

METABOLIC MANAGEMENT

Lifestyle modifications for GDM

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Abstract

Prevalence of gestational diabetes mellitus (GDM) is increasing worldwide more so in Southeast Asian countries like India and Pakistan.¹ GDM is associated with various adverse foetal and maternal effects. The management of GDM aims at reducing blood glucose to reduce maternal and foetal morbidity and mortality. Various studies have shown that lifestyle modifications are an important tool for reducing blood glucose levels in patients with GDM. Lifestyle modifications consist of dietary modifications and daily physical activity. Dietary modifications aim to achieve glycaemic control by providing adequate calories to the mother and foetus. Exercise is an obvious adjunct to dietary modifications for management of GDM. Therefore the purpose of this review is to summarize the benefits of lifestyle interventions in patients with GDM.

Keywords: India and Pakistan, Lifestyle modifications, Exercise.

Dietary modifications in GDM

Individualized medical nutrition therapy (MNT) is recommended for all patients with GDM.² It not only helps in achieving glycaemic control but also helps in fulfilling essential nutrient requirements of the mother and foetus. Many trials have proven that that about 90% of patients with GDM can be managed with MNT alone.

Goals for MNT in pregnancy include:

- Adequate nutrient intake to support a healthy pregnancy
- Excellent glucose control by balancing food/carbohydrate intake with physical activity and

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insulin treatment

c) Adequate but not excessive weight gain

d) Learning appropriate food and exercise behaviours that can contribute to long-term maternal health.

Weight gain during pregnancy

Excessive weight gain during pregnancy has been shown to be associated with adverse maternal and foetal outcomes. Institute of medicine has provided guidelines based on pre pregnancy body mass index (BMI) for weight gain during pregnancy.³ Various studies have shown strong correlation between maternal weight gain and infant size. Based on BMI it has been recommended that women with normal pre pregnancy BMI (19.8-26.0 kg/m²) gain a total of 11.4-15.9 kg, whereas those who are overweight (19.8-26.0 kg/m²) or obese (BMI >29 kg/m²) the recommendation for weight gain is 6.8-11.4 kg and 7 kg respectively. However it has also been suggested that Asian cut-offs for BMI should be used to define normal, overweight and obese.

Total calorie intake

The Dietary Reference Intakes (DRI) recommends no increase in calorie requirement during the first trimester but recommends an additional 340 kcal for 2nd trimester and 450 kcal for 3rd trimester.⁵ American diabetes Association (ADA) suggests restriction of 30-33% of calorie restriction with a minimum of 1800 kcal in obese pregnant women with GDM.³ Severe calorie restriction to less than 1500 kcal is not recommended as it is associated with increased chances of ketonemia. Various formulas for calculation of total calorie requirement using body weight (35-40 kcal/kg desirable body weight for underweight, 30-35 kcal/kg for normal BMI, and 25-30 kcal/kg for overweight women) have been used but there is inadequate evidence to support the use of these.

GDM meal plan

MNT suggests a carbohydrate controlled meal that

Table-1: Recommendations on Medical Nutrition Therapy (MNT).

- ◆ Limit carbohydrate intake to 35% to 45% of total calories, distributed in 3 small- to moderate-sized meals and 2 to 4 snacks including an evening snack.
- ◆ Diet should contain 175 g/day of digestible carbohydrate, 1.1 g/kg/day of protein and enough fiber intake (28 g/day), in form of vegetables, fruits, and whole grains.
- ◆ Fat consumption should be limited to < 30% of the total calories. Consumption of unsaturated fatty acids including the n-6 and n-3 fatty acids should be encouraged; saturated fat should be limited to < 10% of energy intake and trans fats to the minimal amount possible.
- ◆ Reduce folic dose to 0.4 mg-1mg from 5 mg at 12 weeks of gestational age
- ◆ Women are encouraged to acquire micronutrients from natural food sources, but a prenatal supplement of vitamins and minerals should be considered in women with pre-existing diabetes
- ◆ Vegetarian pregnant women may need supplements of vitamin D and vitamin B12.

provides adequate nutrition with appropriate weight gain without inducing ketosis. American Diabetes Association (ADA) recommends that total calories during pregnancy should comprised of 40% to 50% carbohydrates, including high-fibre fruits and starches and milk if tolerated; 20% protein; and 35% fat. Table-1 summarizes the current ADA guidelines for MNT.^{2,6,7} It has been suggested that women should be taught to read food labels and recognize the total carbohydrate content and serving size. Furthermore, maintaining food diaries by the patients have been shown to improve glycaemic control.

Distributing carbohydrate in three major meals and three snacks help in reducing postprandial hyperglycaemia. Low glycaemic index food also helps in achieving better blood glucose control. In a meta-analysis Miller et al⁸ reported that food with low glycaemic index results in an additional 0.4% reduction of glycated haemoglobin (HbA1c). As far as artificial sweeteners are concerned, Aspartame has been reported to be safe as a non-nutritive sweetener in pregnancy except in women with phenylketonuria.⁹ Saccharin crosses placenta but currently there is no evidence of any harmful effects on foetus.⁹ Dietary plan should be given by a registered dietician on the first occurrence of hyperglycaemia and then on ongoing basis throughout the pregnancy and postpartum.

Exercise and pregnancy

Exercise not only increases insulin sensitivity but also reduces the production of counter regulatory hormones. Furthermore it has been shown that routine physical activity during pregnancy reduces adverse foetal or maternal outcomes in both previously active and inactive women. However various factors like lack of motivation, perceived lack of time and postponement of weight loss to after pregnancy have been reported as barriers to exercise during pregnancy. Further due to uncertainty of

risks and benefits of exercise women tend to avoid exercise in pregnancy.

Benefits of Exercise During Pregnancy Benefits to the Mother

Beneficial effects of exercise during pregnancy have been documented as early as 17th and 18th century. In the late 18th century it was believed that exercise helped in easier labour and reducing the size of baby.¹⁰ However it was only in 2nd and 3rd decade of 20th century that scientific literature became available on benefits of exercise in pregnancy. In patients with diabetes Bung et al¹¹ reported that seventeen of the twenty-one women in the exercise group, all of whom were previously insulin dependent, were able to maintain normal glucose levels without using insulin. These findings were further validated by Jovanovic-Peterson et al,¹² who concluded that women engaged in diet plus exercise had lower fasting plasma glucose after 6 weeks of training than women who underwent the diet only intervention. Furthermore, various studies have shown that benefits of exercise during pregnancy include improved cardiovascular function, improved lean muscle mass, improved sense of wellbeing, improvement of lower back pain and improved sleep. Preeclampsia has also been shown to decrease with increase in physical activity.

Exercise also helps in weight management during pregnancy. Weight gain during pregnancy is natural, however excessive weight gain is associated with maternal and foetal complications. Different studies have reported a reduction in excessive weight gain by 70-77% using low to moderate intensity exercise. It has further been suggested that exercise reduces level of TNF- α thus reducing insulin resistance.¹²

Exercise not only improves physical wellbeing but it also has a positive effect on psychological wellbeing. A randomized control trial in 2012 reported that after 3 months of supervised exercise in pregnant women there was significant reduction in depression scores in women following an exercise schedule as compared to control women.¹⁴ It has also been proposed that due to limitation of weight gain and fat retention, exercise improves self-image. Furthermore according to American College of Obstetricians and Gynaecologists (ACOG) exercise decreases constipation and insomnia.¹⁵

Benefits to the Foetus and the Child

Foetal benefits credited to maternal exercise include decreased foetal heart rate, increased amniotic fluid volumes and increased placental viability and volume. Some studies have reported increase in endothelium

dependent vasodilation, thus reducing the risk of preeclampsia.¹⁶ Other advantages of maternal exercise to foetus are reduced risk of preterm birth, improved neurodevelopment and lower body fat percentage. Jukic et al¹⁷ in a longitudinal study reported that children of mothers who did physical activity during pregnancy had a better verbal score at 15 months as compared to control women.

Current Guidelines for Exercise in GDM

American Diabetes Association recommends that pregnant women without any obstetrical or medical contraindications (Table-2) should be encouraged to do at least 30 minutes of physical activity daily as a part of

groups in a continuous rhythmic manner. The effect of aerobic exercise on reducing blood glucose levels lasts for more than 24 hours but less than 72 hours. However, some forms of exercises are not recommended during pregnancy. These include:

- i. Recreational sports with increased risk of forceful contact or falling (i.e., basketball, rugby, horseback riding and gymnastics),
- ii. Exercising in a supine position after the first trimester (may obstruct inferior vena cava flow),
- iii. Motionless standing and scuba diving (risk of foetal decompression sickness).

Table-2: Contraindications to physical activity during pregnancy.

Contraindications	Medical	Obstetric
Absolute	<ul style="list-style-type: none"> ◆ Hemodynamically significant heart disease ◆ Restrictive lung disease 	<ul style="list-style-type: none"> ◆ Incompetent cervix ◆ Multiple gestation at risk for premature labor ◆ Persistent second or third trimester bleeding ◆ Placenta previa after 26 weeks gestation ◆ Premature labor during the current pregnancy ◆ Ruptured membranes ◆ Pre-eclampsia, pregnancy induced hypertension ◆ Intrauterine growth restriction in the current pregnancy
Relative	<ul style="list-style-type: none"> ◆ Severe anemia ◆ Unevaluated maternal cardiac arrhythmias ◆ Chronic bronchitis ◆ Uncontrolled Type 1 diabetes ◆ Extreme morbid obesity ◆ Extreme underweight (BMI <12 kg/m²) ◆ History of extremely sedentary lifestyle ◆ Poorly controlled hypertension ◆ Poorly controlled hyperthyroidism ◆ Poorly controlled seizures ◆ Orthopaedic limitations ◆ Heavy smoker 	

their overall diabetes management.

Type of exercise

Various exercises reported to be safe during pregnancy include low impact aerobic exercises, progressive resistive strengthening, stretching exercises, yoga, and Qi. The type of aerobic exercises used during pregnancy have been stationary bicycling, jogging, walking, stair climbing, treadmill use, water exercise, swimming, and an aerobic dance class. Yoga is an ancient way of exercise which originated in India but is now being practiced throughout the world. A recent meta-analysis suggested that yoga is well indicated for pregnant women and leads to improvements on a variety of pregnancy, labour, and birth outcomes.¹⁸ These exercises use large muscle

iv. Exercises that may cause even mild abdominal trauma, including activities that include jarring motions or rapid changes in direction.

v. High impact activities that require extensive jumping, hopping, skipping, or bouncing

vi. Deep knee bends, full sit-ups, double leg raises and straight-leg toe touches but it has been shown that squatting after 36 weeks of gestation helps in vaginal delivery.

vii. Bouncing while stretching

Most of the guidelines on exercise during pregnancy stress on aerobic exercises and to a lesser extent on resistance exercises. Although the major obstetrical

societies like the Royal College of Obstetricians and Gynaecologists (RCOG), ACOG, the Society of Obstetricians and Gynaecologists of Canada (SOGC) recommend resistance exercise (like weightlifting) during pregnancy but they are yet to provide specific guidelines for practice. Hall et al¹⁸ in a study on pregnant women reported that patients who did moderate intensity exercise had significantly lower glucose levels as compared to control women.

Aerobic water based exercises not only improve physical fitness but also reduce peripheral oedema. Furthermore, water based exercise because of buoyancy of water, reduce the risk of musculoskeletal injuries and provide pain relief for the back pain associated with pregnancy. American College of Sports Medicine (ACSM) recommends that combined aerobic and resistance exercises are more effective in reducing blood glucose as compared to either one.¹⁹ The combination is more effective as aerobic exercise (increase insulin sensitivity) and resistance exercise (increase glucose disposal by increasing muscle mass) act through different pathways. A warm up of 5-10 minutes using aerobic exercises prior to exercise increases core temperature and reduces post exercise muscle soreness and stiffness. Furthermore doing a post exercise cool down helps in reducing the chances of vasovagal syncope after a vigorous exercise.

Frequency and Duration of Exercise

Pre pregnancy pattern of physical activity should be considered before prescribing exercise during pregnancy. Although trimester specific guidelines for exercise are not available but in sedentary women it is preferable to start exercise schedule in second trimester as by then most of the discomforts like morning sickness and fatigue has settled down. At the same time women should be motivated to start exercise as soon as possible to. Women should start with 15 minutes of aerobic activity and gradually increase it to 30 minutes for at least 5 days a week. Although guidelines on upper limit of exercise are not available, however ACOG advises against exercising for more than 45 minutes as this may increase foetal temperature. ACSM recommends that exercise should be conducted with no more than 2 consecutive days between aerobic exercise sessions.¹⁹ This is because improvement in insulin action and passive glucose uptake is transient after exercise (upto 48 hours). For resistance training ACSM recommends a minimum of twice a week on non-consecutive days and ideally three times a week.¹⁹

Intensity of Exercise

Most of the current guidelines recommend moderate intensity physical activity during pregnancy. Heart rate

Table-3: Age wise target heart rate zone for aerobic exercises during pregnancy.¹⁶

Maternal age (Years)	Target heart rate (beats/min)	Target heart rate (beats/min) for Sedentary overweight and obese
<20	140-155	
20-29	135-150	102-124
30-39	130-145	101-120
>40	125-140	

should be used as indicator of intensity of exercise during pregnancy but it should be remembered that heart rate is increased by 10-15 beats/min is blunted at maximal exercise levels. So RCOG recommends to use modified targets to monitor intensity of exercise during pregnancy (Table-3). Resistance training of moderate intensity have been associated with positive pregnancy outcomes and ACSM recommends strength training at a moderate (50% of 1-repetition maximum) or vigorous (75%-80% of 1-repetition maximum) intensity for optimal gains in strength and insulin action.¹⁹ Furthermore ACSM recommends moderate intensity exercise for women with pre pregnancy BMI of <25kg/m² and light intensity exercise for women with a BMI of <25kg/m².

When to Terminate Exercise?

Exercise should be terminated if any of the following signs occur: vaginal bleeding, dizziness, headache, chest pain, muscle weakness, preterm labour, decreased foetal movement, amniotic fluid leakage, calf pain or swelling and dyspnoea without exertion. Hypoglycaemia, though rare may also require termination of exercise. It is advisable not to start exercise if pre exercise blood glucose level is less than 72mg/dl. Furthermore insulin should be taken well before exercise to avoid hypoglycaemia.

Barriers to Exercise During Pregnancy

Lack of knowledge about safety and benefits of exercise during pregnancy seems to be the most important barrier to exercise during pregnancy. It is common belief that doing exercise during pregnancy will have adverse effects on foetus. Lack of time, as house hold chores are usually done by the women, is another important barrier. Most of the pregnant women believe that doing household chores gives them the required amount of physical activity. However a study from Ireland found that people who consider doing household chores is equivalent to exercise tend to be heavier as they overestimate there physical activity.²⁰ Imparting proper education to pregnant females about safe exercises and their benefits to mother and foetus during pregnancy can help to remove the taboos associated with exercise during

pregnancy. Further familial support can help to motivate the patient to do exercise.

Conclusion

GDM presents a window of opportunity to prevent diabetes and associated metabolic illness, not only in the mother, but also in the unborn generation. Lifestyle interventions are the cornerstone for management of GDM. In most of the patients MNT is sufficient for management of GDM. When used correctly exercise is an effective tool in management of GDM. Thus a sound knowledge of lifestyle intervention to the providers of diabetes care during pregnancy will not help in better management of these patients but will also help in reducing development of type 2 diabetes later in life.

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