Chapter

Improving Gestational Diabetes Management through Patient Education

Radiana Staynova and Vesselina Yanachkova

Abstract

The challenge of achieving a healthy pregnancy and a successful birth outcome in women with gestational diabetes mellitus (GDM) requires a multidisciplinary approach with close collaboration between healthcare providers. One of the key elements for the successful management of GDM is the education of pregnant women. Patient education has been shown to improve quality of life, contribute to better compliance, and reduce complications and healthcare costs. In this chapter, we will present and discuss the main barriers in the educational process of women with GDM and innovative approaches for improving diabetes self-management education during pregnancy. The focus will be on the different educational methods, such as printed leaflets and booklets, Web-based educational programs, and new technologies including telemedicine and smartphone applications.

Keywords: gestational diabetes, patient education, pregnancy, booklet, telemedicine

1. Introduction

Pregnancy is a specific condition that is associated with significant changes in the course of metabolic processes in the female body [1]. Gestational diabetes mellitus (GDM) is a common pregnancy complication and it was estimated that it affects 1 in 6 births [2]. GDM is associated with multiple adverse pregnancy outcomes including caesarian delivery, preeclampsia, subsequent development of type 2 diabetes, macrosomia, shoulder dystocia, neonatal hypoglycemia, and respiratory distress syndrome [3].

GDM can be a scary experience in the beginning, and it can take time for a pregnant woman to make the necessary changes to ensure optimal control. In addition to the potential risks it poses to the mother and fetus, GDM can also have a negative effect on the mental health and quality of life of pregnant women [4, 5].

In most cases, GDM is a temporary condition that usually occurs between 24 and 28 weeks of gestation and disappears after a woman gives birth. However, its occurrence poses a risk in affected women for the development of type 2 diabetes in the future [6]. There are no generally accepted standards for diagnosing GDM, which is why many women do not receive the treatment they need to achieve successful birth outcomes [7].

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 [8]. Education is the key element in the diabetes care process. It provides an opportunity for women with GDM to realize their place and role in the diabetes team. The main education strategy during pregnancy is aimed at acquiring knowledge and skills for adaptation and self-management of diabetes [9].

Providing education and counseling to women with GDM can sometimes face additional challenges and barriers [8]. For improving diabetes self-management education during pregnancy and overcome these challenges, innovative approaches can be used.

2. Diabetes education during pregnancy

Dr. Elliott P. Joslin (1869–1962) is considered to be the founder of modern diabetes education. As early as 1925, he conducted educational courses that included an explanation of the disease, insulin treatment, food intake, and physical activity. Dr. Joslin is also the author of the first diabetes patient handbook called "Diabetic Manual—for the Doctor and Patient" [10]. Part of the Joslin Clinic team was Dr. Priscilla White (1900–1989), who is considered a pioneer in the treatment of diabetes during pregnancy [11].

Pregnancy complicated by diabetes can be an adventure full of challenges. During this adventure, pregnant women require additional information, education, support, as well as appropriate treatment and practical advice for self-management. All this requires the active involvement of the woman with GDM, her family, and the diabetes team. Newly diagnosed women sometimes feel scared and insecure about how they will deal with GDM self-management. Providing structured education, support, and trust-building partnership between the patient and a well-collaborating diabetes team is crucial to acquiring knowledge and skills in managing the "sweet" disease [12]. According to Okun et al., an effective healthcare partnership includes health providers working in concert with patients and family caregivers to achieve positive experience and mutually agreed-upon outcomes [13].

Providing diabetes education is a keystone in a comprehensive therapeutic approach. Patients should gain knowledge, skills, and motivation to overcome daily challenges associated with the disease [9, 14]. Diabetes self-management education in parallel with insulin discovery is considered to be one of the most important advances in diabetes treatment in the 20th century [9].

The education of women with GDM is very important for the normal course of pregnancy and avoidance of complications. If a woman has not had diabetes before pregnancy, she may not know how to measure and track her blood glucose levels or how to administer insulin.

The main goals of the education process of women with GDM include the following:

- Optimization of knowledge about diabetes pathophysiology, risk factors, and management;
- Increasing the pregnant women's motivation to take care of themselves;
- Effective compliance with diet and performing physical activity;
- Meal planning and carbohydrate counting;

- Instructions for administrating insulin and recommendations for dealing with side effects (e.g., hypoglycemia);
- Self-monitoring and tracking of blood glucose levels;
- Effective communication between members of the diabetes team;
- Prevention of type 2 diabetes later in life.

In 2017, International Diabetes Federation (IDF) developed interactive online courses called the IDF School of Diabetes. These educational programs consist of several modules that cover all aspects of diabetic care, disease management, and prevention. The courses are certified and end with a final exam. They are suitable for all health professionals involved in diabetes care, including general practitioners, nurses, pharmacists, dietitians, social workers, and others. In addition to training, the Web site also offers access to information on the latest advances in diabetes therapy. The main mission of the IDF School of Diabetes is to provide innovative educational programs for health professionals involved in the care and treatment of diabetes, which in turn provide the necessary training resources to people with diabetes and those who care for them [15].

In Bulgaria, in 1997, a unified large-scale training program for patients with diabetes was introduced, supported by the Government of Denmark and the Bulgarian Ministry of Health. There are 56 training centers in the country—4 university centers, 48 regional centers, and 4 training centers for children with diabetes, in which a structured five-day training program for patients has been introduced. Initially, teams of doctors and nurses from the Medical Universities of Sofia, Plovdiv, Varna,

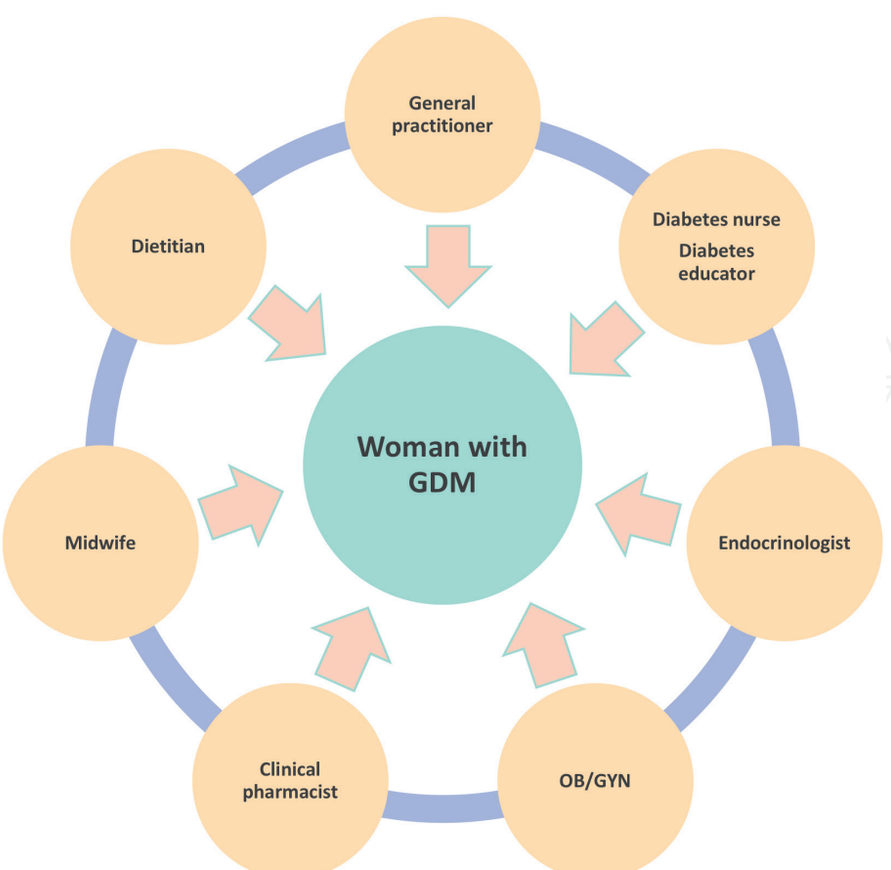

Figure 1.
The diabetes team involved in the educational process of woman with GDM.

and Pleven were trained at the Steno Diabetes Center in Copenhagen, after which they organized the training of other teams in the country [16].

The challenge of achieving a healthy pregnancy and a successful birth outcome in women with GDM requires a multidisciplinary approach with close collaboration between healthcare providers. The diabetes team involved in the educational process may include medical professionals with different specialties (**Figure 1**).

The education for women with GDM focuses on their needs, preferences, and goals, helping to increase not only the knowledge about the disease but also to provide skills related to self-management and treatment [17]. Patient education has been shown to improve quality of life, contribute to better compliance, and reduce complications and healthcare costs [17–20].

3. Barriers in the educational process of women with GDM

In the educational process, the diabetes team often encounters difficulties of different nature, which may affect both healthcare providers and pregnant women [14]. These difficulties or barriers could be classified as patient-related, healthcare provider-related, and socioeconomic or cultural barriers (**Figure 2**).

The most common barriers related to pregnant women include lack of motivation, inpatient behavior, low level of trust in healthcare providers, poor adherence and compliance to health advice, a tendency to deny their own role in the process of education, or not being willing to assist in the implementation of instructions and prescriptions. There may also be barriers related to healthcare providers such as the use of a non-motivational approach, poor communication skills, insufficient time, lack of special qualifications. Other barriers that may

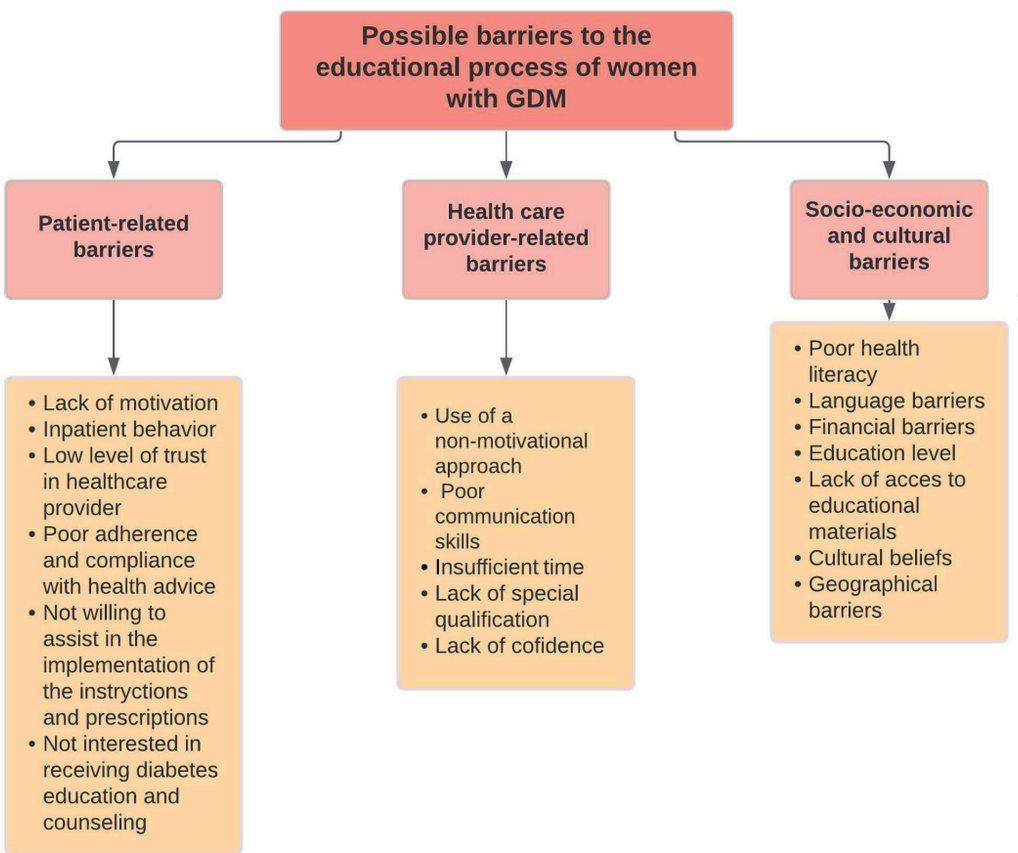

Figure 2.
Possible barriers to the educational process of women with GDM.

occur during the education process include socioeconomic factors, geographical factors, cultural factors, level of education of patients, poor health literacy, and lack of access to educational materials [14].

Different strategies could be used for overcoming barriers during the educational process. These strategies may include demonstrations, written information (leaflets, brochures, booklets, etc.), pictograms, audio and video materials, and mobile applications.

4. Printed leaflets and booklets

Verbal or oral communication is essential for the educational process, but it is not enough in itself. The provision of printed educational materials such as leaflets and booklets in addition to healthcare provider counseling makes patient education more effective [21]. The use of written informational materials in the educational process can improve the quality of life, contribute to better compliance, prevent complications, and reduce healthcare costs [22].

Printed leaflets and booklets must meet the basic requirements for the effectiveness of the written educational materials in terms of content, structure, language, layout, and illustrations [22]. Using plain language, followed by appropriate charts, figures, and illustrations, is essential in the development process of printed educational materials [23]. The information included in them must be based on reliable, publicly available, and evidence-based literature sources. Attractive visualization is very important for a better understanding of the information included in the leaflets/booklets [22, 24]. Printed educational materials should provide practical and easy-to-follow advice to help pregnant women manage their condition successfully.

Some of the diabetes associations and health organizations have developed informational brochures and guidelines designed especially for women with GDM. IDF has developed an educational manual entitled "Having a baby? Now is the time to learn more about gestational diabetes?" which aims to provide information about GDM in an easy-to-understand form for expectant mothers [25]. American Diabetes Association provides information on GDM on its Web site, as well as in the book "Pregnancy & Diabetes: A Complete Guide for Women with Gestational, Type 2, And Type 1 Diabetes" [26]. In the USA, The Centers for Disease Control and Prevention also provides a brochure about GDM and pregnancy [27]. In Australia, National Diabetes Services Scheme developed an educational booklet that provides comprehensive information on GDM management and where pregnant women can get additional help. In addition to the English version, the brochure is also available in seven other languages [28].

In Bulgaria, we developed an educational manual for healthy pregnancy designed for women with GDM [29]. The educational manual gives the readers realistic insight and practical advice on how to deal with the daily challenges of pregnancy with diabetes. It covers all the aspects of GDM management (medical nutrition therapy; recipes for healthy meals; exercise tips for pregnancy: types, benefits, and cautions; insulin use; self-monitoring of blood glucose; sources of additional information and support—mobile applications, technologies, and Web sites). Information about the follow-up of GDM and prevention of type 2 diabetes has also been included. A feedback study showed a very high level of patient satisfaction. Pregnant women find the educational manual very useful [30].

Even in the modern digital age, written health information could play an important role in improving the connection between the patient and the healthcare provider. The provision of printed educational materials can increase patients' health literacy, as well as their personal responsibility, motivation, and attitude toward their

own health. The development of printed educational materials about GDM may improve pregnant women's knowledge, their lifestyle habits (appropriate weight gain, meal planning, physical activity, etc.), and regular self-monitoring of blood glucose (four times daily), and contribute to avoiding maternal and fetal complications.

5. Telemedicine and Web-based education

Telemedicine can be defined as a way of providing medical services remotely without physical contact between the healthcare provider and the patient, most often through a telephone conversation or video link through a platform [31]. The rapid development of digital technologies in recent years has turned telemedicine into an important component of healthcare delivery [32]. During the COVID-19 pandemic, telemedicine allowed patients to communicate completely safely and effectively with their healthcare providers [33]. Diabetes care is the area where telemedicine finds wide application [34].

A recent systematic review evaluated the effectiveness of telemedicine interventions for women with GDM. The meta-analysis included 32 randomized controlled trials and showed that telemedicine was associated with significant improvement in glycemic control (HbA1c, fasting, and postprandial blood glucose levels) and lower incidence of adverse pregnancy outcomes (Cesarean sections, neonatal hypoglycemia, macrosomia, preterm birth) compared to standard care [35].

The use of telemedicine in the management of GDM may have notable benefits. More cost evaluation studies are required to confirm its cost-effectiveness.

Since the Internet is found to be the primary source of information during pregnancy, the use of Web-based education programs for women with GDM could have a beneficial effect on diabetes self-management [36]. In Australia, Carolan et al. developed and tested an educational Web site for women with GDM [37]. The researchers 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 showed that both approaches resulted in excellent knowledge scores [36]. Recent randomized control trial (RCT) using the same Web site aimed to evaluate changes in maternal body mass index, blood pressure, glycemic level, and infant birth weight after using a Web-based educational program compared to standard clinic-based GDM education. Results showed significant improvements in the intervention group that received Web-based education. Significant differences were observed between groups regarding women's postpartum weight, glycemic level, and attendance at oral glucose tolerance test by 12-week postpartum [38].

6. Smartphone applications

In today's digital age, in addition to the role of medical professionals who care for women with GDM, a new assistant would take part: mobile applications.

There are mobile applications (apps) designed specifically for women with GDM, which are already popular and highly desired among pregnant women [39, 40].

A recent study performed by Zahmatkeshan et al. aimed to review the evidence for the effectiveness of using mobile health (m-health) interventions for GDM. Based on their findings, it can be concluded that m-health interventions, including apps, could have a positive effect on GDM management and outcomes [41].

Another study evaluated the mobile apps applicability for pregnant women at risk of GDM. According to the results, the authors suggest that there is a need

for the development of more apps that provide both comprehensive educational content and tracking tools [42].

There are few RCTs that assess the effects of mobile apps on GDM management [39, 43–46]. The largest one [46] was conducted in Singapore among 340 pregnant women with GDM. The results from this study show that in addition to usual care, the use of a smartphone app coaching program led to better glycemic control and fewer neonatal complications [46].

Mobile apps cannot replace consulting a healthcare provider, but they could be useful in GDM management.

7. Conclusion

This chapter summarizes all of the aspects of diabetes self-management education during pregnancy including possible challenges and innovative approaches that can find practical application in the educational process. Health professionals can encourage women with GDM to look for mobile apps, Web sites, and new technologies that can help them to successfully manage the disease. Active involvement of pregnant women and good collaboration of the diabetes team member is essential for the effectiveness of the educational process.

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Conflict of interest

The authors declare no conflict of interest.

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References

[1] Ianatchkova V, Chaveeva P, Shterev A. The gestational diabetes mellitus as a specific pregnancy state. Akush Ginekol (Sofiia). 2015;**54**(9): 29-33 [Article in Bulgarian]

[2] International Diabetes Federation. IDF Diabetes Atlas. 9th ed. Brussels, Belgium: International Diabetes Federation; 2019

[3] Hod M, Kapur A, Sacks DA, Hadar E, Agarwal M, Di Renzo GC, et al. The International Federation of Gynecology and Obstetrics (FIGO) initiative on gestational diabetes mellitus: A pragmatic guide for diagnosis, management, and care. International Journal of Gynecology & Obstetrics. 2015;**131**:S173-S211

[4] Dalfrà MG, Nicolucci A, Bisson T, Bonsembiante B, Lapolla A. Quality of life in pregnancy and post-partum: a study in diabetic patients. Quality of Life Research. 2012;**21**(2):291-298

[5] Lapolla A, Di Cianni G, Di Benedetto A, et al. Quality of life, wishes, and needs in women with gestational diabetes: Italian DAWN pregnancy study. International Journal of Endocrinology. 2012;**2012**:6

[6] Kim C, Newton KM, Knopp RH. Gestational diabetes and the incidence of type 2 diabetes. Diabetes Care. 2002;**25**(10):1862-1868

[7] Karagiannis T, Bekiari E, Manolopoulos K, Paletas K, Tsapas A. Gestational diabetes mellitus: Why screen and how to diagnose. Hippokratia. 2011;**2**:187

[8] Goldschmidt VJ, Colletta B. The challenges of providing diabetes education in resource-limited settings to women with diabetes in pregnancy: Perspectives of an educator. Diabetes Spectrum: A Publication of the American Diabetes Association. 2016;**29**(2):101-104

[9] Todorova K. Diabetes and pregnancy. 1st ed. Sofia: Artik; 2010 [In Bulgarian]

[10] Diabetes Legends: Dr. Elliot Proctor Joslin – A Pioneer of Diabetes Treatment. Available from: https://www.diabetes.co.uk/blog/2015/06/diabetes-legends-dr-elliot-proctor-joslin/ [Accessed: 20 August 2021]

[11] Dunn PM. Dr Priscilla White (1900-1989) of Boston and pregnancy diabetes. Archives of Disease in Childhood. Fetal and Neonatal Edition. 2004;**89**(3):F276-F278

[12] Holt T, Kumar S. Helping people live with diabetes. In: ABC of Diabetes. 7th ed. Chichester, West Sussex: Wiley-Blackwell; 2015. pp. 11-14

[13] Okun S, Schoenbaum SC, Andrews D, et al. 2014. Patients and health care teams forging effective partnerships. NAM Perspectives. Discussion Paper, National Academy of Medicine. Available from: https://nam.edu/perspectives-2014-patients-and-health-care-teams-forging-effective-partnerships/. [Accessed: 01 September 2021]

[14] Rhee M, Cook C, El-Kobbi I, Lyles R, et al. Barriers to diabetes education in urban patients. Perceptions, patterns, and associated factors. The Diabetes Educator. 2005;**31**(3):410-417

[15] IDF School of Diabetes. Available from: https://www.idfdiabeteschool.org [Accessed: 20 August 2021]

[16] Tankova T. Diabetes Mellitus. 1st ed. Sofia: Paradigma; 2013 [In Bulgarian]

[17] Golay A, Lagger G, Chambauleyron M, et al. Therapeutic

education of diabetic patients. Diabetes/Metabolism Research and Reviews. 2008;**24**(3):192-196

[18] Cochran J, Conn VS. Meta-analysis of quality of life outcomes following diabetes self-management training. The Diabetes Educator. 2008;**34**(5):815-823

[19] Duncan I, Ahmed T, Li Q, Stetson B, Ruggiero L, Burton K, et al. Assessing the value of the diabetes educator. The Diabetes Educator. 2011;**37**(5):638-657

[20] Robbins JM, Thatcher GE, Webb DA, Valdmanis VG. Nutritionist visits, diabetes classes, and hospitalization rates and charges. Diabetes Care. 2008;**31**(4):655-660

[21] Wizowski L, Harper T, Hutchings T. Writing Health Information for Patients and Families: A Guide to Creating Patient Education Materials that are Easy to Read, Understand and Use. 4th ed. Hamilton, ON, Canada: Hamilton Health Sciences; 2014

[22] Hoffmann T, Warrall L. Designing effective written health education materials: Considerations for health professionals. Disability and Rehabilitation. 2004;**26**(9):1166-1173

[23] Lebanova H, Getov I. Adapted methodology for development and evaluation of patients' educational materials for pharmacovigilance. Academia. 2013;**3**:35-37

[24] Oliveira SC, Lopes MV, Fernandes AF. Development and validation of an educational booklet for healthy eating during pregnancy. Revista Latino-Americana de Enfermagem. 2014;**22**(4):611-620

[25] IDF, E-library, Guidelines. Available from: https://www.idf.org/e-library/guidelines/97-having-a-baby-now-is-the-time-to-learn-more-about-gestational-diabetes.html [Accessed: 01 September 2021]

[26] Chaparro M. Pregnancy & Diabetes: A Complete Guide for Women with Gestational, Type 2, and Type 1 Diabetes. 1st ed. Alexandria (VA): American Diabetes Association; 2020

[27] CDC. Diabetes and Pregnancy – Gestational Diabetes. Available from: https://www.cdc.gov/pregnancy/documents/Diabetes_and_Pregnancy508.pdf [Accessed: 01 September 2021]

[28] NDSS. Gestational Diabetes: Caring for Yourself and Your Baby. Available from: https://www.ndss.com.au/wp-content/uploads/resources/booklet-gestational-diabetes-caring-for-yourself-and-baby.pdf [Accessed: 01 September 2021]

[29] Staynova R. Gestational Diabetes Mellitus – Manual for Healthy Pregnancy. 1st ed. Sofia: TEA Design Ltd.; 2017 [In Bulgarian]

[30] Staynova RA, Gueorguiev SR, Petkova-Gueorguieva ES, Vasileva EV, Stoimenova AH, Yanatchkova VE, et al. Written health education materials for women with gestational diabetes mellitus—Evaluation of usefulness and patients' satisfaction. Folia Medica. 2019;**61**:117

[31] Craig J, Petterson V. Introduction to the practice of telemedicine. Journal of Telemedicine and Telecare. 2005;**11**(1):3-9

[32] Galiero R, Pafundi PC, Nevola R, Rinaldi L, Acierno C, Caturano A, et al. The importance of telemedicine during COVID-19 pandemic: A focus on diabetic retinopathy. Journal of Diabetes Research. 2020;**2020**:1-8

[33] Reicher S, Sela T, Toren O. Using telemedicine during the COVID-19 pandemic: Attitudes of adult health care consumers in Israel. Frontiers in Public Health. 2021;**9**:653553

[34] Aberer F, Hochfellner DA, Mader JK. Application of telemedicine in diabetes care: The time is now. Diabetes Therapy. 2021;**12**(3):629-639

[35] Xie W, Dai P, Qin Y, Wu M, Yang B, Yu X. Effectiveness of telemedicine for pregnant women with gestational diabetes mellitus: An updated meta-analysis of 32 randomized controlled trials with trial sequential analysis. BMC Pregnancy and Childbirth. 2020; **20**(1):1-4

[36] Sayakhot P, Carolan-Olah M, Steele C. Use of a web-based educational intervention to improve knowledge of healthy diet and lifestyle in women with gestational diabetes mellitus compared to standard clinic-based education. BMC Pregnancy and Childbirth. 2016;**16**(1):1-2

[37] Carolan-Olah M, Steele C, Krenzin G. Development and initial testing of a GDM information website for multi-ethnic women with GDM. BMC Pregnancy and Childbirth. 2015;**15**(1):1-9

[38] Carolan-Olah M, Sayakhot P. A randomized controlled trial of a web-based education intervention for women with gestational diabetes mellitus. Midwifery. 2019;**68**:39-47

[39] Miremberg H, Ben-Ari T, Betzer T, et al. The impact of a daily smartphone-based feedback system among women with gestational diabetes on compliance, glycemic control, satisfaction, and pregnancy outcome: A randomized controlled trial. American Journal of Obstetrics and Gynecology. 2018; **218**:453.e1-453.e7

[40] Immanuel J, Simmons D. Apps and the woman with gestational diabetes mellitus. Diabetes Care. 2021;**44**(2): 313-315

[41] Zahmatkeshan M, Zakerabasali S, Farjam M, Gholampour Y, Seraji M, Yazdani A. The use of mobile health interventions for gestational diabetes mellitus: A descriptive literature review. Journal of Medicine and Life. 2021;**14**(2):131

[42] Tassone C, Keshavjee K, Paglialonga A, Moreira N, Pinto J, Quintana Y. Evaluation of mobile apps for treatment of patients at risk of developing gestational diabetes. Health Informatics Journal. 2020;**26**(3): 1983-1994

[43] Guo H, Zhang Y, Li P, Zhou P, Chen LM, Li SY. Evaluating the effects of mobile health intervention on weight management, glycemic control and pregnancy outcomes in patients with gestational diabetes mellitus. Journal of Endocrinological Investigation. 2019;**42**(6):709-714

[44] Mackillop L, Hirst JE, Bartlett KJ, Birks JS, Clifton L, Farmer AJ, et al. Comparing the efficacy of a mobile phone-based blood glucose management system with standard clinic care in women with gestational diabetes: Randomized controlled trial. JMIR mHealth and uHealth. 2018;**6**(3): e9512

[45] Al-Ofi EA, Mosli HH, Ghamri KA, Ghazali SM. Management of postprandial hyperglycaemia and weight gain in women with gestational diabetes mellitus using a novel telemonitoring system. Journal of International Medical Research. 2019;**47**(2):754-764

[46] Yew TW, Chi C, Chan SY, van Dam RM, Whitton C, Lim CS, et al. A randomized controlled trial to evaluate the effects of a smartphone application-based lifestyle coaching program on gestational weight gain, glycemic control, and maternal and neonatal outcomes in women with gestational diabetes mellitus: The SMART-GDM study. Diabetes Care. 2021;**44**(2): 456-463