Effect of Tele-nursing Guidelines on Knowledge among Women with Gestational Diabetes during COVID-19 Pandemic

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Abstract

Background: Gestational Diabetes Mellitus is a global disorder and one of the most common complications during pregnancy. Tele- Nursing provides a solution for maintaining continuity of care while practicing physical distancing due to COVID-19. **Aim of the study:** was to evaluate the effect of Tele-nursing guidelines on knowledge among gestational diabetic women during COVID-19 pandemic **Subjects and Method: Research design:** Quazi experimental design (pre & posttest) was adopted to carry out this study **Setting:** The study was conducted at family planning and antenatal care unit in outpatient clinic, at Zagazig University Hospital **Subjects**: Purposive sample composed of 55 pregnant women with gestational diabetes. **Tools of data collection:** three tools were used for data collection. **Tool I:** A structured interviewing questionnaire, **Tool II:** Knowledge regarding Gestational Diabetes Mellitus questionnaire. **Tool III:** An educational nursing guidelines booklet for pregnant women with gestational diabetes. **Results:** The study result showed that 96% of studied women had unsatisfactory level of knowledge about the gestational diabetes at pre intervention and this percentage was changed to 4.0% at post intervention   with statistically highly significant (p<0.001). Additionally, the mean± SD of total women knowledge was 10.32±3.15 at the pre intervention and changed to 29.18±2.29 at the post intervention. **Conclusion:** It was concluded that Tele-nursing guidelines significantly improve the   women knowledge regarding Gestational Diabetes Mellitus as well as women self-care management. **Recommendations:** Simple clarified Tele nursing guidelines should be implemented to increase women's knowledge about gestational diabetes mellitus through the application of the Tele-nursing guidelines with the routine care in antenatal care units.

Key words: Tele-nursing, guidelines, GDM, knowledge, COVID19

Introduction

In recent years, women become more susceptible to a number of pregnancy complications, due to increasingly sedentary behavior and rising rates of obesity. One such complication is gestational diabetes mellitus. It is a serious pregnancy disorder [1] . (GDM) is diabetes that is first diagnosed in the second or third trimester of pregnancy without overt diabetes prior to pregnancy and which resolves postnatal, according to the American Diabetes Association (ADA) in 2019 [2].

The GDM prevalence is continually rising worldwide. It becomes one of the major public health problems and becomes a global public health burden [3].It was estimated that 21.3 million births (16.2%) worldwide were affected by hyperglycemia in pregnancy, and 86.4% of these, were due to GDM[4].

Gestational diabetes results from changes in glucose metabolism that typically begin in the second half of pregnancy, as insulin resistance increases to accommodate the growing fetus, the rise in insulin resistance is likely to be caused by increasing amounts of hormones related to pregnancy, such as (placental lactogen, cortisol, estrogen, progesterone) and changes in

etabolism to meet the needs of the fetus[5].

Screening for GDM should be completed for all women more specifically women that are at risk according to the predisposing factors must be screened early. GDM is generally diagnosed with an oral glucose tolerance test (OGTT) result, which administered at 24–28 weeks' gestation or as early as possible for high-risk women [6].

It is important to understand which the main risk factors for GDM are, in order to improve screening programs and diagnostic accuracy. The most important risk factors for GDM that affect the pregnant woman include; obesity and maternal overweight (Body Mass Index, BMI > 30. Particular risk factors for gestational diabetes mellitus (GDM) are advanced age (≥35 yrs.), overweight, excessive gestational weight gain, excessive central body fat deposition, family history of diabetes, short stature (<1.50 m), excessive fetal growth[3]. Furthermore, history of recurrent miscarriage, offspring malformation, fetal or neonatal death, macrosomia, GDM during prior pregnancies and polycystic ovary syndrome. In addition to the most common factors the sedentary lifestyle may also be a risk factor for GDM [7]

One of the major difficulties with GDM is that there few symptoms and the pregnant woman is usually unaware that she has GDM until it is diagnosed at routine prenatal screening. However, despite being virtually symptom free, serious pregnancy complications are associated with GDM. It is widely accepted that pregnancies complicated by GDM are at high risk of short- and long-term adverse outcomes for both mother and offspring because the intrauterine hyperglycemic state is toxic for both of them [8].

In late December 2019, a new coronavirus known (COVID-19) has emerged in Wuhan, China. The World Health Organization (WHO) declared its outbreak as a public health emergency [9].In addition, pregnancy complications such as diabetes, heart failure and hypertension have known as a double risk factor of COVID-19 for pregnant women. When people are being asked to keep the social distance and quarantine to minimize exposure to the virus, many people who need ongoing health care are avoiding receive cares due to the fear of infection [10]. In this situation the most important action for these patients is self-care [11].

Nurses can use available technologies such as mobile phones, computers and existing communication applications such as Instagram, What's app and Telegram in order to continue care and provide ongoing care services. [12].

Considering the lack of care-giving personnel during this pandemic, it is necessary to applying Tele nursing to make nursing services more effective. It seems that Tele-nursing as a follow-up caring technology can be helpful in achieving this goal [13] .

Poor knowledge about the disease results in inadequate understanding of health provider's instructions, restricted adherence to management protocols and ultimately unfavorable perinatal outcomes so knowledge is an essential element of health concepts shaping [14]. Recent studies have reported that many women misunderstand gestational diabetes mellitus (GDM), with women reporting that GDM only affects them during pregnancy, and that once the baby is born the complication is no longer a health threat, although GDM usually resolves postpartum, there are long term consequences following diagnosis of GDM ,there is also strong evidence indicating that improving self-management by promoting health

lifestyle habits such as weight loss, exercise, and healthy diet will reduce the risk of developing type 2 diabetes. Self-management of diabetes plays a key role in the care of women with GDM, including educating the patients for glycemic control and dietary adjustment [15]. Self-management consists of the activities that individuals initiate and perform on their own to maintain their quality of life and wellbeing. Women with GDM need help with decision-making, behavioral control and acquiring the necessary knowledge and skills for self-care [16].

A major part of GDM management involves educating the patients. Knowledge about this disease will be translated to an increase in self-care as a result of early diagnosis and treatment, which ultimately will contribute to complication reduction, since undiagnosed or inadequately treated GDM can lead to significant maternal and fetal complications. In Egypt, there is lack of national guidelines for the screening and management of GD, lack of knowledge about GD effect, management as well as nursing care measures to reduce complications and to educate the pregnant women self-care measures [17], thus it is important to raise women knowledge of this disease and to ameliorate the harmful effects of GD once diagnosed [18] .

Significance of the Study:
Gestational diabetes mellitus (GDM) has potentially life-threatening complications for both mother and child. The prevalence of diabetes in Egypt is 7.2%. The seriousness of GDM and the dramatically increasing incidence of this disease make it one of the most urgent health challenges of this century, so it is important to raise women's knowledge about this disease and to ameliorate the harmful effects of GDM .Once Women diagnosed with GDM need high-quality multidisciplinary education in

order to have ownership of their diagnosis and to make necessary self-care management to changes their lifestyle in order to achieve adequate blood glucose control [24]. In addition to the appearance of COVID-19 lead to alternative solution in providing midwifery care services throw Tele-nursing which solve the main problem of reducing the level of contact between people, for thus the implementation of Tele-nursing during the COVID-19 pandemic has become crucial to ensure the continuity of the care[25] .So the current study was conducted to evaluate the effect of Tele-nursing guidelines on knowledge among women with gestational diabetes during COVID-19 pandemic.

Aim of the study:
The aim of the study was:
Evaluate the effect of Tele-nursing guidelines on knowledge among gestational diabetes women during COVID-19 pandemic.

Research hypothesis:
Knowledge among women with gestational diabetes will be improved after the application of Tele nursing guidelines.

Subjects and Method:
Research design:
Quazi experimental design (pre & posttest) was adopted to carry out this study.

Study Setting:
This study conducted in the family planning and antenatal care unit in outpatient clinic, at Zagazig University Hospital. The location of this unit in the second floor of the outpatient clinic. This unit beside the gynecological unit and consist of two rooms, small one for the assisted nurse and the large one is well equipped for examination it is opened daily from 9 am to 2 pm.

Study Subjects:
Purposive sample composed of 50 pregnant women with gestational diabetes from the above mentioned setting, meeting the following criteria:

• **Inclusion criteria: -**
- Women who can read & write.
- Had single fetus with gestational age between 24-28 weeks.
- Had telephone, accessed with internet connection.
- Not using medications which increase blood glucose such as corticosteroids.
- No history of previous gestational diabetes and any chronic diseases such as chronic hypertension.

Exclusion criteria
- Previous loss of pregnancy
- Premature delivery.

Sample size calculation:

Sample size needed was 50 women who completed the study. It was calculated using Open Epi version 3.0 software packages. Providing Confidence level is 95% with power of study 80%. Assuming the Practice exercise as walk from time to time is a parameter of self-care activities during pregnancy and the percent of women did walk from time to time at pre intervention phase was (6.7%) the percentage of improvement after intervention was (30.0%) according to (Saboula et al 2018 (21).

Tool for data collection:

In order to fulfill the objectives of the study three tools were used to collect necessary data:

Tool I: A structured interviewing questionnaire. It was developed by the researcher in simple Arabic language to collect the necessary data for achieving the study objectives. It was composed of two parts:

Part 1: Demographic characteristics of the study sample: For collecting data pertaining to demographic characteristics of the studied women, it composed of 5 questions (as telephone number, age, level of education, residence and occupation).

Part 2: Obstetric history which included: number of Para, number of gravida, mode of delivery and gestational age.

Tool II: knowledge about the gestational diabetes mellitus questionnaire. It was developed by the researcher in simple Arabic language for assessing woman's knowledge about gestational diabetes based on previous literature Pinidiyapathirage et al., [19], Rasmussen, et al. [20] and O'Malley et al.,[21] It composed of 19 multiple choice questions. It was composed of two parts:

Part 1: general knowledge regarding GDM to collect the necessary data to assess the women knowledge about the gestational diabetes mellitus as; definition, signs and symptoms, risk factors and complications.

Part 2: Women knowledge regarding self-management, it included questions about health lifestyle behaviors such as proper diet, exercise and physical activity, treatment regimen, medications, insulin injection, monitoring of blood glucose level and recorded it, preventive measures of corona virus and importance of postpartum follow up.

Scoring System: The total score was ranged from 0-38 grades for each item and was assigned: A score (2) was given when the answer was completely correct, a score (1) was given when the answer was incompletely correct and a score (0) was given when the answer was wrong or don't know.

Total knowledge regarding gestational diabetes mellitus was calculated as:
•Satisfactory knowledge ≥ 60% of total scores
•Unsatisfactory knowledge < 60% of total scores

Tool III: Supportive material (an educational nursing guidelines booklet for pregnant women with gestational diabetes).It was developed by the researcher from the recent related literature and using evidence-based

data on nursing care for women with GDM, in simple Arabic language. The content of the educational booklet included information about definition, causes, symptoms, risk factor and the complications of gestational diabetes. Also included health lifestyle behavior such as proper diet, exercise and physical activity, treatment regimen, adherence to medications, the importance of keeping blood glucose level and weight within normal range, daily self-monitoring of blood glucose level and recorded it, stress management, preventive measures of corona virus and importance of follow up.

Content Validity and Reliability:

The tools was tested for content validity by Jury of three experts, (one professor of obstetrics and gynecological nursing department, one professor of community health nursing department and one from the faculty of medicine). These experts assessed the tool for clarity, relevance, comprehensiveness, applicability, and understanding. All recommended modifications in the tools were done. Additionally, the researcher prepared a guide handbook for the studied subjects, which covered all items related to GDM based on their identified needs and in view of the pertinent literature .The same experts who validated the tool also revised and validated the guide handbook. The all recommended modifications were done. The reliability of the items of the tools was assessed using cronbach's alpha test, it's results was 0.75 for women knowledge about the gestational diabetes, which indicate an accepted reliability of the tool.

Field work:

The data collection was done first using the interview questionnaire sheet, after identifying the pregnant women with GDM who fulfilled the inclusion criteria of the study, the researcher explained the aim of the study to the women and the methods of contact them and their agreement to participate was obtained. The activity took place in the previously mentioned setting in the waiting area the sample selected from the antenatal care unit in the outpatient clinic from 9 am to 1pm with following the protective measures against COVID-19 .

The questionnaire tools were filled by the researcher by asking the women and the average time spent with each participant to be interviewed was 30-45 minutes. The study was for a period of six months, during the period from the beginning of October 2021 to the end of March 2022. An educational sessions were developed based on actual educational need assessment of the studied subjects to improve their knowledge regarding GDM. It was developed by researcher in the light of available researches and literature. It was written in simple Arabic language and covers the relevant theoretical and practical aspects of GDM overview, management and control.

To fulfill the aim of the study, the following phases were adopted and carried out through: assessment phase, planning phase, implementation phase and evaluation phase.

❖ **Assessment phase:**

This was the first phase, it was achieved after taken the consent in the study sitting, where the needs in knowledge regarding GDM were identified in (pre-test) through collection and analysis of the baseline data from the filled tools. Thus, the development of the program was partially built on assessment of women knowledge about GDM.

❖ **Planning & Implementation phase:**

Based on the results obtained from assessment phase, the researcher designed the intervention program and sessions contents according to the identified women needs and in view of the related

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literature. Identified needs, requirements and deficiencies in knowledge, was translated into aim and objectives of the intervention sessions. Moreover, the researcher prepared an educational booklet to help them follow the educational sessions and to serve as a reference at home, it sent online for them.

Furthermore the researcher has successfully completed certified professional diploma in Clinical Therapeutic Nutrition and Obesity Management for 4 months from the American University for Continuous Learning(180 hrs), to be qualified in designing diet plans and give nutritional advices for the studied women.

Description of the program:

The first step in developing this program was to determine the main aim and objectives. These objectives were derived from the assessed needs of the sample. These were categorized into specific objectives and tasks were ordered in sequential order consistent with teaching and learning process. The program was set in seven sessions covering the three sections of the educational booklet the first is knowledge about GDM, the second is about health life style behaviors, and the third is about preventive measure of COVID19**.**

General objective of the program: To improve pregnant women knowledge   about GDM and self-management.

Specific objectives: At the end of the sessions the women should be able to:
Define GDM ,identify incidence of GDM, enumerate causes of GDM, list risk factors of GDM, explain how to diagnose GDM, perform blood glucose measurement, list complications of GDM, acquire knowledge about health diet, identify the importance of exercise, list sites of insulin injection,

apply insulin injection technique , record blood glucose measurement, monitor weight gaining, acquire knowledge about COVID 19, list prevention measures of COVID 19.
. **The program consisted of two main parts:**

The theoretical part which covered the basic knowledge about GDM and contain 6 sessions (session 1, 2, 4, 6, &7), the **practical part** covering the blood glucose measurement procedure and insulin injection technique and contain 2 sessions (session 3 &5). The sessions were individualized (deal with each women alone) to maintain women privacy.

The sessions were as follows:

Session 1: Initial session was about GDM definition, incidence, pathophysiology and risk factors. Recorded video by the researcher on youtube used as teaching methods, in addition to what's app chatting to answering any questions. The educational booklet and the researcher own video prepared specially for this study were the media used.

Session 2: Focused on the signs & symptoms, diagnosis and complication of GDM. Recorded video by the researcher on youtube used as teaching methods. The educational booklet and the researcher own video prepared specially for this study were the media used.

Session 3: This session is focusing on the practical part the main objective of this session was to help women to be able to perform blood glucose measurement procedure .Video call by messenger used as teaching methods .Video about blood glucose measurement procedure was the media used.

Session 4: The objectives were to help studied subjects to acquire knowledge about health diet and

identify the importance of exercise and weight gain. Recorded video by the researcher on youtube Chatting on what's app and specific facebook page were used as teaching methods. Educational booklet, pictures and video were the media used.

Session 5: Aimed to help the studied subjects to list sites of insulin injection and apply insulin injection technique. Video call by messenger was used as teaching method, picture –video and educational booklet were the media used.

Session 6: The main objectives were to learn the studied women to record blood glucose measurement and monitor the weight gaining. Recorded video by the researcher, discussion on what's app were used as teaching methods. Educational booklet and video were the media used.

Session7: The objectives of this session were to help the women acquire knowledge about COVID 19 and list prevention measures of COVID 19. Discussion through what's app group and messenger video call was teaching methods. Educational booklet was media used. It was the last session, involved summarization and revision of the aim of the program. The researcher closed the session by acknowledged the women's active participation.

Implementation phase

Every woman received one basic conversation every week, sometimes the connection exceeded more than twice / week according the women condition. The day and the time of conversation were determined according the available time for each woman separately. The contents were based on a supportive booklet and others prepared videos by the researcher about GDM. This booklet had been prepared by the researcher based on the World Health Organization guideline regarding gestational diabetes, American diabetes association and some other scientific literature, and had been confirmed by experts.

The women received Tele-nursing guidelines provided by the researcher throw different Tele-nursing methods as phone calls, facebook page available at : https://www.facebook.com/groups/601574947504325 , messenger video call, what's app voices and chats and recorded video by the researcher on a youtube channel available at:(https://www.youtube.com/channel/UCHxqbviwVT0KRWLxyeO2Ngg. These methods were choiced depend on which one the woman preferred and according to the session content (theoretical or practical). The messenger video call was the best method used during the practical sessions, because this method facilitated the evaluation of the women performance of the practical procedure given during the session while the recorded video by the researcher on a YouTube channel is preferred with the theoretical sessions. When the woman was needed emergency advice or counselling the phone calls and the what's app chat were the best choice to usage.

At each call or online video, the researcher asked the woman about her conditions or problems then the researcher guided the mothers. As well, the woman asked if she adapted the instruction that was given before. The other part of the conversation was about giving information to be followed leading to improve the women knowledge regarding the GDM and self-management behaviors as; diet, exercise, adherence to medications, the importance of maintaining blood glucose levels within normal range, how to record blood glucose level and frequent self-monitoring of blood glucose levels,

stress management, the importance of maintaining the normal weight gain, the importance of measuring the blood pressure. Before the termination of any conversation the feedback was taken to ensure women understand. The mother was once again invited to ask her questions and reminding the next session. Tele nursing follow up were performed once weekly and sometimes twice by using the phone calls for quick follow up in addition the basic online sessions. The total frequency of Tele nursing sessions was 8 basic session per each woman. The average length of these conversations was 30-45 minutes per once.

❖ Evaluation phase:-

In order to evaluate the effect of the intervention of the Tele-nursing guidelines, the post-test was administrated immediately after implementation of the entire Tele-nursing guidelines sessions at antenatal care unit. The same tools used in the pre-test were re-used.

Pilot study:

A pilot study was carried out before performing the main study in order to test the clarity of the tools and the feasibility of the study. The pilot sample involved about 10 % (5) of the main study sample size that fulfilling the set criteria. This pilot study was conducted in month before collection of data. The purpose of the pilot study was to ascertain the feasibility of the tools, and to detect any problems peculiars to the statement as sequence and clarity. It also helped to estimate the time needed for women to fill in the tools of the study. After conducting the pilot study, it was found that the questions of the tools were clear and relevant, but few words were modified to increase clarity. The data collection form was finalized based on the results of the pilot. The subjects of

pilot sample were excluded in the main study sample.   .

Administration and Ethical consideration:

Official permission to collect data and implement of the educational program in the administration building at Zagazig University was obtained by submission of an official letter from the dean of the Faculty of Nursing Zagazig University to the dean of faculty of medicine then the Institutional review board(IRB) unite to obtain the permission for data collection. Meetings and discussions were held between the researcher and the participants to make them aware about the objective of educational program. Concerning the ethical consideration.

Ethical approval was obtained from the Scientific and Ethics Committee of the Faculty of Nursing at Zagazig University (M.D Z U.NUR/141/15/7/2021). The aim of the study was explained to each woman before applying the tools to gain her confidence and trust .A verbal agreement was obtained from each woman who agreed to participate in the study, after ensuring her that data collected will be treated confidentially, and that the study maneuvers do not entail any harmful effects on participating pregnant women. Women were informed that they have the right to withdraw from the study at any time without giving any reason.

Statistical Analysis:

All data were collected, tabulated and statistically analyzed using SPSS 20.0 for windows (SPSS Inc., Chicago, IL, USA 2011)). Quantitative data were expressed as the mean ± SD, median (range) and qualitative data were expressed as absolute frequencies (number) & relative frequencies (percentage). Percent of categorical variables were compared using Chi-square test or Fisher's exact test when appropriate. Multiple

linear regression (step-wise) was also used to predict factors which affect total knowledge scores Cronbach alpha coefficient was calculated to assess the reliability of the scales through their internal consistency. P-value < 0.05 was considered statistically significant, p-value < 0.01 was considered highly statistically significant, and p-value ≥ 0.05 was considered statistically non-significant (NS).

Results:

Table 1 demonstrates that 48% of the studied women their age was 25- ≤30years and the mean of age was 28.22±4.07 years, as regards to the educational level it was obvious that 48.0% of the studied women have university education. The same table reveals that 82% of the studied women were house wife and 54% of them resided in rural areas.

Table 2 shows that 34.0% of the studied women had family history of diabetes and 38.0 % had family history of GDM, and all of those 100.0% were from the first degree of relation.

Table 3 presents statistical highly significant difference of women knowledge regarding GDM throughout the intervention (p<0.001), it was found that the all items regarding the women knowledge were improved in post intervention than pre intervention.

Table 4 shows that there are statistical highly significant differences between the pre and post intervention results of all the items of knowledge regarding GDM women self-management at (p<0.001).

Figure I illustrate that 96% of studied women had unsatisfactory level of knowledge about the gestational diabetes at pre intervention and this percentage was changed to 4.0% at post intervention with statistically highly significant (p<0.001).

Table 5 showed that, there was no significant relation between total satisfactory knowledge level of women with GDM and their demographic characteristics and medical history throughout study phases at (p= >0.05).

As regards for predicting factors which affect total knowledge level post intervention, **table 6** indicated that post-life style score and residence were had a significant independent positive predictors. The model explains 26% of variation in total knowledge level post intervention.

Discussion:

Women diagnosed with GDM need detailed information and appropriate education on the pathophysiology of GDM, treatment options, self-management (self-monitoring of blood glucose, meal planning, exercise), and possible complications of this condition. Education is the key element in the GDM care process. The main education strategy during pregnancy is aimed at acquiring knowledge and skills for adaptation and self-management of GDM. One of the successful management educational methods is used Tele-nursing and smart phone applications [22]. This study was framed in the light of study hypotheses: Knowledge among women with gestational diabetes will be improved after the application of Tele nursing guidelines, and the study findings indicated enhancement of the women's knowledge which leads to acceptance of the research hypotheses.

As regards demographic characteristics, the present study revealed that the mean age of the studied women was 28.22±4.07 year. This could be due to the correlation between the age and the risk of GDM, the risk of GDM becomes significantly and progressively increased from 25 years onwards. The American Diabetes Association recommendation on the use of age ≥25 years as the cutoff for screening and the observation that maternal age

≥25 years is the factor most predictive of GDM. In clinical practice, maternal age of ≥25 years should be adopted instead of ≥35 years or 40 years as a risk factor for the development of GDM Nguyen et al [23].

This finding was inconsistent with El Toony et al [24] who study about assessing the effectiveness of an educational program for patients with gestational diabetes at Assiut University, reported that the mean age of the women was 28±5 years. Additionally this result agree with El-Ansary& Fouad, [14] in their study about the effect of educational sessions on knowledge, attitude, and self-Care practices among pregnant women with gestational diabetes which found the mean age of the study women was 27.6 ±5.9 years.

As regards education level, the present study showed that approximately half of the study women were had a secondary education and university education as well which could be due to highly educated level women being more able to use a smartphone and change their lifestyle.

It is in the same line with Carrol et al., [25] the study carried in Beijing, China and Al-Ofi et al., [26] the study carried out in GDM unit at KAUH the both stated that about half of the study women were at the University educational level.

Additionally Gonzalez-Plaza et al.,[27] in their study about effectiveness of a step counter smart band and midwife counseling intervention on gestational weight gain and physical activity in pregnant women with obesity, found that near half of the studied women were have high educational level.

On the other hand in Egypt at Menoufia Governorate Fathy et al., [4] reported that the higher percentage of gestational diabetes women under study was among secondary school education. This disparity in the result might be due to differences in the education in the study sites

Concerning the occupation and residence, the current study found that the majority of studied women were housewives and above half belonged to rural area. The rational of this result might because pregnant women living in rural areas and slums visit the government hospitals as they are benefitted by the State govt.'s scheme, while pregnant women residing in the urban areas prefer to go for ante-natal check-ups in private nursing homes/clinics owing to the crowd and prolonged waiting hours. .

This result was in agreement with El-Ansary & Fouad [14], Chan et al., [28] in their study which carried out at Egypt, they reported that the majority of their participant were housewives and not working.

As related to the medical and obstetric history of the studied women, the present study shows that one-third of the studied women have a family history of diabetes and the same percentage had family history of the gestational diabetes this result might be because of family history of diabetes have been consistently identified as major risk factors for GDM. In addition the result of this study by Aydın et al.,[29] shown that family history of diabetes mellitus were independent predictors of developing GDM.

It is similar to Al-Hashmi et al., [30] the study that conducted at the antenatal clinic of the sultan Qaboos university hospital, Muscat, Oman. Which founded that approximately two third of women had a family history of T2DM and one third had family history of GDM, respectively.

Women diagnosed with GDM need detailed information and appropriate education on the pathophysiology of GDM, treatment options, self-management (self-monitoring of blood glucose, meal

planning, exercise), and possible complications of this condition. Education is the key element in the GDM care process. The main education strategy during pregnancy is aimed at acquiring knowledge and skills for adaptation and self-management of GDM. One of the successful management educational methods is used Tele-nursing and smart phone applications Abd Elsalam, [2].

The main objective of the current study was to assess the women's knowledge regarding GDM, the study result demonstrates that, the total score of women's knowledge about gestational diabetes through the study phases (pre & post) was highly statistically significant. The explanation of such result might related to various ways of knowledge transmission, including videos and live streaming through Tele- nursing , have the advantages of simple and fast communication and efficient access to information.

Similar to the study by Yang et al., [18] who revealed that the post-intervention GDM knowledge scores of the experimental group were higher than those of the control group ,it might due to the use of Web-based education guidelines and programs for women with GDM   have a beneficial effect on GDM women knowledge and self-management.

A similar finding was reported in a quasi-experimental study by Abd Elsalam [22] , Amira& Fatma, [31], the both carried out at Egypt and reported a statistically significant difference between knowledge scores pre and post the educational interventions.

In the same vein with Abd Elmoaty et al., [32]   the result of their study which carried on pregnant women from Minia university hospital for maternity and child at antenatal care Department, reflect that the majority

of gestational diabetic women had good knowledge in immediate and Post 3 months respectively as compared in pre-educational program with highly statistically significance differences.

Additionally, Staynova et al., [33] who conducted a Quazi experimental study on pregnant women with newly diagnosed GDM who attended antenatal clinic found that there was a significant difference in knowledge about the risk factors for GDM ,GDM treatment , nutritional knowledge, self-monitoring of blood glucose (P < 0.001) at post intervention. .

Furthermore the Saykhet et al., [34] study about use of a web-based educational intervention to improve knowledge of healthy diet and lifestyle in women with GDM compared to standard clinic-based education, the study indicated that both approaches, standard education and standard education plus web-based program, resulted in excellent knowledge scores .This is may be due to multiple and immediate access to the web-based education program at home may prove useful as a source of reference for women with GDM.

The same in Carolan-Olah et al., [35] who assessed pregnant women's knowledge of GDM and healthy lifestyle (healthy diet and foods), after using the Web-based program compared to women who received standard education. The findings indicated that the intervention was effective at improving GDM knowledge scores.

The current study illustrated that the majority of pregnant women had unsatisfactory knowledge about GDM pre-intervention then decreased to became only one-tenth post intervention, this result was consistent with the study by Saboula et al., [36] in Egypt ,about the effect of nursing intervention on knowledge, attitude and self-care activities among gestational diabetic women, which stated that the post-intervention score

for knowledge about gestational diabetes increased than pre-intervention.

In addition El Toony et al., [24] reported that all participant women showed improvement in their knowledge about their disease, complication, and proper diet and insulin therapy.In agreement with Mohammed et al., [37] who showed that there was a statistically significant difference between total knowledge and total lifestyle score ,after the implementation of the educational sessions.

As regards to the relation between the women knowledge and the demographic characteristic, the present study showed that, there was no significant relation between total satisfactory knowledge level of women with GDM and their demographic characteristics throughout study phases   at (p= >0.05).

On the contrary to the results of the current study, Abd Elmoaty et al., [32] presented that there were statistically significance relationship between total knowledge scores of gestational diabetic women pre-educational program and their age and educational level , mean weal there is non-statistical relation between the residence and the demographic characteristic in the same study

As regards for predicting factors which affect total knowledge level post intervention, the current study indicates that residence was had a significant independent positive predictors on the total knowledge level post intervention. This result was consistent with previous studies carried by Ogu etal., [38] who found that the model explains that the residence at 95% confidence interval (CI), had positively predicted good overall knowledge of GDM.

On the other hand, Lis-Kuberka& Orczyk-Pawiłowicz, [39] revealed that place of residence did not predict levels of GDM knowledge. This was

probably closely connected with the fact that recently the majority of women have access to information from different media.

Conclusion:

On the light of results of the current study and verified of the research hypothesis, it was concluded that, Tele-nursing guidelines is an effective way for improving women knowledge regarding gestational diabetes.   It was found that the total score of women's knowledge about gestational diabetes through the study phases (pre & post) was highly statistically significant.

Recommendation:

In the light of the current study findings, the following recommendations are suggested :

- Tele-nursing should be programmed as a part of health plan for women with GDM mellitus in different health setting.

- Simple clarified Tele nursing guidelines booklet should be implemented to increase women's knowledge and promote their self-management

- Application of the Tele-nursing guidelines with the routine care in antenatal care units.

- ProvidingTele-nursing educational program for recently diagnosed gestational diabetic women about proper management of GDM.

- Applying Tele-nursing counseling tips in gestational diabetic women discharge teaching plan to maintain healthy life style and maximum glycemic control prior to a future conception.

- **Further researches are required to study :**

- The effect of Tele-nursing guidelines on the pregnancy outcome .

- The factors affecting implementation and utilization of Tele-nursing services.

Table (1): Distribution of Demographic Characteristics of the Studied Women with Gestational Diabetes (n=50).

Demographic Characteristics	No.	%
Age (year)		
21- <25	14	28.0
25- ≤30	24	48.0
>30	12	24.0
Mean± SD	28.22±4.07	
Range	21-38	
Educational level		
Primary education	0	0.0
Preparatory education	6	12.0
Secondary education	20	40.0
University	24	48.0
Occupation		
Worker	9	18.0
House wife	41	82.0
Residence		
Rural	27	54.0
Urban	23	46.0

Table (2): Distribution of the Studied Women with Gestational Diabetes According to their Medical and Obstetric History (n=50).

History	No.	%
Medical history		
Family history of diabetes		
Yes	17	34.0
No	33	66.0
Family history of gestational diabetes		
Yes	19	38.0
No	31	62.0
IF there is family history, what is the degree of the relation (n=19)		
First degree	19	100.0
Obstetric history		
No. of Gravidity		
≤2	35	70.0
>2	15	30.0
Mean± SD	2.16±0.71	
Range	1-4	
No. of parity		
≤1	35	70.0
>1	15	30.0
Mean± SD	1.16±0.71	
Range	0-3	
Present Gestational age (weeks)		
Mean± SD	26.56±1.31	
Range	24-28	
Mode of last delivery		
Non	8	16.0
Normal vaginal delivery	26	52.0
Caesarean section	16	32.0

Table (3): Distribution of the Studied Women with GDM Regarding Their Knowledge About GDM Through the Intervention Phase (n=50).

knowledge Items		In correct		Incomplete correct		Complete correct		^{MH}p-value
		No.	%	No.	%	No.	%	
Definition of gestational diabetes	Pre	18	36.0	32	64.0	0	0.0	<0.001**
	Post	0	0.0	20	40.0	30	60.0	
Diagnosis of GDM	Pre	22	44.0	28	56.0	0	0.0	<0.001**
	Post	0	0.0	26	52.0	24	48.0	
Risk Factors of GDM	Pre	27	54.0	23	46.0	0	0.0	<0.001**
	Post	0	0.0	28	56.0	22	44.0	
Signs and symptoms of GDM	Pre	10	20.0	40	80.0	0	0.0	<0.001**
	Post	0	0.0	17	34.0	33	66.0	
Fasting glycemic targets for GDM	Pre	30	60.0	20	40.0	0	0.0	<0.001**
	Post	0	0.0	25	50.0	25	50.0	
Maternal Complications of GDM	Pre	24	48.0	26	52.0	0	0.0	<0.001**
	Post	0	0.0	23	46.0	27	54.0	
The fetal complications of GDM	Pre	25	50.0	24	48.0	1	2.0	<0.001**
	Post	0	0.0	9	18.0	41	82.0	
Complications of GDM after delivery	Pre	29	58.0	21	42.0	0	0.0	<0.001**
	Post	1	2.0	30	60.0	19	38.0	

MH: Marginal homogeneity   **: statistically highly significant (p<0.001)

Table (4): Distribution of the Studied Women with GDM Regarding Their Knowledge About Self-management Through the Intervention Phase (n=50).

Knowledge items		In correct		In complete correct		Complete correct		MH p-value
		No	%	No	%	No	%	
A typical daily meal plan for GDM	Pre	14	28.0	36	72.0	0	0.0	<0.001**
	Post	2	4.0	19	38.0	29	58.0	
Diet regimen that maintain the normal blood glucose level	Pre	17	34.0	33	66.0	0	0.0	<0.001**
	Post	1	2.0	24	48.0	25	50.0	
Daily amount of water needed	Pre	27	54.0	23	46.0	0	0.0	<0.001**
	Post	0	0.0	32	64.0	18	36.0	
Number of times have to practice exercise	Pre	40	80.0	10	20.0	0	0.0	<0.001**
	Post	1	2.0	37	74.0	12	24.0	
Sites of insulin injection	Pre	12	24.0	38	76.0	0	0.0	<0.001**
	Post	0	0.0	0	0.0	50	100.0	
Percussion before insulin injection	Pre	20	40.0	30	60.0	0	0.0	<0.001**
	Post	0	0.0	22	44.0	28	56.0	
Signs and symptoms of hypoglycemia	Pre	19	38.0	31	62.0	0	0.0	<0.001**
	Post	0	0.0	27	54.0	23	46.0	
Normal weight gaining during pregnancy	Pre	30	60.0	20	40.0	0	0.0	<0.001**
	Post	0	0.0	33	66.0	17	34.0	
Post natal follow up	Pre	28	56.0	22	44.0	0	0.0	<0.001**
	Post	0	0.0	19	38.0	31	62.0	

MH: Marginal homogeneity   **: statistically highly significant (p<0.001)
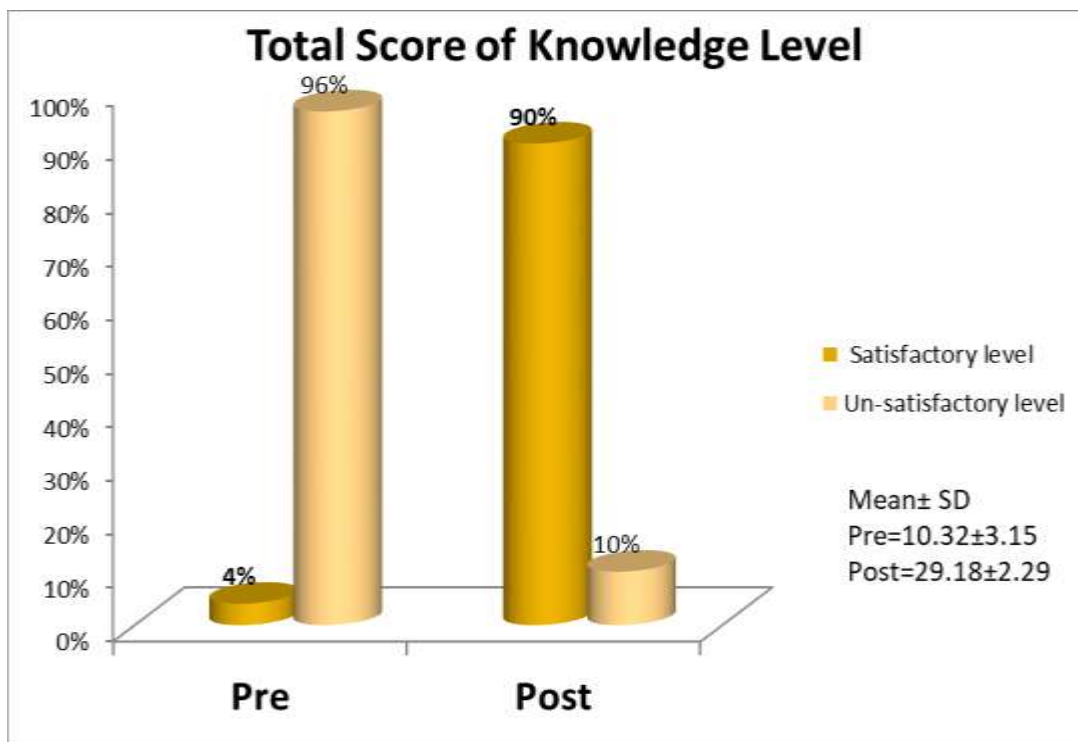
Figure II: Total Score of Women Knowledge about the Gestational Diabetes throughout Study Phases (n= 50).

Table (5): Relation between Total Satisfactory Knowledge Level of Women with Gestational Diabetes and Their Demographic Characteristics and Medical History throughout Study Phases (n=50).

Demographic characteristics and history	Total Satisfactory pregnant females' knowledge level ≥60%				χ 2 (1p-value)	χ 2 (2p-value)
	Pre intervention (n=2)		Post intervention (n=45)			
	No	%	No	%		
Age per years .						
21- <25	1	50.0	13	28.9	0.862 (0.650)	0.331 (0.848)
25- ≤30	1	50.0	21	46.7		
>30	0	0.0	11	24.4		
Educational level						
Preparatory education	0	0.0	6	13.3	0.304 (0. 859)	3.796 (0.150)
Secondary education	1	50.0	16	35.6		
University	1	50.0	23	51.1		
Occupation						
Worker	0	0.0	8	17.8	FET=1	FET=1
House wife	2	100.0	37	82.2		
Residence						
Rural	1	50.0	25	55.6	FET=1	0.651
Urban	1	50.0	20	44.4		
Family history of diabetes						
Yes	2	100.0	16	35.6	FET=0.11	0.651
No	0	0.0	29	64.4		
Family history of gestational diabetes						
Yes	2	100.0	17	37.8	FET=0.14	1.000
No	0	0.0	28	62.2		
No. of Gravidity						
≤2	1	50.0	31	68.9	FET 0.514	1.000
>2	1	50.0	14	31.1		
No. of parity						
≤1	1	50.0	31	68.9	FET 0.514	1.000
>1	1	50.0	14	31.1		

χ 2 : Chi square test   FET: Fisher exact test   non-significant(p>0.05)

p1: for pre-intervention   p2: for post-intervention

Table (6): Step Wise Multiple Linear Regression for Predicting Factors Which Affect Total Knowledge Level post Intervention

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	16.588	3.549		4.674	.000	9.447	23.728
Residence	1.357	.576	.298	2.358	0.023*	.199	2.516

*: statistically significant (p<0.05)

**: highly significant (p<0.001)

R-square=0.263, ANOVA: F=8.384,   P<0.001

Variables entered and excluded: age per years, educational level, occupation, and family history of diabetes, family history of gestational diabetes, no. of gravidity, no. of parity, mode of last delivery, gestational age and post- self-efficacy score.

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