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Original Research Article

EFFECT OF NON-PHARMACOLOGICAL INTERVENTIONS ON GLYCEMIC CONTROL FOR GESTATIONAL DIABETES MELLITUS: A SYSTEMATIC REVIEW

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ABSTRACT

Introduction. Gestational Diabetes Mellitus (GDM) is defined as Impaired Glucose Tolerance (IGT) with onset or first recognition during pregnancy. Gestational diabetes mellitus occurs in 2 to 9 percent of all pregnancies and is associated with substantial rates of maternal and perinatal complications. Women with a history of GDM have a sevenfold lifetime risk of developing type 2 diabetes mellitus (T2DM) compared with those with euglycemic pregnancies.A systematic review was conducted to evaluate the evidence from published studies on the effect of non-pharmacological interventions on the health of glycemic control of pregnant women at high risk (gestational diabetes mellitus).**Method.** The databases used in this systematic review are Scopus, Science Direct, and PubMed. Relevant articles were searched from 27 May to 29 June 2022. The publication year was limited to 2018 – 2022. A total of 20 randomized controlled trials were included that focused on non-pharmacological interventions in GDM women.**Results & Analysis.** The selected articles show that physical exercise interventions consist of moderate-intensity aerobic and resistance exercise, educational interventions include telemedicine and mobile health (m-health), and dietary nutrition interventions.**Discussions.** Non-pharmacological interventions can have a good effect on the control of GDM in the treatment of GDM. In general, women with GDM can improve their condition and prevent the risk of complications in childbirth. The physical exercise intervention had a significant beneficial effect on controlling blood glucose levels in GDM women, while other interventions that also had a beneficial effect were education with telemedicine and mobile health media.

Keywords: Gestational diabetes mellitus (GDM), Non-pharmacological interventions, Glycemic control.

INTRODUCTION

Maternal Mortality Rate (MMR) is defined as the number of maternal deaths during pregnancy, childbirth and the puerperium caused by pregnancy, delivery and postpartum or their management and not due to other causes such as accidents or falls in every 100,000 live births. The maternal mortality rate is a sensitive indicator to measure the success of achieving health development, and at the same time measuring the achievement of the human capital index (Kemenkes RI, 2020).

In the Sustainable Development Goals (SDGs), the MMR target is 70 per

100,000 live births in 2030. The MMR in Indonesia is still relatively high compared to other ASEAN countries, which is 177 per 100,000 live births in 2017 (Susiana, 2019) .

Maternal mortality is caused by 2 factors, namely direct and indirect factors. Direct factors are caused by bleeding, hypertension, infection, prolonged labor, diabetes mellitus, abortion and so on. Indirect factors include: low maternal education level; low socioeconomic level; socio-cultural does not support; transportation is not supported; low reproductive health status; community access to maternal health services is low; inadequate quality & effectiveness of maternal health services; and the maternal health referral system is not yet feasible (Sitorus, 2020).

The prevalence of DMG has continued to increase over the last 20 years. Globally, 16.2% (21.3 million) live births were associated with hyperglycemia in pregnancy, of which 86.4% were due to GDM, 6.2% were due to type 1 diabetes (type 1) or type 2 diabetes (type DM). 2) preexisting, and 7.4% due to type 1 and type 2 diabetes which were first detected during pregnancy. Without proper glucose management, GDM is associated with increased perinatal complications and risk of future metabolic disease in both mother and child

Gestational Diabetes Mellitus (GDM) was recently defined by the American Diabetes Association (ADA) as "diabetes diagnosed during pregnancy that is one of the most common antepartum complications (American Diabetes Association (ADA), 2015a). Gestational diabetes mellitus occurs in 2 to 9 percent of all pregnancies and is associated with substantial rates of maternal and perinatal complications.Women with a history of GDM have a sevenfold lifetime risk of developing type 2 diabetes mellitus (T2DM) compared to those with euglycemic pregnancies (Tawfik, 2017).From the premise of In order to minimize or prevent the occurrence of T2DM in these high-risk women, the International Diabetes Federation recommends postpartum blood glucose screening and the adoption of healthy lifestyle behaviors, especially diet, exercise and weight loss (International Diabetes Federation, 2009).

However, there is a paucity of research-based evidence on the health effects of non-pharmacological glycemic control interventions on the management of high-risk pregnant women. Researching non-pharmacological interventions is important, given the desire of these high-risk women to avoid medical treatment and the potential benefits they may have on physical health and prevention of

complications in pregnancy and childbirth. Therefore, a systematic review was conducted to evaluate the evidence from published studies on the effect of non-pharmacological interventions on the health of glycemic control of pregnant women at high risk (gestational diabetes mellitus).

METHOD AND ANALYSIS

Articles published in English are searched on Scopus, Science Direct, and PubMed. Relevant articles were searched from 27 May to 29 June 2022. The year limit for publication was between 2018 – 2022. The search terms were “gestational diabetes mellitus”, “non-pharmacological interventions”, and “glycemic control”.

The inclusion criteria of the article were: Pregnant women aged between 18 and 45 years were recruited into the study with newly diagnosed gestational diabetes mellitus.

Non-pharmacological interventions, randomized and controlled trials with humans, and scientific papers in English and complete. Pregnant women with pre-existing diabetes (types 1 and 2), articles containing reports from literature review studies, opinion articles, and non-randomized control trial studies, and articles that did not have a final outcome assessment of interventions determined by the PICO methodology were excluded of this research.Women were recruited at approximately 28–32 weeks' gestation, after the diagnosis of GDM, and after they had attended standard clinic-based education classes. Articles are excluded if the article is a systematic review, the subjects in the study include patients with gestational diabetes mellitus with complications of other diseases.

RESULT

An initial literature search identified articles with a total of 310 articles (145 from Scopus, 85 Science Direct, and 100 from PubMed/Medline), but 158 articles were excluded for lack of relevance and 152 articles were selected. From these publications, 112 were excluded and 40 were initially selected on the basis of title and abstract. There were 20 articles which we excluded after reading the full text, in the end 20 articles met the inclusion, exclusion criteria and

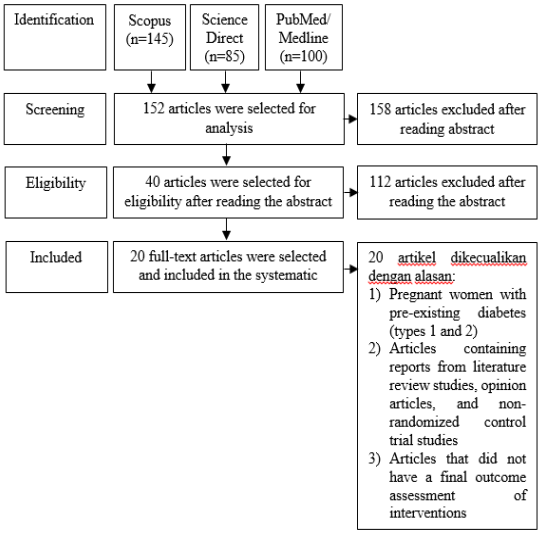

Figure 1. Flowchart and Article Selection

The results of this study are based on 20 quantitative studies of non-pharmacological interventions for gestational diabetes mellitus. Four non-pharmacological interventions are summarized, 1) Physical exercise intervention, 2) Educational Intervention, and 3) Dietary nutrition intervention.

1) Physical Exercise Intervention

Elevated blood glucose levels in patients with gestational diabetes mellitus can be a complication for both mother and fetus, and even levels can be life-threatening. Physical activity is the cornerstone of health promotion and disease prevention, not only in the non-pregnant population, but also in pregnant women. All major guidelines on antenatal health care recommend exercise in pregnancy for women without contraindications. Furthermore, the American Diabetes Association and ACOG recommend exercise for women with GDM (American Diabetes Association (ADA), 2015b).

Benefits of physical exercise during pregnancy can improve cardiovascular function (Prather, Spitznagle and Hunt, 2012), reduce the risk of gestational diabetes in obese and non-obese women, increase strength and lean muscle mass, improve quality of life, in addition to the benefits of physical exercise such as: Aerobics can reduce the risk of bone density loss, and physical discomfort (Ming et al., 2018). In a study conducted by Sklempe Kokic et al., 2018 using the RCT (Randomized Controlled Trial) method, the aim of this trial was to investigate the impact of a structured program of aerobic and resistance exercise on the course and outcome of gestational diabetes mellitus. To our knowledge, this is the first study to investigate the effects of combining aerobic and resistance exercise on pregnant women with GDM, and also the first to investigate the effects of an individualized exercise program of this type (Sklempe Kokic et al., 2018). In addition to aerobic intervention, there are other activities that can help control blood glucose levels and have positive benefits during pregnancy, namely resistance exercise (Huifen et al., 2022). In the study of Huifen et al., 2022, which aims to determine the effect of structured moderate intensity resistance exercise intervention on GDM patients. This study strictly controlled the intensity of the exercise, carried out on-site supervision and intervention, and effectively controlled the quality of the exercise intervention. The results of this study indicate that the structure of moderate intensity in resistance exercise improves blood glucose control, insulin use, pregnancy weight gain and blood pressure

in patients with GDM (Huifen et al., 2022).

2) Educational Intervention

Telemedicine (TM) refers to health services and medical activities, such as remote evaluation, diagnosis and treatment of patients by healthcare professionals carried out using remote communication technologies, such as mobile phones, Bluetooth, telephone, email, and websites. More specifically, healthcare professionals monitor patient health-related indicators and provide timely medical feedback via website-based systems or mobile terminal devices, and provide health knowledge and guidance remotely to improve patients' physical and psychological status (Xie et al., 2020). While studies suggest that telemedicine may offer little benefit in terms of glycemic control in pregnant women with diabetes, there is insufficient evidence at this time to support that it has an effect on other clinical endpoints. The strength of our review is the robust and rigorous search strategy used, identifying 3 additional trials that have been considered in previous reviews on this topic (Rasekaba et al., 2015).

Mobile health intervention management, an outpatient treatment model including personalized diet guidance by educational nurses during the patient's first visit. This nurse calculates the amount of protein, fat, and carbohydrates that patients need each day based on their body weight and activity level, develops a training plan, helps patients choose the right aerobic exercise, and checks their diet and exercise performance at return visits. The specialist creates an outpatient medical service file for each patient to record data for each visit, including blood glucose and weight, which can help with disease assessment and treatment planning. For the initial visit, the patient is required to make one visit a week for 3 consecutive weeks. Fasting and post-prandial glucose self-measurements were monitored at least 3 days per week, and recorded manually using a paper diary for review with their physicians at each visit.

3) Dietary Nutrition Intervention

Health status can be improved by using nutrition education facilities and health promotion patterns. Longitudinal studies should be managed to estimate nutritional comparisons (Basharat et al., 2020). GL (Glcemic Load) based nutritional nursing intervention. All pregnant women were provided with personal dietary guidance at the time of diagnosis. Based on the ideal body weight, actual weight gain, and eating habits of pregnant women, it is recommended to carry out a reasonable diet plan, control diet, and proper exercise. Patients are

treated with insulin if ideal blood glucose levels are not achieved. All pregnant women who are guided on a diet are advised to eat small meals 5 or 6 times a day, to avoid overeating, and to engage in the right amount of exercise. GL-based nutritional nursing interventions are more effective than traditional nutritional care in gestational diabetes patients, and can effectively control blood glucose levels, reduce the incidence of pregnancy complications, and improve pregnancy outcomes. Thus, GL-based nutritional nursing interventions deserve to be popularized (Lv et al., 2019).

DISCUSSION

GDM is one of the most common complications in the obstetrics department. Pathogenesis is now thought to be due to placental hormones, such as estrogen, progesterone, and human placental lactogen (HPL), which cause insulin resistance and high blood glucose. Insulin resistance and hyperinsulinemia induce vascular changes, resulting in thickening of the basement membrane of the capillary walls and worsening of renal ischemia, which can increase the risk of hypertension and other diseases in pregnancy. Numerous studies have shown that the hyperglycemic state in pregnant women increases the proliferation of fetal islet cells, increases insulin secretion, increases fetal protein and fat synthesis, and inhibits glycogen decomposition, resulting in an increased incidence of macrosomia and other diseases. adverse pregnancy outcome. In addition, GDM can cause various diseases, such as polyuria. Indeed, a hypertonic fluid environment can cause a high-permeability diuresis. The concentration of glucose in the amniotic fluid increases, which can stimulate the amnion to increase the secretion of amniotic fluid, resulting in polyhydramnios. A high insulin fetal environment reduces pulmonary surfactant, which delays fetal lung maturation. Therefore, blood glucose levels should be controlled within the normal range to reduce the incidence of complications in both mother and baby.

An increase in blood glucose levels during pregnancy is a high risk factor that can cause complications during pregnancy and even delivery, and can threaten the life of the mother or baby. As for non-pharmacological interventions that can be recommended to help glycemic control during pregnancy (Park and Lee, 2020). The average fasting blood glucose and postprandial blood glucose of 2 patients in both groups decreased after the intervention compared to before the intervention. The average fasting blood glucose and 2-hour postprandial blood

glucose of patients in the experimental group was lower after the intervention compared to the control group (Huifen et al., 2022). This suggests that moderate-intensity resistance exercise and dietary intervention for diabetes are beneficial for lowering blood glucose levels in GDM patients, but increasing exercise intervention based on dietary control has a better effect on blood glucose control (Huifen et al., 2022). The positive effect of resistance exercise on glycemic control in this study may be due to a mechanism similar to the same effect in type 2 diabetes. Insulin resistance in GDM patients is the root cause of hyperglycemia in these patients (Wang, Guelfi and Yang, 2016).

The emergence of mobile medical technology (m-health) has offered a new medical management model for mobility, digitization and high efficiency management of diabetes mellitus, and as a result this approach has become a popular topic at home and abroad (Guo et al., 2019). In the study (Ming et al., 2016), the mobile health (mHealth) group showed higher compliance with blood glucose monitoring, lower levels of hemoglobin A1C before delivery, and lower percentages of target fasting glucose and 2-hour postnatal glucose measurements. -prandial. The number of outpatient visits in the mHealth group has decreased. Patients can upload their blood glucose, diet and exercise information at any time via their mobile phones. Educational nurses are also available for online instruction every night and urge patients to have their blood glucose measured on time. The doctor immediately identifies the problem and communicates it with the patient to provide the correct medical guidance quickly. All of these innovations serve to improve patient compliance, make it easier to achieve normal blood glucose levels, and save patients time and money.

In a study (Heude et al., 2012) studied the relationship of low vitamin D levels with increased gestational high blood glucose levels, analyzing that low vitamin D levels in pregnancy increase insulin resistance and increase susceptibility to gestational diabetes mellitus. The study concluded that a comparison of both case and control groups showed that a high-carbohydrate diet low in calcium and a vitamin D diet low in intake of polyphenol-rich fruits such as dried fruit and green leafy vegetables increased the likelihood of gestational hyperglycemia. hyperglycemia of pregnancy. Other comorbidities identified in this study include a high-carbohydrate diet and sedentary lifestyle during pregnancy. Health status can be improved by using nutrition education

facilities and health promotion patterns (Shoukat et al., 2020).

This article discusses non-pharmacological interventions in women with GDM that are relatively free from the pharmacological side effects associated with pharmacological interventions. Non-pharmacological interventions can have a good effect on the control of GDM in the treatment of GDM. In general, women with GDM can improve their condition and prevent the risk of complications in childbirth. The physical exercise intervention had a significant beneficial effect on controlling blood glucose levels in GDM women, while other interventions that also had a beneficial effect were education with telemedicine and mobile health media, although the results did not significantly affect mobile health statistically in GDM women, but telemedicine has a beneficial effect on GDM women. Pregnant women can also carry out routine control through direct visits with a combination of telemedicine and mobile health to improve glycemic control. In addition, women who suffer from GDM during pregnancy can put themselves in some negative emotions such as worry and anxiety. Thus, in clinical intervention, clinical health care providers in addition to paying attention to physical conditions, the psychological condition of patients is expected to receive the same attention so that GDM women can achieve a better quality of life.

CONCLUSION

Physical exercise interventions have a significant beneficial effect on controlling blood glucose levels in GDM women, while other interventions that also have beneficial effects are education with telemedicine and mobile health media, where patients can achieve a better quality of life both physically and psychologically. Non-pharmacological interventions can have a good effect on controlling GDM in the treatment of GDM, as well as preventing the risk of complications during childbirth.

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