

Effect of Implementation of Health Educational Guidelines on Maternal and Neonatal Outcomes among Women with Gestational Diabetes Mellitus.

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Abstract: Diabetes Mellitus (DM) is one of the most common medical complication that often affects pregnancy. Diabetes in pregnancy may be gestational (90%) or pregestational (10%) when it antedates pregnancy. Gestational Diabetes Mellitus (GDM) can lead to range of adverse pregnancy outcomes including; serious short and long-term maternal, fetal, as well as neonatal complications. Effective management with health educational intervention regarding GDM risks and its proper self-care measures will contribute to complications reduction and improve pregnancy outcomes for the woman and her offsprings. *The aim of this study:* was to evaluate the effect of implementation of health educational guidelines on maternal and neonatal outcomes among women with gestational diabetes mellitus. *Subjects and method:* The study was conducted at antenatal units of obstetric department at three settings; Tanta University Hospital, El-Menshawy General Hospital and El-Mabara Hospital. A convenient sample of 50 pregnant women diagnosed with GDM selected from the previously mentioned settings fulfilling the inclusive criteria were included in the study. Four tools were used for data collection: **Tool I: A structured interview schedule** that included (a). Socio-demographic characteristics, (b). Reproductive history, and (c). History of present pregnancy. **Tool II: Anthropometric measurements**, collected data about body mass index (BMI) of pregnant women. **Tool III: Structured GDM Women's Knowledge Interview Schedule**, included data related to **Part a:** assessment of women's knowledge about GDM and **Part b:** assessment of women's actual self-care measures regarding GDM. **Tool IV: Outcome Assessment Tool:** that included two parts **Part I:** Maternal outcome assessment sheet and **Part II:** Neonatal outcome assessment sheet. **Results:** The results of the present study revealed that fair and good level of knowledge as well as satisfactory level of self-care measures about GDM was reported among the study group after implementation of the education sessions. As well as significant improvement of maternal and neonatal outcomes were revealed among women of the study group who were less likely to develop maternal and neonatal complications after the implementation of the health education sessions in relation to time of onset labor, labor complications, length of hospital stay, neonatal complications, apgar score, birth weight, and also gestational age at delivery, as well as admission to neonatal intensive care unit. **Conclusion:** Health educational guidelines provided to the study group had improved their level of knowledge, awareness as well as self-care measures regarding GDM which consequently reflect positive effect on the maternal and neonatal outcomes in comparison with the control group who received only the routine hospital care. *Therefore, the study recommended:* Planning and developing antenatal health educational classes for all women to increase their awareness about the importance of early antenatal proper screening and effective GDM management to improve their pregnancy outcomes. In addition, refreshing courses and in-service training programs especially for newly appointed nurses can be successful in improving their knowledge and practices regarding GDM.

Keywords: Gestational Diabetes Mellitus , Maternal Outcome, Neonatal Outcome, and Health Education .

Introduction

Although, pregnancy is a normal phenomenon, complications can occur⁽¹⁾. Diabetes Mellitus (DM) is one of the most common medical complication that often affects pregnancy⁽²⁾. Diabetes in pregnancy may be gestational (90%) or pregestational (10%) when it antedates pregnancy⁽³⁾. Gestational Diabetes Mellitus (GDM), is a type of diabetes defined as any degree of glucose intolerance or abnormal glucose metabolism with the onset or first recognition during pregnancy and usually resolves after the birth of the baby^(4,5). It is estimated that 3–9% of pregnancies are complicated by diabetes and 90% of these cases represent women with GDM^(4,6). The rate of gestational diabetes among pregnant women in Egypt affects between 2-14% of all pregnancies⁽⁷⁾. Pregnancy induces progressive changes in maternal carbohydrate metabolic process. As pregnancy advances, insulin resistance and diabetogenic stress due to placental secretion of hormones including estrogen, progesterone, human placental lactogen (HPL), elevated cortisol, and insulinase require compensatory increase in insulin secretion. When this compensatory mechanism fails due to pancreatic β cells inadequacy or the insulin is not used

effectively, gestational diabetes develops^(4,8,9).

There are several risk factors enhances the development of GDM as; age over 30 years, family history of diabetes in a first-degree relative, previous GDM, obesity, a prior macrosomic baby(>4.5 kg), malformed, unexplained fetal/perinatal loss, or recurrent vaginal candidiasis, and repeated miscarriage. GDM is symptomatic although women may notice increased thirst, urinary frequency, hunger, or fatigue especially during the late second or third trimester of pregnancy^(10,11,12,13). Therefore, all pregnant women regardless of risk factors should be screened for gestational diabetes toward the end of the second trimester between (24th& 28th) weeks of gestation^(8,12). While, women with risk factors for GDM should be screened earlier in pregnancy. Typically, screening is based on (Two-Step approach) including Glucose Challenge Test (GCT) which based on oral intake of 50 gram glucose solution followed by a blood sample is taken 1 hour later. Then blood glucose level of 130 to 140 mg/dl is considered as cut off point for a subsequent Oral Glucose Tolerance Test (OGTT) using 100 gram 3-hours or a 75 gram 2-hours OGTT for confirmation of GDM diagnosis^(8,14,15,16).

So, undiagnosed or inadequately managed GDM can lead to range of adverse pregnancy outcomes including; serious short and long-term maternal, fetal, as well as neonatal complications ⁽¹⁷⁾. These complications include; pre-eclampsia, preterm birth, cesarean section delivery, vaginal candidiasis, macrosomia, shoulder dystocia, birth trauma, hypoglycemia, jaundice, respiratory distress syndrome, and admission to neonatal intensive care unit. GDM also predisposes the offspring to childhood obesity and the woman to GDM in subsequent pregnancies and the development of Type 2 diabetes in the long run. So, identifying this group of women and caring for them is important not only in preventing perinatal morbidity but also, in improving long-term outcomes for the mothers and their children ^(18,19,20,21).

Thus, a major part of GDM nursing management involves educating patients regarding GDM risks and its proper self-care measures as; diet, exercise, self-blood glucose monitoring and insulin treatment. As health education plays an important role in increasing women's knowledge and awareness about GDM that will be translated to improve their self-care measures and increase their commitment with the care regimen, which ultimately will contribute to complications reduction.

So, the health educational intervention are necessary step for better GDM management to improve pregnancy outcomes for the woman and their offsprings ^(18,22,23,24).

Aim of the study

The aim of this study was to evaluate the effect of implementation of health educational guidelines on maternal and neonatal outcomes among women with gestational diabetes mellitus.

Research Hypothesis:

Maternal and neonatal outcomes are expected to be free from complications after implementation of the health educational guidelines provided to women with gestational diabetes mellitus.

II. Subjects and method

i. Research design:

A quasi-experimental interventional research design was used in this study.

ii. Setting:

The study was carried out at antenatal units of obstetric department at three settings; Tanta University Hospital, El-Menshawy General Hospital and El-Mabara Hospital.

iii. Subjects:

According to the equation of power analysis, the study compromised of a convenient sample of 50 pregnant women diagnosed with GDM that based on 95% confidence, 80% power of the study. This

sample was selected from the previously mentioned settings fulfilling the inclusive criteria where pregnant women aged range (18-38) years, with gestational weeks between (28-34) at their 3rd trimester of pregnancy, both primigravida and multigravida, diagnosed only with GDM, singleton pregnancy, normal course of pregnancy (free from other medical and obstetrical complications and willing to participate in the study.

The sample was divided into two equal groups:

- 1. The study group:** consisted of 25 pregnant woman diagnosed with GDM and whom the health educational guidelines were provided to them.
- 2. The control group:** consisted of 25 pregnant woman diagnosed with GDM who received the routine hospital care.

iv. Tools of data collection:

Four tools were developed by the researcher based on relevant literatures and used to collect data about the study subjects as follows:-

Tool I: A structured interview schedule: was used to collect data related to three parts as following:

- a. Biosocio-demographic characteristics** as; age, education, occupation, residence and income.

- b. Reproductive history** such as; gravidity, parity, number of abortions and still birth, presence of obstetrical complications in previous pregnancies, deliveries and puerperium, mode and place of last delivery, GDM past history, antenatal booking (initial visit, follow up visits) and attendance of antenatal care classes related to GDM.

- c. History of present pregnancy** as; detection time of GDM, presence of risk factors of GDM, onset of symptoms, method of treatment with GDM (insulin, diet or exercise), presence of GDM complications, blood glucose level at time of hospital admission and previous hospitalization due to GDM.

Tool II: Anthropometric measurements; collect data about body mass index (**BMI**) which included height and weight of pregnant women. Because the current study was conducted on the pregnant women with unknown pre-pregnancy weight, BMI can be calculated by subtracting the measured weight by expected weight gain in normal pregnancy. So, for calculation of pre-pregnancy weight the following equation was used to calculate pre-pregnancy BMI ⁽²⁵⁾:

- Up to 20 weeks of gestation: Subtract 3 kgs from current weight .

- > 20 weeks of gestation: Subtract 3.0 kgs plus 0.5 kg/week from current weight .
- After height and weight were measured for each woman, then the body mass index (BMI) was calculated using the equation and/or formula: $BMI = \text{weight kg} / (\text{height in m})^2$.

Tool III: Structured GDM Women's Knowledge Interview Schedule: It included data related to

- **Part a:** Assessment of women's knowledge regarding GDM as; definition, risk factors, signs and symptoms, effect of GDM on pregnancy including; maternal/fetal-neonatal complications, diagnostic tests needed for GDM, therapeutic management regimen and women's sources of GDM knowledge.

The scoring system regarding women's knowledge of GDM were as follow:

- Correct and complete answers was given score (2).
- Correct and incomplete answers was given score (1).
- Incorrect answers and don't know was given score zero (0) .

The total knowledge score level calculated by (17questions \times 2=34) which was categorized as follows:

- Poor level of knowledge < 60% .
- Fair level of knowledge 60 - < 75% .
- Good level of knowledge 75 - 100% .
- **Part b:** Assessment of women's actual self-care measures regarding GDM as; self-monitoring of blood glucose level, self-injection of insulin, self-care measures for hypoglycemia/hyperglycemia, dietary intake per day, exercise, personal hygienic measures including (bathing, foot, teeth, perineal and breast care measures), self-monitoring of daily fetal movements. In addition, self-care measures after birth as breastfeeding, contraceptive method and follow-up of blood glucose analysis to assess the relieve of GDM.

The scoring system of women's self-care measures regarding GDM were adopted⁽²⁶⁾: The correct answer for any practice items was given a score of "1," and the incorrect given "0." The scores of self-care measures were added and obtained for each woman which ranged from 0-39 then divided by maximal score converted into a percent score. The total score of self-care measures or practice was classified as follow:

- **Satisfactory practice > 60% .**
- **Unsatisfactory practice < 60% .**

Tool IV: Outcome Assessment Tool:

This tool was developed by the researcher based on recent/ relevant literatures and used to evaluate presence of maternal and neonatal complications and/or outcomes during delivery for the study group who was provided by health educational sessions about GDM, as well as the control group who exposed only to the routine hospital care. It was used to collect data related to two parts.

- **Part I: Maternal outcome assessment sheet:** Included assessment of (presence of maternal distress, mode of rupture of membranes-spontaneous and/or artificial, time of rupture of membranes-pre-mature or mature, type of delivery-normal or cesarean section, occurrence of complications during labor related to GDM as (pre-eclampsia, preterm labor obstructed labor, cord prolapse, obstetric trauma, postpartum hemorrhage), length at hospital stay.
- **Part II: Neonatal outcome assessment sheet:** Included assessment of (viability status-alive or stillborn, abnormal apgar score at the first & fifth minutes, need for resuscitation and oxygen administration, visible congenital

malformation, birth weight measurements (macrosomia), gestational weeks at delivery, neonatal complications such as; birth trauma "shoulder dystocia", neonatal hypoglycemia or jaundice, signs of respiratory distress syndrome, admission to neonatal intensive care unit, and hospital length stay.

Method:

1. Administrative approval:

An official permission and approval for carrying out the study was obtained from the responsible authorities before conducting this study through official letters from the Faculty of Nursing Tanta University.

2. Developing the tools:

Four tools of data collection including; a structured interview schedule, anthropometric measurements, women's knowledge interview schedule regarding GDM as well as women's self-care measures, and outcome assessment tool were developed by the researcher after reviewing of the relevant and recent literatures. Tools were translated and tested for content and construct validity by 3 experts in the related field and modifications were accordingly carried out. Tool's reliability was tested for calculating Cronbach's alpha which was

0.784 indicating high reliability of the study tools.

3. Ethical consideration:

All pregnant women with GDM who were approached to participate in the study were informed orally about the purpose of the study, confidentiality of information was ascertained and right to withdraw from the study at any time if desired. Subjects who agreed to participate in the study were asked to give their consent orally.

4. The pilot study:

After the development of the tools, a pilot study was carried out before the actual data collection on 10% of the sample "5" pregnant women diagnosed with GDM from the previously mentioned settings to ascertain the clarity, feasibility and applicability of the developed tools. Accordingly the necessary modifications, and/or rephrasing, were done according to the results of this pilot study, then the tools made ready for use. Data obtained from the pilot study were excluded from the current study sample.

5. The actual study (field work):

- 1) Data were collected from a convenient sample of 50 pregnant women who were diagnosed with GDM within the study and control groups over a period from the beginning of September 2016 to the beginning of June 2018 at

the morning, and afternoon until the predetermined sample size were collected. All cases presented at time of data collection and had the inclusion criteria at each setting were included in the study.

- 2) Data were collected firstly from the control group "assessment phase", for an appropriate health educational sessions to be prepared, planned, and implemented by the researcher for the study group according to needs of GDM women.
- 3) The study was implemented and conducted through 4 phases: assessment, planning, implementation, and evaluation.
 - **Pre-intervention (assessment phase):**
 - All women with GDM were assessed for their general and obstetric characteristics through a structured interview schedule that was distributed and conducted individually for each woman using (**Tool I**) parts (**a, b, c**) for the study and control group as well as BMI assessed with **Tool II** by measuring height and weight at the beginning before the implementation of health education.
 - All women with GDM were also interviewed individually to assess their

knowledge and self-care measures regarding GDM through a pre-test structured women's knowledge interview schedule about GDM using tool (III) parts (a, b) for each woman in the study and control group.

- **Planning phase:** based on the data collected using an interview schedule to assess women's knowledge and self-care measures regarding GDM "assessment phase". An appropriate health educational sessions for pregnant women with GDM were prepared, planned, and implemented by the researcher for the study group, while the control group was left to the routine hospital care. Planning through the following steps:
 - **Setting clear objectives:** Goals and expected outcomes for the health educational sessions was formulated and implemented according to the related literatures based on assessment phase. After completion of health educational sessions, women with GDM were able to:
 - Explain the meaning and definition of GDM.
 - Understand risk factors linked to GDM.
 - Identify sign and symptoms of GDM.
 - Recognize the cause and possible effects of GDM on pregnancy including

maternal and fetal/neonatal complications.

- Know the various aspects of GDM self-care measures.
- Perform the different GDM self-care items.
- **Preparation of the content:** The content of the health educational sessions included information related to the following: Definition and risk factors of GDM, Information about symptoms of GDM as well as hypoglycemia and hyperglycemia, causes and effects of GDM on pregnancy (expected complications of GDM; maternal and fetal/neonatal), Screening, diagnosis and management of GDM, Various aspects of GDM self-care measures including self-monitoring of blood glucose level, insulin self-injection, diet, exercise, fetal movements as well as self-care measures regarding symptoms of hypoglycemia or hyperglycemia and personal hygienic measures.
- **Preparation of teaching methods and aids:-** after completion of content preparation, methods of teaching were selected, prepared and utilized by the researcher which included:- Group or individual discussion, Demonstration and redemonstration, Audiovisual materials,

video and PowerPoint presentation, and an Arabic educational booklet, and equipments of; insulin injection blood glucose device, digital portable adult scale, etc.

- **Implementation phase** :-(Health educational sessions)
- The researcher prepared and presented the health educational sessions in Arabic language for the woman with GDM among the study group during hospitalization or at their visits to the antenatal unit which included 3 main separate sessions ranged from (15-20) minutes and conducted individually or in group according to the available cases in the hospital giving jointly with an educational booklet to be used as a guide for self-learning.
- These sessions if possible were presented in the attendance of family member who cares for the woman with GDM at home to reinforce the instructions given, raising confidence and improve their level of adherence with GDM therapeutic self-care regimen.
- **The program sessions covered the following items:**
- **First session:** Included definition of GDM, risk factors (maternal and fetal-neonatal), causes, signs and symptoms,

expected complications of GDM (maternal and fetal/ neonatal complications), screening and diagnosis of GDM, therapeutic management and its effectiveness in preventing complications.

- **Second session:** Clarified self-care measures regarding GDM as self-monitoring of blood glucose level, self-injection of insulin, monitoring of body weight, dietary intake, physical activity (exercise), as well as self-care measures regarding symptoms of sudden attack of increasing and decreasing blood sugar levels, danger signs, self -monitoring daily fetal movement and hygienic measures.
- **Third session:** Emphasized on diet regimen, physical exercise, medications in addition to prevention of reoccurrence of GDM in next pregnancies, and importance of postpartum follow-up.
- **Follow-up care:** It was conducted for each pregnant woman with GDM in the study group who was admitted to the hospital at obstetric department or came for antenatal follow-up visits after and every 2 weeks after implementation of the sessions until delivery. At each antenatal visit, continuing education reinforced by the researcher for knowledge and self-care

measures related to GDM with reviewing blood glucose chart of women came for follow-up and development of any complications as occurrence of hypo/hyperglycemia and action taken toward it. Also, fasting and postprandial blood glucose levels were assessed for the study group after the implementation of health educational sessions as well as for the control group who received only the routine hospital care. On the other hand, women were telephoned for follow-up and attendance at delivery if discharged from hospital before delivery or who not were able to come for follow-up.

– **Evaluation phase:-**

- Woman's knowledge about GDM and self-care measures were evaluated immediately after implementation of the health educational sessions for study group by using **Tool III " part a, b "** and for control group who received only routine hospital care by using the same tool.
- Maternal and neonatal outcome assessment sheet **tool (IV part I, II)** was also used to evaluate maternal and neonatal conditions related to any complications arised as birth canal injury or lacerations, bleeding during

labor, presence of maternal distress signs, preterm labor, intrapartum pre-eclampsia and/or shoulder dystocia, hypoglycemia, abnormal apgar score, presence of respiratory distress syndrome, need for resuscitation, admission to neonatal intensive care unit and measuring neonate's weight to determine macrosomia etc for the study group immediately and 6 hrs after delivery as well as compared with the control group who received the routine hospital care.

6. Statistical analysis:

The collected data were organized, tabulated and statistically analyzed using SPSS version 19 (Statistical Package for Social Studies) created by IBM, Illinois, Chicago, USA.

III. Results

Table(1): Illustrates that the mean age of women among the study and control groups were (31.16+4.61 and 33.88+5.43 respectively), an equal approximate percentage of the study and control groups (56% and 48%) either were from rural areas or finished secondary/ diplom education, while about each one third (28.0% & 32% respectively) of them had university education. Concerning the occupation, (48% & 64% respectively) among women of the study and control

groups were housewives and the rest of them were working.

Table(2): Clarifies that more than one third (36.0%) of the study group were pregnant more than three times compared to slightly less than half (48.0%) of the control group, (24.0% and 36.0%) of them had a history of abortions from one to two times respectively. As regard to the type of last delivery, (64.0% and 44.0% respectively) of women among the study and control groups delivered by cesarean section and the governmental hospital was the most commonly reported place of last delivery mentioned by (68.0% and 52.0% respectively) of them.

Table(3): Demonstrates antenatal care booking that all (100.0% respectively) of women among the study and control groups sought initial antenatal visit at first trimester, an equal percentage (84.0%) of women within each of the studied groups received antenatal care at private hospital and doctor's clinic and the majority (84.0% & 80.0%) of them had more than four antenatal visits respectively. Also, in relation to attendance of health education classes especially related to GDM, it is found that all the study and control groups (100.0%) respectively did not attend any health education classes related to GDM.

Table (4): Shows that (72.0% & 84.0%) of the study and the control groups had GDM during their third trimester of pregnancy while the rest of them were diagnosed by GDM during the second trimester, about two third (64.0% and 60.0%) for each group had received diet and insulin for GDM management and the rest received only diet management respectively. Pertaining to GDM complications present during current pregnancy, it is apparent that vaginal yeast infections, polyhydramnios and high blood pressure were the most frequent complications occurred due to GDM that was reported by (52.0%, 48.0% and 24.0%) of women among the study group respectively compared to polyhydramnios, high blood pressure, and vaginal yeast infections among women of control group which was recalled by (60.0%, 44.0% and 40.0% respectively). Additionally, the mean of blood glucose level at hospital admission for the study group was 229.36+64.15 corresponding to a mean of 208.60+45.02 among the control group.

Figure (1): Points out that approximate percentage (76.0% and 72.0% respectively) of women within the study and control groups were obese with no statistically significant difference between them. ($p= 1.000$).

Table(5): Revealed the presence of GDM risk factors which clarifies that body mass index >30, family history of DM, and age >30 years were the most common risk factors of GDM among women of the study group that was expressed by (76.0%, 64.0%, and 60.0% respectively) of them. On the other hand, women of the control group who had age >30 years, body mass index >30, and family history of DM as the most frequently encountered risk factors of GDM that was confirmed by (76.0%, 72.0%, and 64.0% respectively). On the other hand, repeated miscarriage, family history of GDM, history of stillbirth, previous history of; pre-eclampsia, GDM, macrosomic baby and polyhydramnios were other risk factors of GDM among women of the studied groups.

Table (6): Revealed that the majority (84.0%) of women within the study group exhibited poor level of knowledge regarding GDM before implementation of the health educational guidelines compared to all (100.0%) of women within the control group. Whereas total score level of knowledge regarding GDM after health education, indicates that slightly less than half (48.0%) and more than one third (36.0%) of women among the study group exhibited fair and good level of knowledge about GDM respectively compared to all

of women within the control group had poor level of knowledge with statistically significant difference between the study and control groups ($Z= 4.099$ $p= 0.001^*$).

Figure(2): Illustrates women's sources of knowledge concerning GDM that family/relatives and occupation were the main sources of knowledge regarding GDM among women of the study group that mentioned by (48% and 40% respectively) of them compared to (72% and 28% respectively) among women of the control group. While, only more than one tenth (16% and 12%) of the women for each of the study and control groups obtained their information about GDM from doctor/nurse respectively.

Table(7): Presents that the majority (96.0% & 80.0% respectively) of women among the study and control groups had unsatisfactory level of self-care measures before implementation of the health educational guidelines regarding GDM compared to (80.0% & 24.0% respectively) of them had satisfactory level of self-care measures after health education with a statistical significant difference before and after health education ($p= 0.001^*$).

Table(8): As regards maternal outcomes after implementation of the health education sessions; there was statistically

significant improvements in maternal outcomes among the study group compared to the control group. These were mainly related to time of onset labor, labor complications and length of hospital stay. As the present study showed that the majority (80%) of the women among the study group had no complications during labor compared to almost (88%) women among the control group who experienced labor complications such as; obstructed labor, postpartum hemorrhage, genital tract lacerations, intrapartum hemorrhage, cord prolapse, preterm labor and also pre-eclampsia. As regards mode of delivery, the table clarified that an equal proportion of the study and control groups (80.0%) respectively delivered by cesarean section, and the rest of them (20.0%) had normal vaginal delivery. In addition, the table also illustrates that the mean length of hospital stay for women of the study group (1.76+1.23) was also shorter than that of the control group (3.56+2.42) with a statistically significant difference between them ($p=0.019$).

Table(9):As regards neonatal outcomes after implementation of the health education sessions; abnormal apgar score is found among only (12%) of the study group compared to (48%) of the control group, (8.0%) of the study group had macrocosmic baby $>4\text{kg}$ compared to more than one third of the control group (40.0%). As regards gestational age at delivery, it is noticed that the mean of gestational age at delivery for the study

group $38.48+1.36$ was higher/ longer than that of the control group $36.36+1.66$. Concerning neonatal complications; the present study concluded that a statistically significant difference was found between the study and control groups where slightly more than three quarters (76.0%) of women among the study group experienced no neonatal complications compared to only about one tenth (8.0%) of the control group. The most frequent rate of neonatal complications were found among the control group were hypoglycemia (36%), jaundice (76%), respiratory distress syndrome (48%) and birth trauma (8%) compared to the study group. Also, about one quarter (20%) of the study group exhibited admission to neonatal intensive care with a mean length of hospital stay ($2.24+1.79$) compared to the majority (88%) of the control group and longer length of hospital stay ($5.16+2.90$).

Table(10):Shows that significant strong correlation is observed between total knowledge score and total score self-care measures difference before and after health education regarding GDM ($p=0.001$). Meanwhile, weak correlation was present between women's total score self-care measures difference before and after health education and reproductive history including gravidity, parity, number of living children and previous pregnancy. However these correlations were not statistically significant.

Table(1): Socio-demographic characteristics of the study and control groups.

Socio-demographic data	Study group (n=25)		Control group (n=25)	
	n	%	n	%
Age (years):				
<25	1	4.0	2	8.0
25 - 29	7	28.0	4	16.0
30 - 34	11	44.0	2	8.0
35 - 38	6	24.0	17	68.0
Range	21-37		22-38	
Mean + SD	31.16+4.61		33.88+5.43	
Residence:				
Urban	11	44.0	13	52.0
Rural	14	56.0	12	48.0
Educational level:				
Illiterate	1	4.0	1	4.0
Primary/preparatory	3	12.0	4	16.0
Secondary/diplom	14	56.0	12	48.0
University	7	28.0	8	32.0
Occupation:				
Housewife	12	48.0	16	64.0
Working	13	52.0	9	36.0

Table(2): Reproductive history of the study and control groups .

Reproductive history	Study group (n=25)		Control group (n=25)	
	n	%	n	%
Gravida:				
Nulligravida	1	4.0	1	4.0
1	5	20.0	4	16.0
2-3	10	40.0	8	32.0
>3	9	36.0	12	48.0
Parity:				
Nullipara	1	4.0	4	16.0
1	6	24.0	5	20.0
2-3	17	68.0	12	48.0
>3	1	4.0	4	16.0
Number of abortions:				
None	17	68.0	10	40.0
1-2	6	24.0	9	36.0
>2	2	8.0	6	24.0
Number of stillbirth:	4	16.0	1	4.0
Type of previous delivery:				
Normal vaginal delivery	8	32.0	10	40.0
Cesarean section	16	64.0	11	44.0
Nullipara	1	4.0	4	16.0
Place of previous delivery:				
Home	0	0.0	2	8.0
Governmental hospital	17	68.0	13	52.0
Private hospital	7	28.0	6	24.0
Nullipara	1	4.0	4	16.0

Table(3): Distribution of the studied groups according to their booking of antenatal care.

Booking of antenatal care	Study group (n=25)		Control group (n=25)	
	n	%	n	%
Time of the initial antenatal visit:				
First trimester	25	100.0	25	100.0
Place of antenatal care: **				
Governmental hospital	1	4.0	1	4.0
Private hospital/ doctor's clinic	21	84.0	21	84.0
MCH Centers	8	32.0	11	44.0
Health Insurance hospital	1	4.0	0	0.0
Number of antenatal visits:				
Three times	3	12.0	0	0.0
Four times	1	4.0	5	20.0
More than four times	21	84.0	20	80.0
Attendance of health education classes especially related to GDM:				
Yes	0	0.0	0	0.0
No	25	100.0	25	100.0

** More than one answer.

MCH: Maternal and Child Health Centers

Table(4):Distribution of the women according to their history of current pregnancy.

History of current pregnancy	Study group(n=25)		Control group(n=25)	
	N	%	N	%
Detection & onset time of GDM:				
Second trimester	7	28.0	4	16.0
Third trimester	18	72.0	21	84.0
GDM management:				
Diet management	8	32.0	10	40.0
Diet + Insulin	16	64.0	15	60.0
Diet+ oral hypoglycemic	1	4.0	0	0.0
Presence of complications due to (GDM):				
Yes	23	92.0	22	88.0
No	2	8.0	3	12.0
GDM complications during current pregnancy: **				
Threatened abortion	0	0.0	1	4.0
High blood pressure	6	24.0	11	44.0
Vaginal yeast infection	13	52.0	10	40.0
Urinary tract infection	4	16.0	5	20.0
Polyhydramnios	12	48.0	15	60.0
Blood glucose level at hospital admission:				
Range	130-400		126-350	
Mean+SD	229.36+64.15		208.60+45.02	
Previous hospitalization due to (GDM):				
Yes	1	4.0	6	24.0
No	24	96.0	19	76.0

*t test

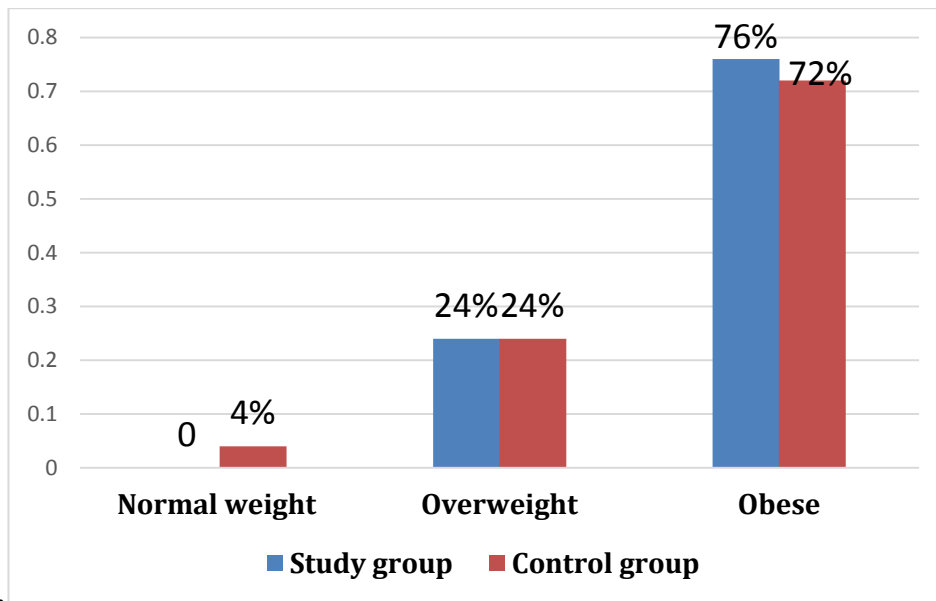
** More than one answer.

Table(5):Distribution of women according to the presence of risk factors of GDM.

Presence of risk factors of GDM **	Study group (n=25)		Control groups (n=25)		χ^2	p
	n	%	n	%		
Age>30 years	15	60.0	19	76.0	1.471	0.225
Previous history of GDM	3	12.0	8	32.0	2.914	0.088
Family history of GDM	4	16.0	1	4.0	FE	0.349
Family history of DM	16	64.0	16	64.0	0.000	1.000
History of pre-eclampsia	3	12.0	5	20.0	FE	0.702
Repeated miscarriage	5	20.0	9	36.0	1.587	0.208
History of polyhydramnios	1	4.0	3	12.0	FE	0.609
History of glycosuria	1	4.0	0	0.0	FE	1.000
Previous macrocosmic baby	2	8.0	6	24.0	FE	0.247
History of still birth	4	16.0	1	4.0	FE	0.349
Unknown intrauterine fetal death	0	0.0	3	12.0	FE	0.235
Body mass index >30	19	76.0	18	72.0	0.104	0.747

FE= Fisher exact test

** More than one answer



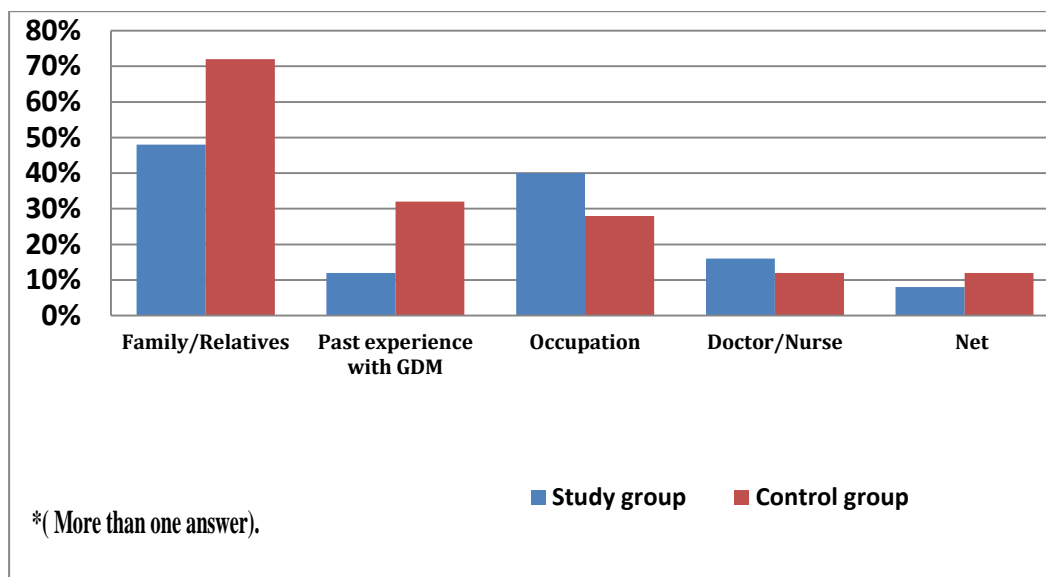
Figure(1):Distribution of the studied groups according to their anthropometric measurements (BMI) before implementation of the health educational guidelines regarding GDM

Table(6):Distribution of women according to their total score level of knowledge regarding GDM before and after implementation of the health educational guidelines (study and control groups).

Level of total knowledge scores regarding GDM	Study group(n=25)		Control group(n=25)		P
	n	%	n	%	
Before health education:					0.110
Poor	21	84.0	25	100.0	
Fair	4	16.0	0	0.0	
Good	0	0.0	0	0.0	
After health education:					0.001*
Poor	4	16.0	25	100.0	
Fair	12	48.0	0	0.0	
Good	9	36.0	0	0.0	
Z	4.099		0.000		
P	0.001*		1.000		

*Significant (P <0.05).

Monte Carlo exact test.



Figure(2):Distribution of the studied groups according to their sources of knowledge regarding GDM before implementation of the health educational guidelines.

Table(7):Distribution of women according to total score level of self-care measures regarding GDM before and after implementation of the health educational guidelines (study and control groups).

Level of total score self-care measures regarding GDM	Study group(n=25)		Control group(n=25)		p
	n	%	n	%	
Before health education:					0.189
Unsatisfactory < 60	24	96.0	20	80.0	
Satisfactory > 60	1	4.0	5	20.0	
After health education:					0.001*
Unsatisfactory < 60	5	20.0	19	76.0	
Satisfactory > 60	20	80.0	6	24.0	
Z	4.359		1.000		
P	0.001*		0.317		

*Significant (P <0.05) .

Monte Carlo Exact Test

Table(8):Distribution of women according to maternal outcome assessment after implementation of the health educational guidelines regarding GDM (study and control groups).

Maternal outcome assessment	Study group (n=25)		Control group (n=25)		χ ²	p	
	n	%	n	%			
Time of onset labor:					10.503	0.001*	
Pre-term	3	12.0	15	60.0			
Full-term	22	88.0	10	40.0			
Time of rupture of membranes:					10.503	0.001*	
Pre-mature/ Mature	22	88.0	10	40.0			
Pre-term PROM	3	12.0	15	60.0			
Mode of rupture of membranes:					8.017	0.004*	
Artificial	19	76.0	9	36.0			
Spontaneous	6	24.0	16	64.0			
Type/ mode of delivery:					0.000	1.000	
Cesarean section	20	80.0	20	80.0			
Normal vaginal delivery	5	20.0	5	20.0			
Labor complications: **							
Preterm Labor	3	12.0	15	60.0	10.503	0.001*	
Obstructed	0	0.0	2	8.0	FE	0.490	
Pre-eclampsia	1	4.0	9	36.0	8.000	0.005*	
Genital lacerations	0	0.0	5	20.0	FE	0.025*	
Intrapartum hemorrhage	0	0.0	5	20.0	FE	0.025*	
Postpartum hemorrhage	0	0.0	2	8.0	FE	0.490	
Cord prolapse	0	0.0	8	32.0	FE	0.004*	
None	20	80.0	3	12.0	23.269	0.001*	
Length of hospital stay:					Z =	0.019*	
Range	1-5		1-8				2.340
Mean+SD	1.76+1.23		3.56+2.42				

** More than one answer. *Significant (P <0.05). FE= Fisher Exact Test. PROM: Premature Rupture Of Membrane.

Table(9):Distribution of women according to neonatal outcome assessment after implementation of the health educational guidelines regarding GDM (study and control groups).

Neonatal outcome assessment	Study group (n=25)		Control group (n=25)		χ ²	p
	n	%	N	%		
Signs of fetal distress:					5.094	0.024*
Present:	3	12.0	10	40.0		
Absent:	22	88.0	15	60.0		
Apgar score:					6.095	0.014*
Abnormal	3	12.0	12	48.0		
Normal	22	88.0	13	52.0		
Need for O₂ & resuscitation	3	12.0	12	48.0	6.095	0.014*
Still birth	0	0.0	2	8.0	FE	0.245
Preterm infant	3	12.0	15	60.0	10.503	0.001*
Macrosomic baby > 4 kg	2	8.0	10	40.0	7.018	0.008*
Neonatal weight:					Z=2.344	0.019*
<2.5 Kg	0	0.0	3	12.0		
>2.5 Kg	25	100.0	22	88.0		
Mean+SD	3.46+0.45		3.84+1.01			
Gestational age at delivery:	38.48+1.36		36.36+1.66		t=4.951	0.001*
Neonatal complications: **						
Congenital malformations	0	0.0	0	0.0	∞,∞∞	∞,∞∞
Birth trauma	0	0.0	2	8.0	FE	0.245
Hypoglycemia	4	16.0	9	36.0	2.599	0.107
Jaundice	4	16.0	19	76.0	18.116	0.001*
Respiratory distress	2	8.0	12	48.0	9.921	0.002*
Admission to intensive care	5	20.0	22	88.0	23.269	0.001*
None	19	76.0	2	8.0	23.727	0.001*
Length of hospital stay					Z=3.955	0.001*
Range	1-7		0-10			
Mean+SD	2.24+1.79		5.16+2.90			

** More than one answer.

*Significant (P <0.05)

FE= Fisher Exact Test

Table (10):Correlation between women's total score of self-care measures difference and reproductive history before and after implementation of the health educational guidelines regarding GDM.

Reproductive history.	Self-care measures score difference	
	r	P
Gravida	-0.166	0.249
Parity	0.011	0.937
Number of living children	-0.008	0.955
Previous pregnancy interval	0.111	0.441
Total knowledge score	0.833	0.001*

*Significant (P <0.05)

V. Discussion:

Pregnancy and diabetes are two distinct clinical entities, one is a normal physiological process that typically results in a positive outcome and other is a pathological disorder with inherent problems and complications⁽²⁷⁾. Gestational Diabetes Mellitus (**GDM**) substantially increases the risk of adverse health outcomes for both the mother and the offspring^(28,29). As adverse outcomes associated with GDM create higher medical costs for prenatal care, labor and delivery of baby, and extended postpartum recovery. Therefore, pregnancy is an ideal time for providing health education to women with GDM^(30,31). Because health education is the first step to diabetes management and one of the tools to provide women with accurate knowledge, skills and actions to cope with the practical aspects of self-care measures regarding GDM to improve fetal and maternal outcomes^(32,33).

Concerning socio-demographic characteristics and reproductive history of the studied women, the findings of the present study revealed that GDM cases were significantly older in age where the mean age of the study and control groups were (31.16±4.61 & 33.88±5.43

respectively), approximately 50% of each group either were from rural areas, finished secondary/diplom education, or housewives. In addition, they had; higher gravidity, parity, abortion, and greater percentage of operative deliveries(Cesarean Section),and governmental hospital was the most commonly reported place of previous delivery among both groups. These findings are expected to increase women's risk for gestational diabetes that recommended education for early proper prenatal screening of GDM as well as effective management for positive outcomes.

Regarding the anthropometric measurements (Body Mass Index) of the pregnant women, the findings of the present study documented that BMI of the studied sample(slightly more than three-quarters of women) were obese with no statistically significant difference between the study and control group. Obesity, remains an important and increasing risk factor for the development of gestational diabetes mellitus. Moreover, the findings of the current study indicated that GDM was also more likely to be observed among women aged more than 30 years, had family history of DM and had repeated

miscarriage that was experienced by slightly more than three quarters of women. On the other hand, it is found that family history of GDM, history of; still birth, pre-eclampsia, GDM, previous macrosomic baby, polyhydramnios and unknown intrauterine fetal death were also other risk factors appear to increase women's risk for GDM.

These findings are in accordance with **El Shair A (2012)**⁽³⁴⁾, and **Azzam H et al (2015)**⁽³⁵⁾, they ascertained that body mass index of their studied sample were obese with no statistical significant difference between the study and control groups. Again, these findings are supported by **List S (2016)**⁽³⁶⁾, who found that prevalence of GDM was among women with BMI between 31.23 and 37.12 for the studied groups as well as **Hieronimus L et al (2016)**⁽³⁷⁾, who observed that overall mean values of BMI in the intervention group was 32.8 compared to 30.0+6.4 in the control group. These findings are also consistent with **Wahabi H et al (2017)**⁽³⁸⁾, who tailed that some of the recognized risk factors for the development of GDM, including increase in maternal age and obesity. Also, **Soheilykhah S et al (2010)**⁽³⁹⁾, reported that GDM was more prevalent among women with positive history of diabetes and those who; older and age >30

years. As well, they added that the incidence of GDM increased among women who had history of macrosomic infant, previous abortion, still birth and previous history of GDM. Also, a study was carried out by **Varma D et al (2017)**⁽⁴⁰⁾, found that GDM is associated with early pregnancy loss, family history of DM and previous history of macrosomic baby. The resemblance between these findings and the findings of the current study could be clarified by the fact that obesity is associated with the development of Type2 DM and GDM due to the increased peripheral resistance to insulin⁽³⁸⁾. Furthermore, literatures draws attention to the fact that risk factors for gestational diabetes are; positive family history of DM (parents, siblings), age over 30 years, obesity, BMI>30, prior GDM, macrosomic baby of 4 kg or more, previous history of macrosomic baby. Additionally, fetal anomalies, unexplained perinatal loss, presence of polyhydramnios or preeclampsia, recurrent Urinary tract infection (UTI) or vaginal candidiasis in present pregnancy and also previous still birth^(3,41).

Since, many women are unaware of pregnancy and maternal or fetal complications resulting from GDM as well as the optimal care of GDM. So, if women

are equipped with better knowledge and self-care measures regarding GDM, they can gain the ability to self-manage their condition properly. As a result, improved outcomes will be achieved for women with GDM and their infants^(42,43,44). **Concerning women's knowledge regarding GDM** before and after the implementation of the health education sessions, the current study revealed that the majority of the women among the study group had poor level of knowledge regarding GDM corresponding to all of the women among the control group before health education sessions. Meanwhile, after health education sessions about one half of the study group had fair level of knowledge, more than one third accomplished good level of knowledge compared to the whole control group who had poor level of knowledge about GDM. The score difference observed is statistically significant before and after health educational sessions regarding GDM between the study and control groups ($p= 0.001$).

These results are in line with **Rashad W & Aboul Azm Sh (2006)**⁽⁴⁵⁾. They indicated that the majority had poor total score before the sessions and the whole study subjects achieved good total score after teaching sessions. The difference in mean total score of knowledge for the study

subjects related to GDM before and after teaching sessions were found to be statistically significant as $Z=4.7821$ $p< 0.001$. These results are also identical with a study by **Hafez S (2003)**⁽⁴⁶⁾, who pointed out that the majority of the subjects had poor level of knowledge before implementing an educational program about GDM with significant increase in the level of knowledge of women among the study group compared to the control group with a statistically significant difference between the two groups. While, **El Shair A (2012)**⁽³⁴⁾ and **El Toony L et al (2018)**⁽⁴⁷⁾ revealed significant improvement in women knowledge about GDM compared with pre-test results. The harmony of the previous studies with the current study may be attributed to the effect of the implemented health education sessions provided about GDM. In addition, a big proportion of women with GDM in the current study were educated to be active participant in the session of the educational program. Furthermore, those women mentioned that they experienced GDM complications during previous pregnancies as well as those did not attend any health education classes regarding GDM make them more eager to gain knowledge to overcome the disease and its adverse outcomes.

As regard to the sources of women's knowledge about GDM, the present study clarified that about; half and three quarters of the women among the study and control groups respectively mentioned family and relatives as the main source of their knowledge regarding GDM. This is serious because such knowledge may be inadequate, inaccurate, premature, and incomplete. While, only more than one tenth of the women for each of the study and control groups obtained their information about GDM from doctor/nurse. These findings are supported by **Elmekresh A et al(2017)⁽⁴⁸⁾**, who mentioned that the major sources of knowledge about GDM were family members, media and educational centers. However, doctors and healthcare providers were the source of information among a lesser proportion of more than one tenth of women.

The findings of the present study also revealed that the majority of the study group had unsatisfactory level of self-care measures before health education sessions compared to more than three quarters of the control group. Whereas, after the health education sessions more than three quarters of women among the study group experienced satisfactory level of self-care measures regarding most of the studied

items such as; self-blood glucose-monitoring, self-injection of insulin, self care measures for occurrence of hypoglycemia or hyperglycemia, dietary intake, exercise, monitoring body weight and daily fetal movement, personal hygienic measures as; bathing, perineal hygiene, care of teeth, foot care and rest or/sleep. In addition, postpartum self-care measures (as breast care, breast feeding, family planning and follow-up for GDM) compared to only about one quarter of the women among the control group. A strong correlation between total knowledge and self-care measures scores, difference before and after health education sessions regarding GDM with a statistically significant difference($p=0.001$). So, well understanding of pregnant women regarding GDM increases their awareness leading to increase women's compliance to care regimen and accordingly enhances their self-care measures and consequently positive outcome.

These findings are matching with **Rashad W&Aboul Azm Sh(2006)⁽⁴⁵⁾**, they explained that only 6.7% obtained fair score while the most of them obtained poor total score before teaching sessions while, all obtained good total score after teaching sessions with statistical significant difference between before and after

teaching sessions. Another study also conducted by **Hafez S (2003)**⁽⁴⁶⁾, corresponds with the findings of the present study who found that the majority of her study subjects had unsatisfactory level of total practices scores before an educational program about GDM. Meanwhile significant improvement in the level of practices of women in the study group after the program compared to the control group. Fortunately, the previous studies are in agreement with the current study this may be attributed to that, education is the process of influencing behavior and producing changes in knowledge, attitude, and self-care measures required to manage problems related to the disease.

As regards maternal outcomes; after implementation of the health education sessions; the results of the current study revealed that there was statistically significant improvements in maternal outcomes among the study group compared to the control group. These were mainly related to time of onset labor, labor complications and length of hospital stay. The present study showed that the majority of the women among the study group had no complications during labor compared to women among the control group who experienced labor complications such as;

obstructed labor, postpartum hemorrhage, genital tract lacerations, intrapartum hemorrhage, cord prolapse, preterm labor and also pre-eclampsia.

These results are in accordance with **Rashad W& Aboul Azm Sh(2006)**⁽⁴⁵⁾, they found that more than two third of their study subjects passes through normal labor and deliveries while slightly more than one quarter had complicated labor and delivery. **Liu J&Xie X (2017)**⁽⁴⁹⁾, also stated that lower incidence rates of premature birth, postpartum hemorrhage, were found in study group than in control group, suggesting that health education intervention can significantly improve pregnancy outcomes. Another study done by **Metwally S & Abd El Fattah H (2004)**⁽⁵⁰⁾. They clarified that statistically significant improvements in maternal outcomes among the study group compared to control group. **El Toony L et al (2018)**⁽⁴⁷⁾, as well observed that the well-educated group had significantly less incidence of pre-eclampsia and hydramnios. In addition, **Carolan-Olah (2016)**⁽⁵¹⁾ had reviewed 12 papers about the efficacy of **GDM** education in reducing its burden, although interventions had a different approach, most were successful in reducing rates of macrosomia, hypertensive disorders, and in improving

pregnancy outcomes. This similarity between these results might be attributed to that the effect of the implemented health education sessions reduces short-term GDM burden and complications.

Concerning the mode of delivery; the results of the present study demonstrated that an equal proportion of more than three-quarters from each of the study and control groups delivered by cesarean section, and the rest of them had normal vaginal delivery. The difference was not statistically significant between both groups. These results are strongly in concurrence with **List S (2016)** ⁽³⁶⁾, who announced that mode of delivery between study and control groups was not statistically significant ($p=0.165$). In the same context, **El Toony L et al(2018)** ⁽⁴⁷⁾, stated that approximate percentage of CS and vaginal delivery was found within studied groups with no statistically significant difference regarding the rate of cesarean section between groups. Meanwhile, **Wang et al (2013)** ⁽⁵²⁾, who found that there was highest rate of cesarean delivery (87.1%) in women with GDM. Furthermore, **Mylonas I & Friese K (2015)** ⁽⁵³⁾, indicated that CS was hence reserved for those diabetic women who had fetal macrosomia, history of previous CS and/or had more than one risk factor.

The similarity between the previous studies results and the results of the current study related to the high incidence of CS which may be attributed to multiple factors such as large percentage of women among the study and control groups had history of previous CS, had more than one risk factors of GDM, the majority of cases of GDM were diagnosed later during third trimester of pregnancy as well as the hospital routine policy for CS in GDM women. Furthermore, **Cunningham F et al (2014)** ⁽⁵⁴⁾, cited that although vaginal birth is expected for most women with GDM, the cesarean rate for these women is as high as 80%. Cesarean birth increases maternal risks of morbidity and mortality but decreases risk of shoulder dystocia and brachial plexus injury.

Additionally, the findings of the present study clarified that a statistically significant difference was noted regarding **the mean length of hospital stay** among the study group (1.76+1.23) which was shorter than that of the control group (3.56+2.42). This can be justified by the majority of women within the study group had no complications during labor and delivery which in turn lead to shorter length of hospital stay compared to labor complications occurred among the control group that necessitates longer duration of

stay at hospital for caring and follow-up. This is in contrary to study done by **Sen E & Sirin A (2014)**⁽⁵⁵⁾, They reported that a statistically significant difference was not found regarding the length of staying at hospital of mothers between the intervention and usual care group.

Concerning neonatal outcome; the findings of the current study pointed out that a statistically significant better apgar score was found within the study group compared to the control group where only more than one tenth of abnormal apgar score among the study group versus about half for the control group. This finding is supported by **Metwally S & Abd El Fattah H (2004)**⁽⁵⁰⁾, who accounted statistically significant better apgar scores among the study group compared to the control group. **Rashad W & Aboul Azm Sh (2006)**⁽⁴⁵⁾, also notified that the majority of newborns in their study were normal. Similarly **Azzam H and El Sharkawy N (2015)**⁽³⁵⁾, confirmed that there was statistically significant difference in relation to apgar score after delivery between two groups. In contrast, **Gasim T (2012)**⁽⁵⁶⁾ and **Sen E & Sirin A (2014)**⁽⁵⁵⁾, concluded that apgar scores showed no significant difference between the two groups. This discrepancy might be interpreted by the difference in routine

policy of observation and in the care of the neonates at different hospitals.

As regards gestational age at delivery, it was noticed that the mean of gestational age at delivery for the study group 38.48 ± 1.36 was longer than that of the control group 36.36 ± 1.66 with a statistically significant difference observed between them. This finding is in harmony with **Azzam H and El Sharkawy N (2015)**⁽³⁵⁾, who portrayed that the mean of gestational age at the time of delivery among the study and control groups were $(38.920 \pm 1.8655 \text{ \& } 37.95 \pm 2.382)$ respectively with statistically significant difference found between the two groups. This may be due to the significant improvement of women's knowledge as well as self-care measures related to GDM where demonstration and compliance of women lead to improved pregnancy outcomes such as longer gestational weeks at delivery, decreased neonatal complications, and also shorter length of hospital stay.

Regarding neonatal complications; the present study concluded that a statistically significant difference was found between the study and control groups where slightly more than three quarters of women among the study group experienced no neonatal complications compared to only about one

tenth of the control group. The most frequent rate of neonatal complications were found among the control group were hypoglycemia, jaundice, respiratory distress syndrome and birth trauma compared to the study group. These results are consistent with **Liu J & Xie X (2017)**⁽⁴⁹⁾, they presented that significant lower incidence rates of neonatal; hyperbilirubinemia, severe asphyxia, hypoglycemia, and pneumonia were found among their study group than in control group. Similar results were also illustrated by **Rashad W & Aboul Azm Sh (2006)**⁽⁴⁵⁾, they showed that the majority of newborns were normal. **El Shair A (2012)**⁽³⁴⁾, also pointed out that incidence of neonatal complications in their study group have decreased compared with the control group. At the same line **Crowther C et al (2010)**⁽⁵⁷⁾, reported decrease in the incidence of dislocated shoulder, hypoxia, hypoglycemia, and respiratory problems in their study. Indicating that health education intervention can significantly improve perinatal health.

Concerning neonatal admission to neonatal intensive care unit and the length of hospital stay; the results of the current study revealed that about one quarter of the study group exhibited admission to neonatal intensive care with a

mean length of hospital stay ($2.24+1.79$) compared to the majority of the control group and longer length of hospital stay ($5.16+2.90$). These results are corresponding to **Azzam H and El Sharkawy N (2015)**⁽³⁵⁾, they reported that neonates in their control group were admitted to NICU from 1 to 4 days than in the study group. This agreement between these studies and the current study could be justified by that causes of admission to NICU ranged from only observation for a period of time which didn't exceed 2 hours to admission due to presence of neonatal complications within the control group such as respiratory distress syndrome, neonatal jaundice and hypoglycemia compared to the study group. Fortunately, health education guidelines given to the study group about GDM, the fear of complications, fear from serious threat to health were powerful incentives that inforce them to follow the strict care regimen even in emergency situations to avoid complications and adverse outcomes.

Accordingly, empowering women with knowledge regarding GDM through health educational guidelines enables them to seek care, follow medical procedures, and participate in health education programs. Knowledge and awareness about GDM

will be translated to improve their self-care measures and increase their commitment with the care regimen, which ultimately contributed to complications reduction. So, the study findings have proved that the health educational guidelines are necessary step for better management of GDM to improve pregnancy outcomes for the woman and her offsprings ^(28,51,58,59,60).

Conclusion:

Based on the findings of the present study, it can be concluded that, health educational guidelines provided to the study group had improved their level of knowledge, awareness as well as self-care measures regarding GDM which consequently reflect positive effect on the maternal and neonatal outcomes in comparison with the control group who received only the routine hospital care.

Recommendations:

This study recommended that:

1. Planning and developing antenatal health educational classes for all women to increase their awareness about the importance of early, proper screening and effective GDM management to improve their pregnancy outcomes.
2. A manual booklet containing basic needed information about GDM and its related complications should be

provided to all pregnant women with GDM at hospital and MCH centers.

3. Refreshing courses and in-service training programs especially for newly appointed maternity nurses can be successful in improving their knowledge and practices regarding GDM.
4. In addition, public orientation through mass media should be directed toward women at risk of GDM to prevent and /or reduce its related maternal and neonatal complications.

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