.

4.2. Research setting

The study was carried out at all Obstetrics and Gynecological Specialty Center Antenatal Clinics at Mansoura University Hospitals, Mansoura City, Dakahlia, Egypt. The setting consists of one floor divided into six sections: Admission unit, gynecological examination unit, vesicular mole unit, and room for nursing staff. The official working hours at the antenatal clinic begin at 9 am and end at noon daily except Thursday. The routine antenatal care was provided by two nurses and five obstetricians (consultant, specialist assistant, specialist, and two junior residents). The flow rate of gestational diabetic women was 7-8 women per week.

4.3. Subjects

A purposive sample of 200 pregnant women who attended the previously mentioned setting and fulfilled the inclusion criteria was enrolled in this study for ten months. According to *Dawson et al. (2002)*, the sample size was calculated using a formula provided:

$$n = \left[\frac{Z_{\alpha/2}}{E}\right]^2 * P(1-P)$$

Where
n= sample size
$Z_{\alpha/2}$ = 1.96 (The critical value of the Z distribution corresponding to a 95% confidence level).
P= prevalence of women with GDM Gestational diabetes affects 10-20% (15%) of pregnancies *(Bener et al., 2011)*.
E= margin of error (1-5%).

According to the previous equation, the sample size was 180 women with GDM (after adding 10% to compensate for the missing).
Inclusion criteria

The sample included women diagnosed with gestational diabetes mellitus, free from any other medical diseases, prime and multipara, weeks of gestations between 16-24 weeks, accepted to participate in this study, and can read and write.

4.4. Tools of the study

4.4.1. Structured Interview Questionnaire

The researcher designed this questionnaire to collect data related to women's characteristics, health history, and knowledge regarding gestational diabetes mellitus. It included two parts. The first part included the personal characteristics and women's health history as follows:

- Personal data included the mother's name, age, education, marital status, residence, occupation, family income, and telephone number.
- Obstetrical history included the number of gravidities, previous gestational diabetes, mode of last delivery, and previous macrosomia.
- Present obstetrical history included gestational age, spacing between present and previous pregnancy (pregnancy interval), regularity of antenatal visits, number of visits per month, and methods of discovering gestational diabetes.
- Family history included positive family history of diabetes mellitus, gestational diabetes, thyroid disease, and obesity in the first-degree relatives.

The second part included women's knowledge regarding gestational diabetes mellitus. It included 15 questions (open-end questions) classified under three knowledge domains that were knowledge about GDM (4 questions), healthy diet (8 questions), and physical activity (3 questions).

Scoring system

For each knowledge item, the correct response was scored two, the incomplete was scored one, and the incorrect or did not know answer scored zero. The woman was considered to have a satisfactory level of knowledge if the score was ≥60%, and if the percent score was <60%, it was considered an unsatisfactory level of knowledge *(Abd Elgawad, 2013).*

4.4.2. Women Reported Self-Care Practice Checklists

The researcher developed this tool to assess the women reported self-care practice. It included four checklists, enclosing the women's reported practices regarding the nutritional practice (7 healthy practices), physical activity (4 healthy practices), insulin self-injection, blood glucose self-monitoring (5 correct practices), and prevention of infection (4 healthy practices).

Scoring system

A correct response was scored two, an incomplete step was scored one, and an incorrect step was scored zero. The practice was considered satisfactory if the percent score was ≥60% and unsatisfactory if less than 60% *(Abd Elgawad, 2013).*

4.5. Procedures

The tools were reviewed for content validity by a jury of nine experts in obstetrics and gynecological nursing and medicine to ascertain their content validity. They were requested to express their opinions and comments on the translated tool. The tools were modified according to jury opinions, such as adding items (such as marital status and family history of thyroid diseases) and changing the translation of some words and sentences.

The tools' reliability was tested using Cronbach's Alpha coefficient test, which revealed that the tools consisted of relatively homogenous items, as showed by the moderate to the high reliability of each tool. The Cronbach's Alpha coefficient test was 0.85 for both tools.

Before starting the study, an official letter was issued from the Dean of the Faculty of Nursing to the director of the previously mentioned study setting requesting cooperation and permission to conduct the study in ante-natal clinics, after explaining the aim of the study.

Ethical considerations: The title and aim of the study and the expected outcomes have been illustrated. The researcher explained the aim of the study to each woman to have her verbal consent. This consent was obtained after a brief explanation of the study to assure them that the information obtained was confidential and used only for the study.

The pilot study was carried out on 10% of the study subjects, which represented 20 women who were excluded from the primary study sample. The purposes of the pilot study were to test the applicability, clarity of the study tools, and feasibility of the research process, and it served to estimate the time needed to complete the tools. It also helped find any obstacles and problems that might interfere with the data collection process. Based on the pilot study findings, certain modifications to the tools were done.

Fieldwork: The data collection expended ten months, from August 2018 to the end of May 2019. According to the schedule of obstetrics outpatient clinics, the antenatal clinic was visited by the researcher three days a week (Sunday, Monday, and Tuesday) from 9.00 am to 12.00 pm. The data collection process was conducted using face to face interview technique that was on an individual basis and in a private area in the center to ensure confidentiality and privacy.

The researcher interviewed the pregnant woman after reviewing her medical record, ensured her health status, explained the aim of the study, and asked for participation. Upon consent to participate, each pregnant woman was interviewed to assess general characteristics, knowledge, and reported self-care practice regarding GDM. The average time for the completion of interviewing questionnaire was (20-25 minutes). The number of interviewed women per day ranged from two to three pregnant women. The researcher filled the questionnaire during the waiting time of the women during their antenatal visits. After completion, the researcher ensured that all statements included in the tools were completed.

Guidelines' development phase: The guidelines were designed based on the baseline data collected (pre-test). The guidelines aimed to improve the women's knowledge and practice regarding gestational diabetes mellitus. In designing the guidelines, an educational booklet was developed in suitable and simple Arabic language. Various teaching methods were considered, including lecturing,

small group discussion, brainstorming, demonstration, and redemonstration.

After developing the educational booklet, the researcher started to give it to studied women for reading and carried out correct practice during this phase. The educational booklet covered the theoretical and practical part of caring for women with gestational diabetes mellitus as follows:

- Definition of gestational diabetes mellitus.
- Reasons and predisposing factors of GDM.
- Diagnosis of GDM.
- Complications of GDM on the mother and the baby.
- Self-care practice about a healthy diet.
- Self-care practice about exercise.
- Self-care practice about blood glucose monitoring.
- The practice of self-insulin injection and doses.
- Self-care practice about skin and foot care.
- Self-care practice about perineal care.
- Differentiate between hypoglycemia and hyperglycemia and how to deal with each one.
- The importance of the antenatal visit

Evaluation phase: After completing the implementation phase, the post-test was done three weeks after implementation using the same tools previously used in the pre-test. The post-test assessment aimed to compare the mothers' knowledge and practice to determine the effect of the intervention on women's knowledge and self-care practices.

4.6. Data analysis

Upon completion of data collection, variables included in the structured interview questionnaire and women's practice reported checklists were coded prior to computerized data entry. The raw data were coded and transformed into coding sheets, and the results were analyzed using (the SPSS version 20) statistical software package. Output drafts were checked against the revised coded data for typing and spelling mistakes. Finally, data were tabulated, and analysis and interpretation of data were conducted. The significance level was considered at $p \leq 0.05$, and 0.01 was considered a high statistical significance level.

5. Results

Table 1 illustrates the studied women's characteristics. More than half of the studied women (52%) were in the age group over 30 years, with a mean age of 29.7 ± 5.8. More than two-thirds of the studied women (66.0%) had secondary levels of education. Almost all of them (98.0%) were married, and 76.0% had a rural residence. Meanwhile, only 2% reported enough family income.

Table 2 indicates that more than two-thirds (66.0%) of studied women were multigravida. The mean gravidity was 1.97 ± 0.91. Concerning previous gestational diabetes, more than one-tenth of them (18.2%) had previous gestational diabetes, and most of the studied women (87.9%) were previously delivered by cesarean section. More than one-third of them (39.6%) had previous macrosomia. Moreover,

the mean gestational age was 21.36 ± 2.49 weeks, with a mean of 3.44 ± 2.75 years of space between pregnancies.

Furthermore, 52% reported irregular antenatal follow-up with a mean number of visits per month of 1.42 ± 0.5 visits. Meanwhile, more than one-third of women (44.0%) discover GDM by signs and symptoms.

Figure 1 shows that more than three-quarters of the studied women (86.0%) had a family history of diabetes mellitus. More than one-third of studied women (44.0%) had a family history of gestational diabetes. Concerning obesity, it was observed that more than one-third (38.0%) of the studied women had a family history of obesity, and only 10% had a history of thyroid disease.

Table 3 displays that more than three quarters (82.0%) incorrectly defined gestational diabetes, and 68.0% could not identify the cause pre guidelines implementation compared to none of them post-self-care guidelines implementation. More than two-thirds of the studied women (64.0%) knew signs and symptoms of GDM incompletely pre implementing self-care guidelines compared to 98% of them knowing signs and symptoms of GDM post guidelines correctly and completely, with a highly statistically significant difference between the two study phases.

Additionally, the majority of studied women (94.0%) could not mention the contents of a healthy meal, the number of daily meals, the importance of drinking milk, the importance of eating vegetables pre-self-care guidelines implementation compared to 100% of them identified them correctly and completely post self-care guidelines implementation with a statistically significant difference between the two study phases.

Furthermore, 96.0% and 94.0%, respectively, did not know the importance of physical exercise for women with GDM, the type of exercise performed, and precautions for the performance of exercise for women with gestational diabetes, the improvement of knowledge reached 100% in post-test with highly statistically significant differences at ($p<0.001$).

Table 4 displays that half of the studied women (50.0%) did not apply a diet regimen during pregnancy compared to 96% applying a diet regimen correctly post implementing guidelines. 88.0% of women did not eat a suitable number of daily meals before implementing self-care guidelines, while 96% ate a suitable number of meals post-implementation. Besides, 74.0% did not eat vegetables daily, 72% did not eat a balanced meal, 46% did not take an adequate amount of fluid per day, and 36% did not drink milk, compared to 86%, 94%, 98%, 92% post-self-care guidelines implementation with highly statistically significant differences at ($p<0.001$).

Meanwhile, 88% of them reported that they did not practice any exercise pre-implementing the self-care guidelines, 96% did not exercise adequate time, and 94% did not take exercise precautions pre-implementation of self-care guidelines compared to 94%, 100%, 100% respectively post self-care guidelines implementation with statistically significant differences at ($p<0.001$).

Regarding the practice of insulin self-injection and blood glucose monitoring, the table reveals that 84% of women did not monitor their blood glucose with the proper frequency/week, 78% did not use a home device for monitoring glucose, 58% monitored the blood glucose in the wrong time pre-implementation of self-care guidelines compared to 88%, 84%, 100% respectively post-implementation of self-care guidelines at p <0.001. Also, 64% of them could not record their blood glucose result and show them to the doctor pre-implementation of self-care guidelines increased significantly to 98% post-intervention.

Women's practice regarding infection prevention reveals that 76% of women incorrectly wash their hands after using the toilet, 86% did not care for the perineal area, and 80% did not take corrective action regarding signs of infection pre-implementation of self-care guidelines compared to 100%, 98%, 100% did them correctly after implementation of self-care guidelines with statistically significant differences at p<0.001.

Table 5 compares total women's knowledge and reported self-care practice before and after self-care guidelines. The results show highly statistically significant differences between pre and post-self-care guideline implementation at p <0.001.

Table 6 presents the relationship between women's characteristics and their total knowledge pre- and post-implementing self-care guidelines. It displays statistically significant relations between total women's knowledge and their age at pre and post-test. There is an association between the number of gravidities, previous gestational diabetes, and knowledge pre-implementation of self-care guidelines. In contrast, education, residence, and previous macrosomia relate to women's knowledge post-implementation of self-care guidelines.

Table 7 clarified no statistically significant relations between women's characteristics and their total practices pre-implementing self-care guidelines. Additionally, a relationship between total women's practices and their age, education, residence, number of gravidities, and previous gestational diabetes after implementation of self-care guidelines.

Table (1): Frequency and percentage distribution of the studied women characteristics (n=200).

Women characteristics	No	%
Age		
<20y	12	6.0
20-30y	84	42.0
>30y	104	52.0
Mean±SD	29.7±5.8	
Education		
Read & Write	8	4.0
Basic education	28	14.0
Secondary education	132	66.0
University	32	16.0
Marital Status		
Divorced	4	2.0
Married	196	98.0
Residence		
Rural	152	76.0
Urban	48	24.0
Occupation		
Work	20	10.0
Not work	180	90.0
Family income		
Enough	4	2.0
Inadequate	196	98.0

Table (2): Frequency and percentage distribution of the studied women's obstetric history (n=200).

Previous obstetrical history	No	%
Number of gravidities		
Prime	68	34
Multi	132	66
Mean ± SD	1.97 ± 0.91	
Previous gestational diabetes		
Yes	24	18.2
No	108	81.8
Mode of last delivery		
Normal	10	7.6
CS	116	87.9
With help	6	4.5
Previous macrosomia		
Yes	52	39.6
No	80	60.4
Present obstetrical history		
Gestational age (weeks)	21.36±2.49	
The interval between pregnancies (years)	3.44 ± 2.75	
Regular antenatal visits (months)		
Yes	96	48
No	104	52
Mean ± SD	1.42 ± 0.5	
Method of discovering GDM		
By luck	24	12
At antenatal visit	16	8
Diabetic patient	12	6
Signs and symptoms	88	44
Doctor order	60	30
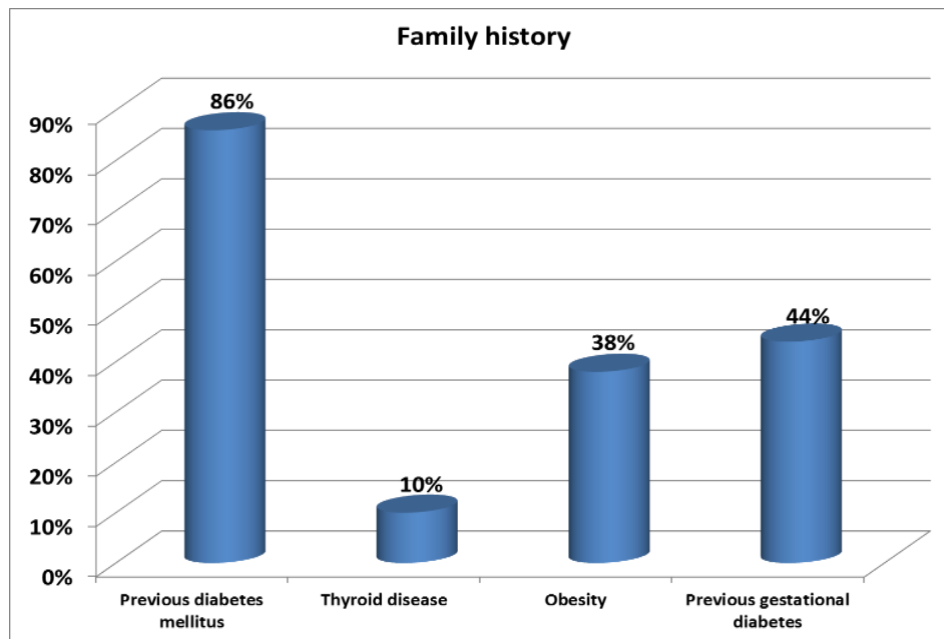
 # The woman's response includes more than one answer

Figure (1): Percentage distribution of the studied women's family history.

Table (3): Comparison of women's knowledge regarding gestational diabetes pre- and post-self-care guidelines implementation (n=200).

Knowledge domain	Pre-test						Post-test						Z	P
	Incorrect		Incomplete		Complete		Incorrect		Incomplete		Complete			
	No	%	No	%	No	%	No	%	No	%	No	%		
Knowledge about GDM														
Definition of GDM	164	82	36	18	0	0	0	0	0	0	200	100	13.210	<0.001
Causes of GDM	136	68	64	32	0	0	0	0	0	0	200	100	12.828	<0.001
Signs and symptoms of GDM	72	36	128	64	0	0	0	0	4	2	196	98	12.792	<0.001
Complications of GDM	92	46	108	54	0	0	0	0	0	0	200	100	12.670	<0.001
Knowledge about a healthy diet														
Contents of healthy meal	188	94	12	6	0	0	0	0	0	0	200	100	13.763	<0.001
Body weight during pregnancy	184	92	16	8	0	0	0	0	0	0	200	100	13.653	<0.001
Number of daily meals for women with GDM	188	94	12	6	0	0	0	0	0	0	200	100	13.763	<0.001
Amounts of fluids/day	140	70	60	30	0	0	0	0	8	4	192	96	12.792	<0.001
Fluids limitations for women with GDM	140	70	60	30	0	0	0	0	10	5	190	95	12.776	<0.001
Importance of drinking milk	188	94	12	6	0	0	0	0	0	0	200	100	3.619	<0.001
Importance of fruits	184	92	16	8	0	0	0	0	0	0	200	100	8.105	<0.001
Importance of eating vegetables	188	94	12	6	0	0	0	0	0	0	200	100	10.751	<0.001
Knowledge about physical activity														
Importance of physical exercise for women with GDM	192	96	8	4	0	0	0	0	0	0	200	100	13.881	<0.001
Type of exercise performed by women with gestational diabetes	188	94	12	6	0	0	0	0	0	0	200	100	13.763	<0.001
Precautions for the performance of exercise	188	94	12	6	0	0	0	0	0	0	200	100	13.763	<0.001

Table (4): Comparison of women's reported self-care practices pre/post-implementation of the self-care guidelines (n=200).

Self-reported practice	Pre-test						Post-test						Z	P
	Not done		Done incorrectly		Done correctly		Not done		Done incorrectly		Done correctly			
	No	%	No	%	No	%	No	%	No	%	No	%		
Nutritional practices														
Apply diet regimen during pregnancy	100	50	88	44	12	6	0	0	8	4	192	96	12.277	<0.001
Number of meals per day	176	88	24	12	0	0	0	0	8	4	192	96	13.286	<0.001
balanced meal content	144	72	56	28	0	0	0	0	12	6	188	94	12.673	<0.001
Adequate amount of fluids per day	92	46	92	46	16	8	0	0	4	2	196	98	12.014	<0.001
Drinking milk per day	72	36	104	52	24	12	0	0	16	8	184	92	11.852	<0.001
eating fruits daily	12	6	156	78	32	16	0	0	0	0	200	100	12.557	<0.001
eating vegetables daily	148	74	44	22	8	4	0	0	28	14	172	86	12.484	<0.001
Physical activity practices														
Performing exercise	176	88	20	10	4	2	0	0	12	6	188	94	13.140	<0.001
Type of exercise performed by the woman	180	90	8	4	12	6	0	0	0	0	200	100	13.443	<0.001
Adequate time of exercise performance	192	96	0	0	8	4	0	0	0	0	200	100	13.856	<0.001
Taking precautions at performance exercise	188	94	12	6	0	0	0	0	0	0	200	100	13.763	<0.001
Practices of insulin self-injection & Blood glucose monitoring														
Changing injection site each time	112	56	88	44	0	0	0	0	0	0	200	100	12.680	<0.001
Use of a home device for monitoring glucose,	156	78	0	0	44	22	32	16	0	0	168	84	11.136	<0.001
Frequency of monitoring blood glucose/week	168	84	32	16	0	0	0	0	24	12	176	88	12.847	<0.001
Timing of monitoring blood glucose	116	58	84	42	0	0	0	0	0	0	200	100	12.694	<0.001
Recording result and showing it to the doctor	16	8	128	64	56	28	0	0	4	2	196	98	11.283	<0.001
Practices in preventing infection														
Frequently washing their hands after using the toilet	16	8	152	76	32	16	0	0	0	0	200	100	12.443	<0.001
Wiping after using the toilet	40	20	152	76	8	4	0	0	0	0	200	100	12.847	<0.001
Caring for perennial area	172	86	28	14	0	0	0	0	4	2	196	98	13.286	<0.001
Women's actions regarding signs of infection	160	80	40	20	0	0	0	0	0	0	200	100	13.140	<0.001

Table (5): Comparison of total women's knowledge and total reported practice pre/post-implementation of self-care guidelines (n=200).

	Pre-test				Post-test				Z	P
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory			
	No	%	No	%	No	%	No	%		
Total Knowledge	8	4	192	96	180	90	20	10	13.115	<0.001
Total practices	10	5	190	95	188	94	12	6	13.342	<0.001

Table (6): Relation between knowledge, women characteristics, and obstetric data pre/post implementing self-care guidelines (n=200).

Items	Knowledge Pre				Knowledge Post				Test of significance			
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory		Pre		Post	
	No	%	No	%	No	%	No	%	χ^2	P	χ^2	P
Age												
<20y	2	25	10	5.2	12	6.7	0	0				
20-30y	4	50	80	41.7	80	44.4	4	20	6.309	0.043	7.245	0.027
>30y	2	25	102	53.1	88	48.9	16	80				
Education												
Read and write	0	0	8	4.2	0	0	8	40				
Primary	2	25	26	13.5	28	15.6	0	0	2.489	0.477	77.609	<0.001
Secondary	6	75	126	65.6	124	68.9	8	40				
University	0	0	32	16.7	28	15.6	4	20				
Marital Status												
Divorced	0	0	4	2.1	4	2.2	0	0	0.170	0.680	0.454	0.501
Married	8	100	188	97.9	196	97.8	20	100				
Residence												
Rural	8	100	144	75	132	73.3	20	100	2.632	0.105	7.018	0.008
Urban	0	0	48	25	48	26.7	0	0				
Occupation												
Work	0	0	20	10.4	20	11.1	0	0	0.926	0.336	2.469	0.116
Not work	8	100	172	89.6	160	88.9	20	100				
Family income												
Enough	0	0	4	2.1	4	2.2	0	0	0.170	0.680	0.454	0.501
Not enough	8	100	188	97.9	176	97.8	20	100				
Number of gravidities												
Prime	6	75	62	32.3	64	35.6	4	20	6.243	0.012	1.941	0.164
Multi	2	25	130	67.7	116	64.4	16	80				
Previous gestational diabetes												
Yes	2	100	22	17.5	20	17.2	4	33.3	8.804	0.003	1.849	0.174
No	0	0	104	82.5	96	82.8	8	66.7				
Mode of last delivery												
Normal	0	0	8	6.3	8	6.9	0	0				
CS	2	100	114	90.5	104	89.7	12	100	0.210	0.900	1.370	0.504
With help	0	0	4	3.2	4	3.4	0	0				
Previous macrosomia												
Yes	2	100	50	39.7	44	37.9	8	66.7	2.969	0.085	3.723	0.054
No	0	0	76	60.3	72	62.1	4	33.3				

Table (6): Relation between self-reported practice, women characteristics, and obstetric data of pre/post implementing self-care guidelines (n=200).

Items	Practice Pre				Practice Post				Test of significance			
	Satisfactory		Unsatisfactory		Satisfactory		Unsatisfactory		Pre		Post	
	No	%	No	%	No	%	No	%	$\chi2$	P	$\chi2$	P
Age												
<20y	2	20	10	5.3	12	6.4	0	0				
20-30y	4	40	80	42.1	74	39.4	10	83.3	3.740	0.154	9.024	0.011
>30y	4	40	100	52.6	102	54.3	2	16.7				
Education												
Read and write	0	0	8	4.2	8	4.3	0	0				
Primary	2	20	26	13.7	28	14.9	0	0	0.854	0.836	12.016	0.007
Secondary	6	60	126	66.3	126	67	6	50				
University	2	20	30	15.8	26	13.8	6	50				
Marital Status												
Divorced	0	0	4	2.1	4	2.1	0	0	0.215	0.643	0.261	0.610
Married	10	100	186	97.9	184	97.9	12	100				
Residence												
Rural	8	80	144	75.8	140	74.5	12	100	0.092	0.761	4.031	0.045
Urban	2	20	46	24.2	48	25.5	0	0				
Occupation												
Work	2	20	18	9.5	20	10.6	0	0	1.170	0.279	1.418	0.234
Not work	8	80	172	90.5	168	89.4	12	100				
Family income												
Enough	0	0	4	2.1	4	2.1	0	0	0.215	0.643	0.261	0.610
Not enough	10	100	186	97.9	184	97.9	12	100				
Number of gravidities												
Prime	6	60	62	32.6	68	36.2	0	0	3.171	0.075	6.576	0.010
Multi	4	40	128	67.4	120	63.8	12	100				
Previous gestational diabetes												
Yes	2	50	22	17.7	20	16.7	4	50	2.647	0.104	5.470	0.019
No	2	50	102	82.3	100	83.3	4	50				
Mode of last delivery												
Normal	0	0	8	6.5	8	6.7	0	0				
CS	4	100	112	90.3	108	90	8	100	0.427	0.808	0.883	0.643
With help	0	0	4	3.2	4	3.3	0	0				
Previous macrosomia												
Yes	2	50	50	40.3	47	39.2	5	62.5	0.150	0.698	1.693	0.193
No	2	50	74	59.7	73	60.8	3	37.5				

6. Discussion

Gestational diabetes is defined as carbohydrate intolerance of variable severity with onset or first recognition during pregnancy *(Buschur et al., 2018)*. It occurs in women with insulin resistance and relative impairment of insulin secretion. Identifying this group of women and caring for them prevents perinatal morbidity and improves long-term outcomes for mothers and their children *(Charles et al., 2014)*.

The therapeutic diet of GDM is complex. It includes specific behavioral changes on the part of women with GDM. So, the women's life with GDM may depend on their participation in their therapeutic diet. This participation requires the women to learn new information, skills, and actions to deal with practical items of self-care management, including diet, exercise, self-blood glucose monitoring, insulin therapy, and injection. The needs of gestational diabetic women include eating a carefully planned diet, getting plenty of exercise, maintaining a healthy pregnancy weight, and monitoring glucose levels *(Thomas, 2018)*. The present study aims to construct and evaluate the effect of self-care guidelines on the knowledge and practice of pregnant women with gestational diabetes mellitus.

More than two-thirds of the studied women had secondary education regarding educational level. From the researcher's point of view, the increased prevalence of gestational diabetes among housewives and low educated may be due to decreased knowledge about gestational diabetes mellitus, poor information regarding healthy diet, and decreased practice of physical work at home. As evidenced in the current study, the information about diet and exercise among most women was incorrect before intervention. This finding was congruent with *El-didamoney (2016),* who found an increased prevalence of the disease among low educated women, incongruent with *Abd-elhady (2002)*. They found that more than half of the sample was illiterate, and educational level was not a factor in causing gestational diabetes mellitus in his study.

More than half of the sample's follow-up visits during pregnancy were irregular. *Waldron (2011)* supported this result, finding that most of the sample was carless for follow-up, increasing the risk of complications. Concerning

women's parity, the present study finds that more than two-thirds were multi multigravida. This finding aligns with *Elshair et al. (2012)* in their study in Gaza Strip, which found that most pregnant women were multipara. This finding might indicate an association between parity and GDM. This result agrees with *Egeland et al. (2000),* who found that gravidity increased the risk of GDM for women with two, three, and four or more deliveries. In contrast, this finding was incongruent with, *Muckona (2017),* who showed no association between GDM and gravidity but could be mediated by other factors such as obesity.

Also, the findings reveal that majority of them had a family history of diabetes mellitus among their first-degree relatives, and about half of them had previous gestational diabetes. Additionally, more than half of them had previous macrosomia. This finding was supported by *Al sultan et al. (2004),* who found that history of gestational diabetes mellitus in a previous pregnancy, family history of diabetes mellitus in a first-degree relative, and macrosomia were risk factors for subsequent gestational diabetes. This result is supported by *the American Diabetes Association (ADA) (2006)*, which stated that women under 25 years of age had normal body weight, no first degree relative with diabetes mellitus, and no history of poor obstetric outcomes at low-risk gestational diabetes mellitus. From the researcher's point of view, weight gain during pregnancy is related to traditional customs in Egyptian culture. There is a positive relationship between weight gain during pregnancy and the wellness of the mother and fetus.

The present study also reveals 3.44±2.75 years of space between pregnancies. This short interval between pregnancies might be a factor in developing gestational diabetes. This result agrees with *Kamal (2005),* who found that one-quarter of women with GDM, their youngest child, aged less than two years. Also, *El-didamoney (2016)* reported that more than two-thirds had a short interval between pregnancies.

Regarding women's knowledge about GDM, the present study's finding shows that most women had unsatisfactory total knowledge preimplantation of self-care guidelines. Most of them could not identify the GD correctly, and around two-thirds could not identify the causes. This result agrees with *Kamal (2005)*, who found that most of the studied women had a poor level of knowledge about GDM.

On the other side, women's knowledge about a healthy diet is one of the GDM self-care items. The current study results show that most of the studied women did not know the contents of healthy meals, the number of daily meals, or the importance of drinking milk and eating vegetables. This finding reflects the extreme need of the studied women to be supported with proper diabetic education, particularly during pregnancy. These results agree with *Reader (2007) and Brown et al. (2017),* who studied medical nutrition therapy and lifestyle intervention in gestational diabetes. They found that two-thirds of the studied women need nutritional support and appropriate knowledge.

Regarding women's practices regarding diet, the current study results show that the half of the studied women did not apply a diet plan for GDM during pregnancy, most of them did not eat a suitable number of daily meals, and near three quarters did not eat vegetables daily, did not eat a balanced meal. More than one-third did not take an adequate amount of fluid per day and did not drink milk. These improper practices might be referred to their poor knowledge regarding diabetic care before self-care guidelines implementation. These results agree with a study done in Zimbabwe by *Kusemwa et al. (2019),* who found that about nearly half of the participants ate fast foods, which is not recommended in the diet plan for such group population.

The present study's findings show that most studied women did not practice exercise. These findings might be referred to their lack of awareness of the importance of exercise in controlling the blood sugar level. This finding is evident in the current study as most of them answered the knowledge question of the importance of exercise, types, and precaution for performing it incorrectly. These results agree with *Downs (2006),* who studied exercise beliefs and behaviors in women with gestational diabetes and found that only 39% of the women in their study were currently practicing exercise. This observation aligns with *El-didamoney (2016)*, who mentioned that one-fourth of the studied women did not have practice exercise currently and needed exercise support. Also, it agrees with *Kusemwa et al. (2019)*, who found limited knowledge about gestational weight gain guidelines, appropriate diet, and physical activity.

According to women's practice of insulin injection and blood glucose monitoring, the current study results show that more than three quarters did not monitor their blood glucose with adequate frequency and did not use home devices for monitoring glucose. This finding might be referred to their low socioeconomic standards to get a home device or visit the lab for frequent monitoring, as only two percent of them reported that they had enough income. These findings matched those of studies conducted by *Agarwal et al. (2010) and El-didamoney (2016)* in Egypt. They studied the health needs of gestational diabetic women. They found that about two-thirds of the studied women had poor knowledge about insulin injection and blood-sugar monitoring in more than three-quarters of their samples.

Women's practice regarding infection prevention reveals that more than three-fourths of women incorrectly wash their hands after using the toilet, do not care for the perineal area, and take corrective action regarding signs of infection pre-implementation of self-care guidelines. This finding may be referred to their poor knowledge and lack of educational programs regarding infection prevention in diabetic females. This result agrees with *Hatfield (2013)*, who reported that symptoms of UTI for women with gestational diabetes were: Frequent urination, burning with urination, and cloudy urine, while symptoms of vaginal infection were cheesy-white vaginal discharge and severe itching and discomfort. Most women do not wash their

hands after using the toilet or care for the perineal area. From the researcher's point of view, this finding may be referred to their poor knowledge and lack of educational programs regarding infection prevention in diabetic females.

The present study results show a significant increase in the level of knowledge and improvement practices of the studied women after implementing self-care guidelines, supporting the current research hypothesis. It may be attributed to the effect of information and skills regarding GD entailed in the self-care guidelines booklet that helped the studied women with GDM acquire knowledge about different aspects of GD and its required self-care. This finding is congruent with the findings of *Ankur (2010),* who showed that educational intervention programs could bring about a desirable change in the knowledge among pregnant women regarding reproductive health.

Also*, Kamal (2005)* found that most of the subjects who adhered to physician appointments adhered to their insulin therapy. Also, in the same line *Clapp (2006)* stated that diet and physical activity adherence altered the increase in insulin resistance, especially during mid and late pregnancy. Also, *London et al. (2011)* reported that dietary intervention with insulin therapy reduces the risk of fetal macrosomia, preeclampsia, and serious perinatal complications.

Regarding the relation between knowledge and personal characteristics in studied pregnant women, the present study results show a relationship between the studied women's total knowledge with age (pre/post), education (post), residence (post), number of gravidities (pre), and previous GDM (pre), while no relationship between personal characteristics of the studied women and their total practices in all personal characteristics (pre) but in the post-implementation phase, there were significant relationships between the total practice and age, education, residence, number of gravidities, previous gestational diabetes. From the researcher's point of view, the major ratio of studied women with GDM was educated and wishful to know and learn about GDM as they saw the significance of guidelines booklets information and apply it in daily self-care practices. These results agree with *El Sagheer and Hamdi (2018),* who found a relation in an Egyptian study between age, parity, previous gestational diabetes, and macrosomia and studied sample knowledge, and this was incongruent with, *Muckona (2017),* who showed no association between GDM and gravidity but could be mediated by other factors such as obesity.

7. Conclusion

The study concluded that the self-care guidelines positively affected the knowledge and practice of women with gestational diabetes mellitus, supporting the current research hypothesis.

8. Recommendations

Based on the results of the present study, the following recommendations were suggested:

Regular and continuous health education programs are essential for improving the women's knowledge and self-care practices regarding GDM, and this guidelines booklet should be provided in another setting, encourage nurses, especially midwives, to attend continuing education in the form of workshops, conferences, training programs and review update nursing care related to GDM.

Establish a library with recent scientific books and magazines in the Arabic language in the practice settings. A budget should be allocated yearly for the educational activities of nurses, midwives, and women with GDM.

The health care system should maintain an unbroken chain of referral and appropriate case management which stretches from the woman's home to the places where she can, as necessary, receive care for GDM and any other obstetric complication.

9. References

Abdelgawad, D., Sorour, A. S., & Elsayed, A. A. (2013). Problem of obesity and the predisposing factors among preschool children in Mansoura City. *Zagazig Nursing Journal, 9*(2), 130-140. https://znj.journals.ekb.eg/article_38854_8080df9cc845e16a371c61278f7b238a.pdf.

Abdelhady, R. M. (2002). Blood glucose level in high-risk newborn infants of high-risk diabetic pregnancy, Doctorate Dissertation*, Faculty of Nursing, Zagazig University, Benha Branch, 150.*

Agarwal, M. M., Dhatt, G. S. & Shah, S. M. (2010). Gestational diabetes mellitus: Simplifying the international association of diabetes and pregnancy diagnostic algorithm using fasting plasma glucose. *Diabetes Care, 33*(9), 2018-20. https://doi.org/10.2337/dc10-0572.

Alsultan, F. A., Anan, G. D. & Ahmed, S. A. (2004). Clinical epidemiology of gestational diabetes in Kuwait, *KMJ-Kuwait Medical Journal, 36*(3), 195-198. https://pesquisa.bvsalud.org/portal/resource/pt/emr-67222.

American Diabetes Association (ADA) (2014). Diagnosis and classification of diabetes mellitus, *Diabetes Care*, *37*(1), S81-90. https://doi.org/10.2337/dc14-S081.

Ankur, B. (2010). Effectiveness of reproductive health education in adolescent, rural schoolgirls of Udupi Taluk, Karnataka *JIMSA. 23* (4), 6. https://manipal.pure.elsevier.com/en/publications/effectiveness-of-reproductive-health-education-in-adolescent-rura.

Bener, A., Saleh, M. N., & Al-Hamaq, A. (2011). Prevalence of gestational diabetes mellitus and associated maternal and neonatal complications in a fast-developing community: Global comparison. *Int J Women's Health., 3*(1), 367-373. https://doi.org/10.2147/IJWH.S26094.

Brown, J., Alwan, N. A., West, J., Brown, S., McKinlay C. JD & Farrar, D. (2017). Lifestyle interventions for the treatment of women with gestational diabetes. Cochrane Database of Systematic Reviews. *5*(5), CD011970. https://doi.org/10.1002/14651858.CD011970.pub2.

Buschur, E., Stetson, B., Barbour, L. A., Feingold, A. R., Anawalt, B., Boyce, A., Chrousos, G., Herder, W., Dhatariya, K., Dungan, K., Hershman, J. M., Hofland, J., Kalra, S., Kaltsas, G., Koch, C., Kopp, P., Korbonits, M., Kovacs, C., Kuohung, W., & Laferrère, B. (2018). Diabetes in Pregnancy. https://pubmed.ncbi.nlm.nih.gov/25905241/.

Charles, R. B., Beckmann, W. H., Laube, D., Ling, F., & Smith, R. (2014). *Obstetrics and Gynecology.* 7th ed. Lippincott Williams and Wilkins. Baltimore. https://www.amazon.com/Obstetrics-Gynecology-Charles-Beckmann-MHPE/dp/1451144318.

Cheung, N. W., & Moses, R. G. (2018). Gestational diabetes mellitus: Is it time to reconsider the diagnostic criteria? *Diabetes Care, 41*(7), 1337-1338. https://doi.org/10.2337/dci18-0013.

Clapp, J. F. (2006). Effects of diet and exercise on insulin resistance during pregnancy. *Metabolic Syndrome and Related Disorders. 4*(2), 84-90. https://doi.org/10.1089/met.2006.4.84.

Cunningham, F. G., Leveno, K. J., Bloom, S. L., Dashe, J. S., Hoffman, B. L., Casey, B. M., & Spong, C. Y. (2018). *Williams obstetrics.* McGraw-Hill Education. New York. Pp. 1125-43. https://accessmedicine.mhmedical.com/book.aspx?bookID=1918.

Dawson, G., Munson, J., Estes, A., Osterling, J., McPartland, J., Toth, K., Carver, L., & Abbott, R. (2002)

(2004). Neurocognitive function and joint attention ability in young children with autism spectrum disorder versus developmental delay. *Child Dev*., *73*(2), 345-58. https://doi.org/10.1111/1467-8624.00411.

Downs, D. S., & Ulbrecht, J. S. (2006). Understanding exercise beliefs and behaviors in women with gestational diabetes mellitus. *Diabetes Care, 29*(2), 236 240. https://doi.org/10.2337/diacare.29.02.06.dc05-1262.

El Sagheer, G. M., & Hamdi, L. (2018). Prevalence and risk factors for gestational diabetes mellitus according to the Diabetes in Pregnancy Study Group India in comparison to International Association of the Diabetes and Pregnancy Study Groups in El-Minya, Egypt, *J Intern Med; 1*(30), 131-9. https://doi.org/10.4103/ejim.ejim_11_18.

El-didamoney, M. M. (2016). Health needs of women with gestational diabetes attending antenatal clinic of Suez Canal university hospitals. Master Thesis, Suez Canal University. *Faculty of nursing.*

Elnashar, A. (2014). Gestational diabetes mellitus at Benha University Hospital. Master Thesis. Benha University, Faculty of Medicine.

Elshair, A., Shenouda, M., & Elkader, S. (2012). Gestational diabetes in UNRWA health clinics in Gaza Strip: Impact of the educational program, *New York Science Journal, 5(*12), 66-72. http://www.sciencepub.net/newyork/ny0512/010_11617ny0512_66_72.pdf.

Egeland, G. M., Skjaerven, R., & Irgens, L. M. (2000). Birth characteristics of women who develop gestational diabetes: Population-based study. *British Medical Journal, 321*(7260), 546-7. https://doi.org/10.1136/bmj.321.7260.546.

Harrison, A. N., Shields, N., Taylor, N. F., & Frawley, H. C. (2016). Exercise improves glycemic control in women diagnosed with gestational diabetes mellitus: A systematic review. *Journal of Physiotherapy, 62*(4), 188-196. https://doi.org/10.1016/j.jphys.2016.08.003.

Hossein-Nezhad, A., Maghbooli, Z., Vassigh, A-R., & Larijani, B. (2007). Prevalence of gestational diabetes mellitus and pregnancy outcomes in Iranian women, *Taiwan J obstetric gynecology, 46*(3), 41. https://doi.org/10.1016/S1028-4559(08)60026-1.

Hatfield, N. T. (2013). *Introductory Maternity & Pediatric Nursing.* 3rd ed. Lippincott Williams & Wilkins. Pp. 360-366. https://www.amazon.com/Introductory-Maternity-Pediatric-Nursing-Prepu/dp/1469854694.

International Diabetes Federation, (IDF) (2017). Gestational diabetes mellitus, activities-prevention; IDF Diabetes Atlas, International Diabetes Federation: Brussels. https://diabetesatlas.org/upload/resources/previous/files/8/IDF_DA_8e-EN-final.pdf.

Jolivet, R., Moran, A. C., O'Connor, M., Chou, D., Bhardwaj, N., Newby, H., Requejo, J., Schaaf, M., Say, L., & Langer, A. (2018). Ending preventable maternal mortality: Phase II of a multi-step process to develop a monitoring framework, 2016-2030. *BMC Pregnancy Childbirth 18*(1), 258. https://doi.org/10.1186/s12884-018-1763-8.

Kamal, S. (2005). Effect of self-care program for women with gestational diabetes on their compliance. Master Thesis. Faculty of Nursing. Alexandria, Egypt.

Kolivand, M., Keramat, A., Rahimi, M., Motaghi, Z., Shariati, M., & Emamian, M. H. (2018). Self-care education needs in gestational diabetes tailored to the Iranian culture: A qualitative content analysis. *Iran J Nurs Midwifery Res. 23*(3), 222-229. https://doi.org/10.4103/ijnmr.IJNMR_108_17.

Kusemwa, P., Mukona, D. M., Zvinavashe, M., Dodzo, L. G., & Makoni, P. (2019). Knowledge of Gestational diabetes mellitus and Self-care Practices in Pregnancy. *EC Diabetes and Metabolic Research*, 3.1: 26-34. https://www.researchgate.net/publication/331166583_EC_DIABETES_AND_METABOLIC_RESEARCH_Research_Article_Knowledge_of_Gestational_Diabetes_Mellitus_and_Self_Care_Practices_in_Pregnancy.

Lindsay, S. R., Mackin, S. T., & Nelson, S. M. (2017). Gestational diabetes mellitus-right person, right treatment, right time?" *BMC Medicine*, (15), 1-163. https://doi.org/10.1186/s12916-017-0925-2.

London, M. B., Mele, L., Spong, C. Y., Carpenter, M. W., Ramin, S. M., Casey, B., Wapner, R. J., Varner, M. W., Rose, D. J., Thorp Jr, J. M., Sciscione, A., Catalano, P., Harper, M., Saade, G., Caritis, S. N., Sorokin, Y.,

Peaceman, A. M., Tolosa, J. A., & Anderson, G. D. (2011). The relationship between maternal glycemia and perinatal outcome. *Obstet. Gynecol., 117*(2 Pt 1), 218-224. https://doi.org/10.1097/AOG.0b013e318203ebe0.

Muche, A. A., Olayemi, O. O., & Gete, Y. K. (2019). Prevalence of gestational diabetes mellitus and associated factors among women attending antenatal care at Gondar town public health facilities, Northwest Ethiopia. *BMC pregnancy childbirth, 19*(1), 334. https://doi.org/10.1186/s12884-019-2492-3.

Mukona, D. M., Munjanja, P. S., Zvinavashe, M., Stray Pederson, B. (2017). Adherence to anti-diabetic therapy in women with diabetes in pregnancy. *Diabetes Complications, 1*(4), 1-6. https://doi.org/10.33425/2639-9326.1019.

Plows, J. F., Staneley, J. L., Baker, P. N., Reynods, C. N., & Vickers, M. H. (2018). The pathology of gestational diabetes mellitus**.** *International Journal Molecular Science, 19*(11), 3342. https://doi.org/10.3390/ijms19113342.

*Reader, M. D. (2007)***.** Medical nutrition therapy and lifestyle interventions. *Diabetes Care, 30* (2), S188-93. https://doi.org/10.2337/dc07-s214.

Sharma, S. K. (2018). Nursing research and statistics. 3rd ed. Elsevier. India. https://www.onlinebooksstore.in/elsevier-nursing-research-and-statistics-3rd-edition-by-suresh-k-sharma.

Thomas, R. M. (2018). Diabetes Mellitus and Pregnancy. *Drug & Diseases, endocrinology,* Medscape. https://emedicine.medscape.com/article/127547-overview#a1

Waldron, D. M. (2011). Improvement in nutrition knowledge and retention about gestational diabetes mellitus among Hispanic pregnant women, master of dietetics administration in nutrition, dietetics & food sciences, testate university. 32'33. https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1103&context=gradreports.

World Health Organization. Regional Office for South-East Asia. (2014). Self-care for health. WHO Regional Office for South-East Asia**.** https://apps.who.int/iris/bitstream/handle/10665/205887/B5084.pdf.