بسم الله الرحمن الرحيم

تغذیه درمانی پزشکی در دیابت بارداری

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۳۰ تیرماه ۱۴۰۱

Overview

- Introduction
  - ✓ GDM definition
  - ✓ GDM diagnosis
  - ✓ GDM prevalence
  - ✓ GDM risk factors
- GDM management
- Medical nutrition therapy in GDM
- Energy requirement
- Macronutrinets
- Non-nutritive sweeteners
- Self-monitoring of blood glucose (SMBG)
- Glycemic target in pregnancy
- Physical activity
- Prevention of GDM
- Case study

Gestational Diabetes Mellitus

- GDM is diabetes diagnosed in the second or third trimester of pregnancy that is not clearly either type 1 diabetes or type 2 diabetes (T2DM).

- Diabetes diagnosed in the first trimester is considered undiagnosed T2DM

Diabetes Care 2016; 39 :S39-S46.

Screening for GDM

- All pregnant women should be screened for GDM
- Screening for GDM generally is performed at 24–28 weeks of gestation.
- In overweight and obese women and women with a prior history of GDM: Early pregnancy screening for **undiagnosed type 2 diabetes**, preferably at the initiation of prenatal care

Practice Bulletin Gestational Diabetes Mellitus,2017;130:e17-e31.

Prevalence of GDM in 2021

Region	Standardized prevalence (%)
Global	14 (13.97–14.04)
IDF region	
North America and Caribbean	7.1 (7.0–7.2)
Europe	7.8 (7.2–8.4)
South America and Central America	10.4 (10.1–10.7)
Africa	14.2 (14.0–14.4)
Western Pacific	14.7 (14.7–14.8)
South-East Asia	20.8 (20.2–21.4)
Middle East and North Africa (MENA)	27.6 (26.9–28.4)

Diabetes Res Clin Pract. 2022 Jan;183:109050

Diagnosis of GDM

One-step strategy	Two-step strategy
• Fast at least 8 h • 75-g glucose solution • Blood drawn at fasting, and 1 and 2 h • Diagnosis made with one abnormal value	Step 1 • 50-g glucose solution given at any time of day • If the plasma glucose level measured 1 h is >140 mg/dL, administer step 2, 3 days later. Step 2 • Fast at least 8 h before test • 100-g glucose solution given • Blood drawn at fasting, 1,2, and 3 h • Diagnosis made if two values are abnormal

GDM Diagnostic Criteria

	Fasting blood glucose (mg/dl)	**1-h blood glucose** (mg/dl)	**2- h blood glucose** (mg/dl)	**3-h blood glucose** (mg/dl)
ACOG	≥95	≥180	≥155	≥140
IADSPG, ADA	≥92	≥180	≥153	-
WHO	92-125	≥180	153-199	-

ACOG, American College of Obstetricians and Gynecologists; ADA, American Diabetes Association; IADPSG, International Association of Diabetes and Pregnancy Study Groups; WHO, World Health Organization.

Chapter 32, Nutrition in the Prevention and Treatment of Disease (Fourth Edition) 2017, Pages 709-729.

Risk Factors

- Age > 40 years
- Overweight or obesity
- Physical inactivity
- Previously diagnosed with GDM
- Previous delivery of infant with birth weight > 4 kg
- First degree relative with diabetes
- Polycystic ovary syndrome
- High-risk race/ethnicity

  (Asian, Middle East, African-American, and Pacific Islanders)

J Diabetes Res. 2021;2021:5266919.

Nutritional risk factors

- Excess calorie consumption
- Excessive gestational weight gain, especially in early pregnancy (up to 18-week gestation)
- Vitamin D deficiency
- High intake of heme iron and increased plasma ferritin???
- Number of dietary patterns have been identified:
  - Increased risk with excess saturated and trans fats, simple sugars, and red and processed meat consumption
  - Decreased risk with diets high in fruits, vegetables, and fish

Current Diabetes Reports 2019; 19:73

GDM Management

- Medical Nutrition therapy
- Patient education
- Glycemic monitoring: SMBG and targets
- Fetal monitoring: ultrasound
- Pharmacological therapy

GDM Management

- GDM should be managed first with diet and exercise
- Medications should be added if needed
- GDM can control with lifestyle modification alone in **70-85**% of women with GDM
- MNT, physical exercise, weight control, and implementing a self-control strategy, should begin as soon as possible after diagnosis (the first week).

Diabetes Care Volume, 2015; 38, Supplement 1.
Diabetes Care 2020;43(Suppl. 1):S183–S192.

GDM Management

- Pregnant women should be taught:
  - ✓ To self-monitor fasting and postprandial glucose
  - ✓ To keep a diary where to note down the values of self-measured blood glucose, data on the food, and physical exercise.

- It is useful to identify:
  - ✓ The individual variations of glycemic values
  - ✓ The factors determining them

➡ Taking appropriate decisions regarding their lifestyle changes.

J Diabetes Res. 2021;2021:5266919.

Goals for MNT in GDM

- Optimal nutrition and weight gain for fetus and mother
- Avoiding the mother's excessive weight gain
- Maternal euglycemia
- Reduce the risk of diabetes related complications
- Minimize the maternal and infant morbidity and mortality
- Integrate diet, activity and pharmalogic therapy
- Introducing healthy habits to prevent or delay onset of type 2 diabetes

Assessing from an interview

- Age
- Obstetric history
- Weight history
- Significant medical history (co-morbidities)
- Food preferences and eating habits
- Food allergies
- Individuals psychological, social and physical status
- Lifestyle, culture, and socio-economic status
- Readiness to change

Assessing clinical status

- Laboratory tests to determine clinical status
  - OGTT, FBS, HbA1C
  - Urine ketones and proteins
  - Lipid profile
  - Hemoglobin, creatinine, thyroid function
  - Blood pressure
- Anthropometric data
- Current medications and nutrition supplements
- Nutritional assessment

Energy requirement

- The Institute of Medicine (IOM) does not recommend weight loss during pregnancy
- If the caloric restriction is required, this should be performed in a controlled manner
- Severe food restriction may lead to a rapid turn of the body into using fatty acids (FA) and glucose saving
- Most international organizations recommend that normal and overweight pregnant women should be encouraged in having an adequate weight gain, according to the IOM recommendations.

Weight gain outcomes

Pre-pregnancy BMI (kg/m^2)	Total weight gain (kg)	Mean (range) in kg/week (2^{nd} and 3^{rd} trimesters)
Underweight (<18.5)	12.5-18	0.51 (0.44-0.58)
Normal weight (18.5-24.9)	11.5-16	0.42 (0.35-0.50)
Overweight (25.0-29.9)	7-11.5	0.28 (0.23-0.33)
Obese (>30.0)	5-9	0.22 (0.17-0.27)

Institute of Medicine, National Research Council. Weight Gain During Pregnancy: Reexamining the Guidelines. Washington, DC: National Academies Press, 2009

Energy requirement

The specific energy intake recommendation should be individualized based on :

- Pre-pregnancy weight status
- Physical activity level
- Weight gain to date in pregnancy

Energy and protein requirement in pregnancy

	Energy (kcal/day)	Protein (g/day)
1st trimester	No additional energy	+25
2nd trimester	+340	+25
3rd trimester	+452	+25

Energy requirement in pregnancy

Pre-pregnancy weight	1st trimester	2nd trimester	3rd trimester
Normal	ER	ER + 340 kcal	ER + 452
Lean	ER + 300-500 kcal	ER + 300-500+ 340	ER + 300-500+452
Overweight /obese	ER according to AIBW*before pregnancy	ER according to AIBW+ 340 kcal	ER according to AIBW+452

* Adjusted ideal body weight

$$AIBW = IBW + 0.25 \times (\text{actual weight} - IBW)$$

Energy requirement

- Women require between 1,800-2,500 kcal/day.
- A minimum 1600-1800 kcal/d to prevent ketosis

Reasonable caloric intake based on BMI prior to pregnancy

BMI prior to pregnancy (kg/m2)	Energy requirement (kcal/kg/d)
Underweight (<18.5)	35-40
Normal (18.5-24.9)	30-34
Overweight (25-29)	25-29
Obese (30-39.9)	Maximum 24

J Diabetes Res. 2021;2021:5266919.

Carbohydrate in GDM

- Carbohydrate (CHO) is the primary nutrient affecting postprandial glucose levels.

- Glycemic response to intake of CHO depends on:
  - CHO quantity
  - CHO distribution
  - CHO quality

Curr Diab Rep (2016) 16: 22.
Ann Nutr Metab 2020;76(suppl 3):17–29.

Carbohydrate Quantity

- Carbohydrate restriction remains the most common approach for MNT in GDM.

- The recommended amount of CHO varies :
  - 35-40% of energy (lower CHO)
  - 50-60% (moderate CHO)

- ADA recommendation is a minimum amount of 175 g/day of carbohydrates (35-50% of energy).

Curr Diab rep 2016; 16.22.
Ann Nutr Metab 2020;76(suppl 3):17–29.

Carbohydrate distribution

- There is no evidence from studies highlighting a certain distribution that can be correlated with better results in controlling maternal blood glucose and the effects on the fetus.

- The quantity and distribution of CHO should be made according to the particularities of every pregnant woman:
  - ✓ BMI
  - ✓ Weight gain during pregnancy
  - ✓ Fasting and postprandial glucose values
  - ✓ Presence or absence of ketonemia

Carbohydrate distribution

- Distributing the total daily CHO into 3 small meals and 2–3 snacks per day.

- Most guides recommend the following distribution:
  - ✓ Breakfast : 10-15%
  - ✓ Lunch : 20-30%
  - ✓ Dinner: 30-40%
  - ✓ Snacks: 5-10%

- CHO is generally less well tolerated at breakfast than at other meals due to the morning peak of cortisol secretion (CHO reduced to 15-30 g)

- An evening snack may be needed to prevent accelerated ketosis overnight.

J Diabetes Res. 2021;2021:5266919

Carbohydrate quality

- The type and quality of carbohydrate is an important consideration

- Indicators of the quality of CHO:
  - Glycemic index / Glycemic Load
  - Content of fiber and indigestible plant-based CHO

Glycemic Index

- Current evidence suggests that an low-GI nutritional approach is reasonably safe in GDM
- Low-GI advice in GDM might therefore be considered, especially in women with uncontrolled 2-h post-prandial glucose / fasting plasma, before starting insulin treatment.
- This aspect could also be used in deciding a menu for breakfast, especially in women who have difficulties in controlling postprandial glucose during this time of the day.
- More than 9 guidelines on nutrition recommendation for GDM from professional organizations recommend a low-to-moderate GI diet

Nutrients **2019**, 11, 1549.

GLYCEMIC INDEX

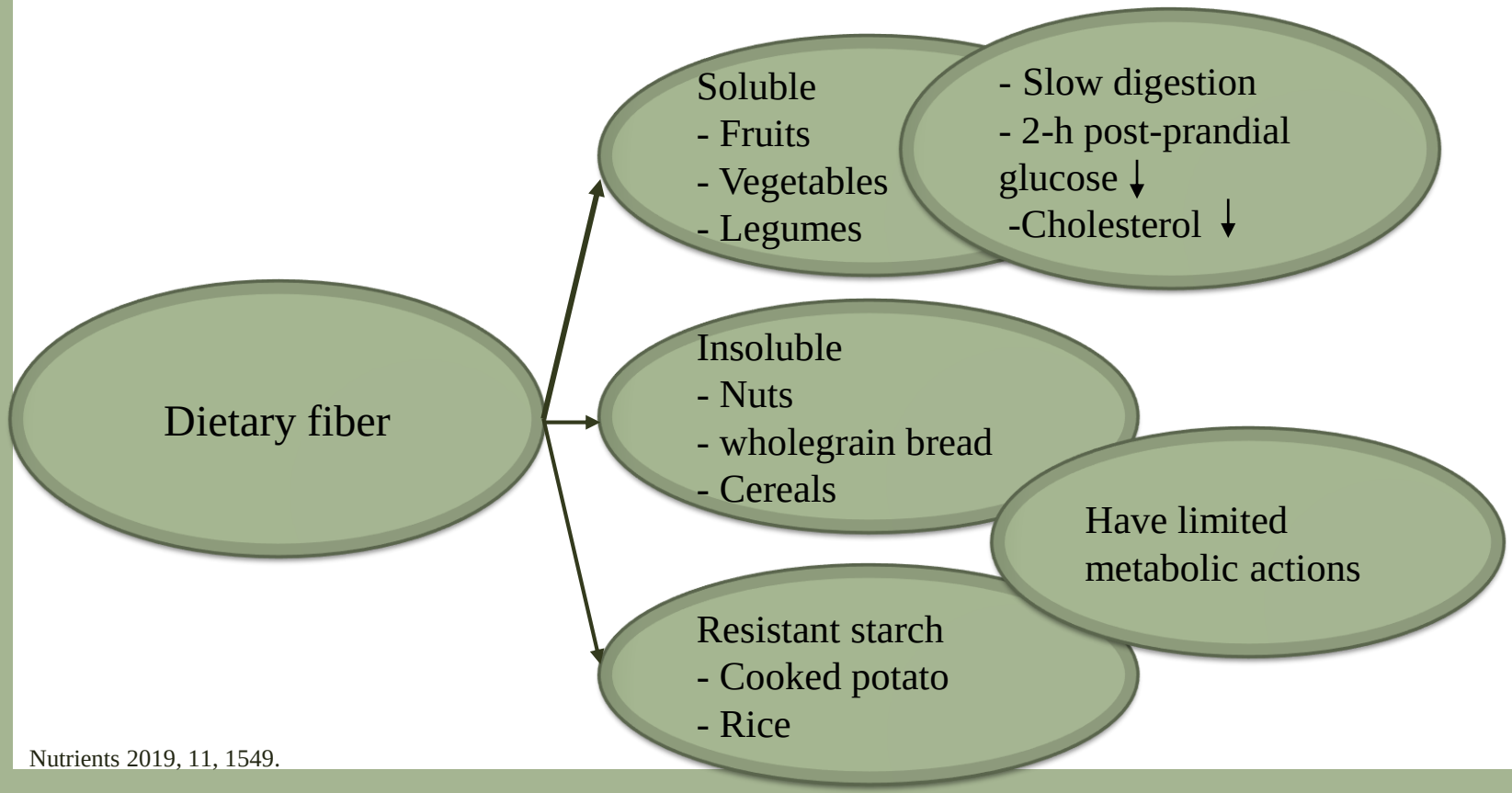
Low GI (<55), Medium GI (56-69) and High GI (70>)

Grains / Starchs		Vegetables		Fruits		Dairy		Proteins	
Rice Bran	27	Asparagus	15	Grapefruit	25	Low-Fat Yogurt	14	Beans, Dried	40
Bran Cereal	42	Broccoli	15	Apple	38	Plain Yogurt	14	Black-Eyed Beans	59
Spaghetti	42	Celery	15	Peach	42	Whole Milk	27	Kidney Beans	41
Corn, sweet	54	Cucumber	15	Orange	44	Soy Milk	30	Lentils	41
Wild Rice	57	Lettuce	15	Grape	46	Fat-Free Milk	32	Lima Beans	46
Sweet Potatoes	61	Peppers	15	Banana	54	Skim Milk	33	Peanuts	21
White Rice	64	Spinach	15	Mango	56	Chocolate Milk	35	Pinto Beans	55
Cous Cous	65	Tomatoes	15	Pineapple	66	Fruit Yogurt	36	Split Peas	45
Whole Wheat Bread	71	Chickpeas	33	Watermelon	72	Ice Cream	61		
Muesli	80	Cooked Carrots	39	Cherries	22	Soy milk	30		
Baked Potatoes	85	Peas	22	Plums	24	Low fat yogurt no sugar	15		
Oatmeal	87	Sweet Corn	55	Kiwifruit	52				
Taco Shells	97	Mashed potato	73	Pears	36	Fat free milk	32		
White Bread	100			Dates	100				
Bagel, White	103								
Cornflakes	84								
Banana bread	47								
All bran	42								
Oat bran bread	48								

Dietary fiber

- The recommended daily intake of fiber in women : 28 gr/d

- High-fiber foods in a mixed meal can serve the same purpose as low-GI diets



Nutrients 2019, 11, 1549.

Protein in GDM

- Protein is the macronutrient with the greatest influence on birth weight.
- Most nutrition guidelines recommend a protein intake between 10 and 20% of daily energy and between 60 and 80 g of protein intake
- ADA recommends a protein intake of a minimum 71 g/day in pregnant women with GDM for all stages of pregnancy.
- Protein should be increased from the first trimesters

Ann Nutr Metab 2020;76(suppl 3):17–29.

Fat in GDM

- Increased consumption of total and saturated fat :
  - Maternal excessive weight gain
  - Worsen insulin resistance
  - Increased fetal growth

- Total fat and saturated fat of diets of women with GDM need to be moderated.

- Most GDM guidelines of various professional organizations do not specify the amount of recommended fat intake

- The acceptable macronutrient distribution range of fat is 20-35% of total energy, the same as for non-pregnant women.

- The ACOG guideline being the outlier recommending: up to 40%

Fat in GDM

- The saturated FA and Trans FA should be reduced as much as possible (<7% of energy).
- Pregnant women are advised to choose meat with a fat content <10%, as well as low-fat dairy products.
- The remaining percentage is divided to:
  - ✓ Monounsaturated fatty acids (olive oil, nuts, peanut, nuts, and avocado)
  - ✓ Polyunsaturated fatty acids
    - ✓ omega-3 (fish, fish oil, and flax oil)
    - ✓ omega-6 (soya oil, sunflower, rape, and corn oil)

GDM guidelines

Organization, region, years	Energy restriction	Macronutrient distribution	CHO consideration	Protein
ACOG, USA, 2018		CHO: 33–40% PRO: 20% Fat: 40%	Complex CHO, LGI, high fiber, CHO distributed over 3 meals and 2–3 snacks	
ADA, USA, 2018			CHO: >175 g/d Fiber: 28 g/d	>71 g/d
IFIGO international, 2015	EI: 2,050 kcal/d irrespective of body weight	CHO: 35–45%	>175 g CHO/d, LGI, CHO distributed in 3 small-to medium-sized meals and 2–4 snacks. Evening snack needed to prevent overnight ketosis. Fibre:<28 g/d	Diabetic nephropathy: 0.6–0.8 g/kg ideal body weight

American College of Obstetricians and Gynaecologists
American College of Obstetricians and Gynaecologists
International Federation of Gynaecology and Obstetrics

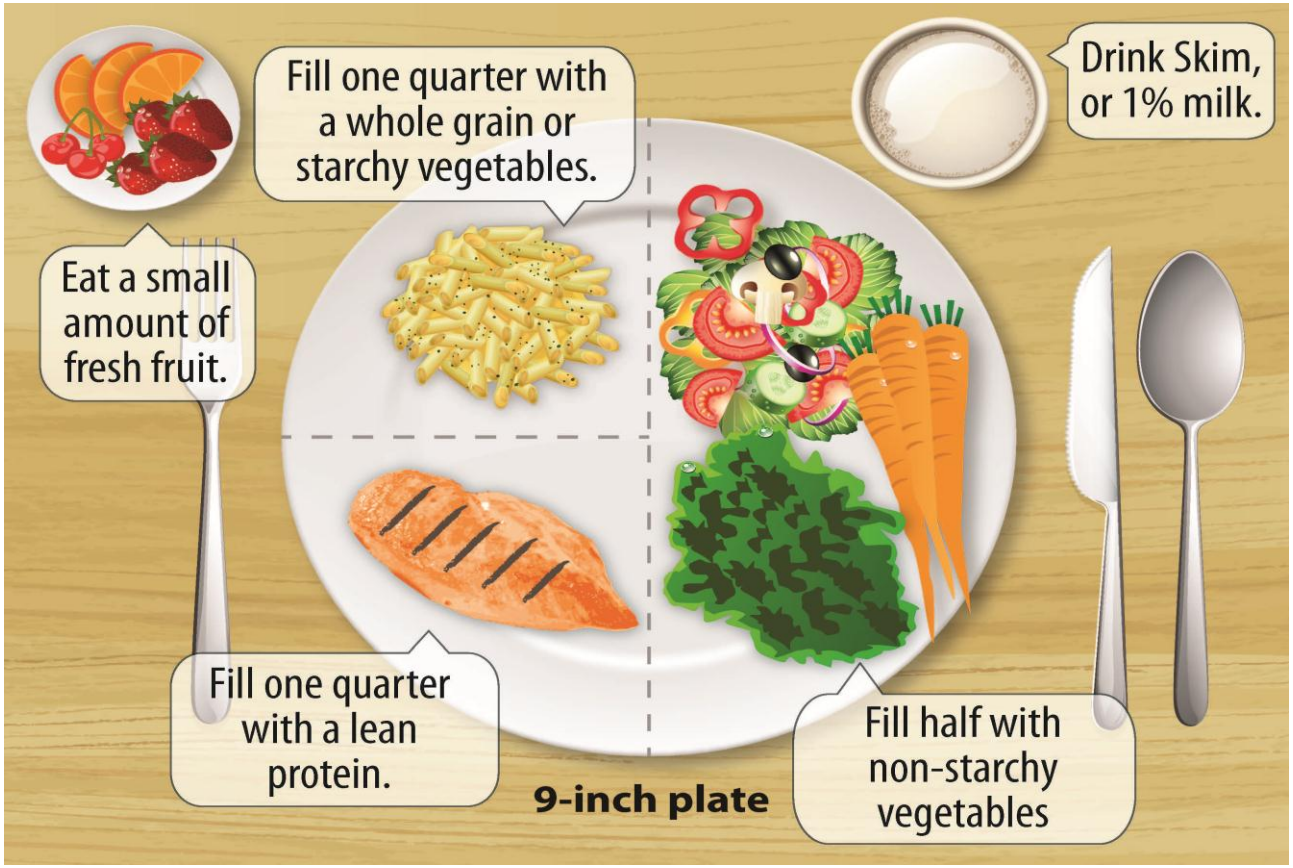
Ann Nutr Metab 2020;76(suppl 3):17–29

Non-Nutritive Sweeteners

- The use of non-nutritive sweeteners during pregnancy has not well studied.
- Few guidelines recommended aspartame, saccharin, acesulfame, and sucralose in moderate
- Cyclamates are not approved

Ann Nutr Metab 2020;76(suppl 3):17–29

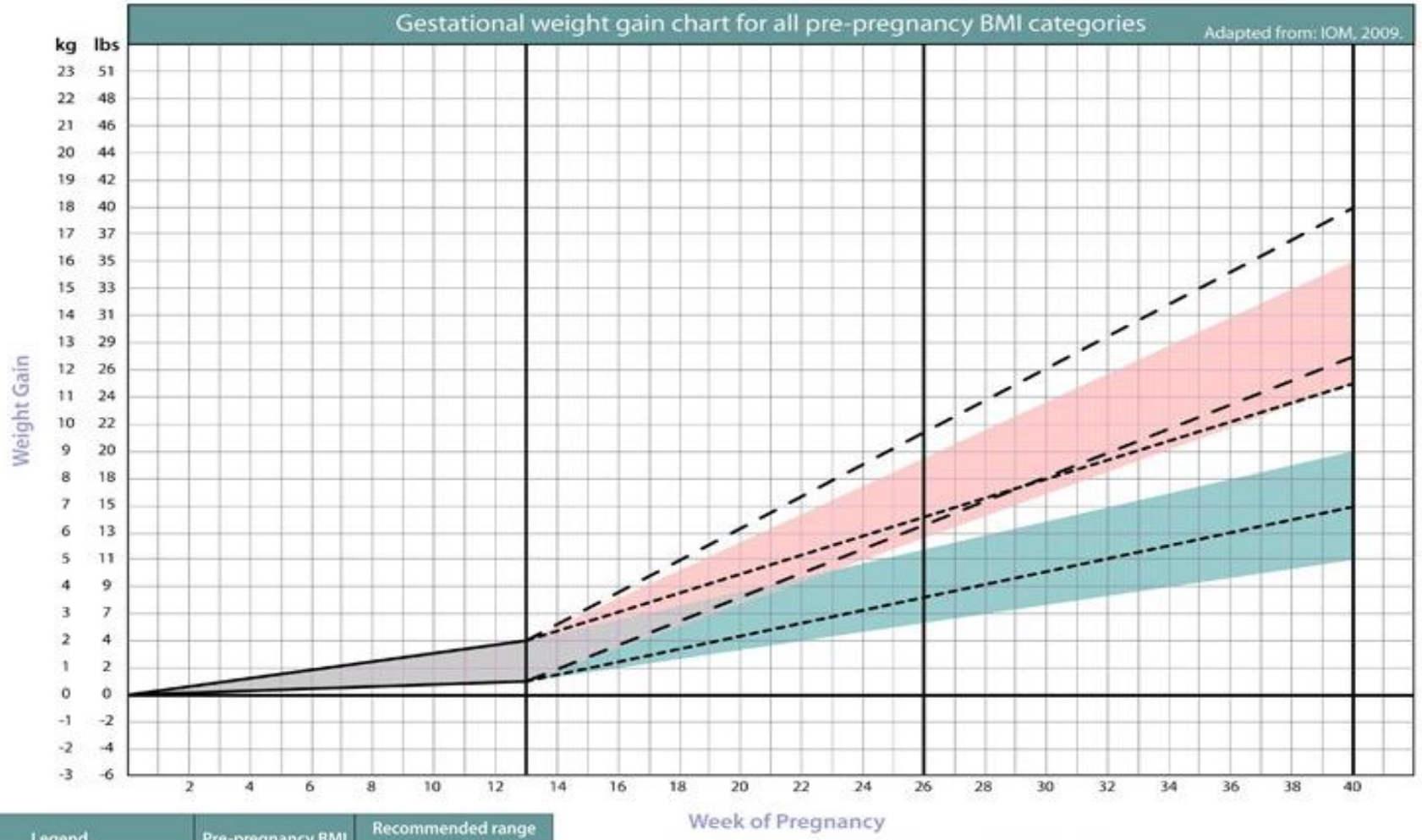
Healthy plate models



Food exchange list & carbohydrate counting

TOOL KIT: NUTRITION COMPOSITION USING THE EXCHANGE SYSTEM												
Exchange List Reference Values	Exchange Calculation Values	Starchy Foods	Fruits	Veg. Low Starch	Milk (cup)			Meat/Subs. (oz)			Fats/Oils	Sweets & Alt. Carbs (Sugar 3 tsp = 1 exchange)
					Low Fat (1% or below)	Reduced Fat (2%)	Whole	Lean Meat	Medium Fat Meat	High Fat Meat		
	Energy (kcal)	80	60	25	100	120	160	45	75	100	45	60
	Carbohydrate (g)	15	15	5	12	12	12	0	0	0	0	5
	Protein (g)	3	0	2	8	8	8	7	7	7	0	0
	Fat (g)	1	0	0	2	5	8	2	5	8	5	0

Weight gain assessment



Legend	Pre-pregnancy BMI	Recommended range of total weight gain
— — — — — —	< 18.5	12.5 – 18 kg (28 – 40 lbs)
	18.5 – 24.9	11.5 – 16 kg (25 – 35 lbs)
- - - - - - - - - - - -	25.0 – 29.9	7 – 11.5 kg (15 – 25 lbs)
	≥ 30	5 – 9 kg (11 – 20 lbs)

Self-monitoring of blood glucose (SMBG)

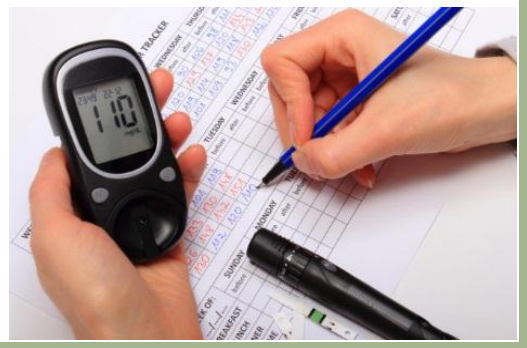
- SMBG is an important part of standard diabetes care.
- Frequent SMBG helps patients understand better the influence that food and exercise have on their blood glucose values, thus increasing their adherence to the treatment plan.
- The number of tests required to adequately monitor blood glucose levels depends on several factors: diet, physical activity, type of treatment(diet/insulin), and the risk of hypoglycemia

Self-monitoring of blood glucose (SMBG)

- The ADA and ACOG recommend:

  women with GDM monitor their blood glucose levels four times daily-fasting and after meals

- The frequency of monitoring may be reduced from daily to every third or fourth day once control of blood glucose is established.



Glycemic Target in pregnancy

Test	Goal
Fasting	< 95 mg/dl
1 hour	< 140 mg/dl
2 hour	< 120 mg/dl

Diabetes Care 2020;43(Suppl. 1):S183–S192

Glycemic Target in pregnancy

- The target of A1C in pregnant women with preexisting diabetes : 6-6.5%.
- There is currently no recommendation to monitor the A1C in women with GDM.
- A1C may not fully capture postprandial hyperglycemia, which drives macrosomia.
- A1C may be useful, it should be used as a secondary measure of glycemic control in pregnancy, after self-monitoring of blood glucose.

Diabetes Care 2020;43(Suppl. 1):S183–S192.

Physical Activities in Pregnancy

- Moderate exercise may be an important adjunctive therapy in the management of diabetes in pregnancy, particularly in GDM.

Physical activity Benefits in GDM

- ✓ Decreased physical discomforts associated with pregnancy
- ✓ Improved sleep
- ✓ Decreased stress and anxiety
- ✓ Increased insulin sensitivity
- ✓ Improved glycemic control
- ✓ May help to avoid excessive weight gain

Physical Activities in Pregnancy

- Aerobic exercises and mild or moderate resistance exercises, being beneficial through increasing the insulin sensitivity
- A duration of 30 minutes of physical activity/day is recommended
- This duration can be fractioned in 10-minute rounds.
- Advise to pregnant women :
  - ✓ To hydrate during exercise
  - ✓ Avoid physical effort under conditions (high temperature or humidity, when they are hunger or do not feel well).

Physical Activities in Pregnancy

Safe activities	Unsafe activities
• Swimming • Water aerobics • Walking • Jogging • Low-impact aerobics • Prenatal yoga • Stationary bike	• Horseback riding • Contact sports (e.g., soccer, basketball, volleyball) • Downhill skiing • Gymnastics • Bike riding • Scuba diving • Sauna, hot tubes, steam room • Any activity that involves lying on the back

http:// www.marchofdimes.org/pregnancy/exercise-during-pregnancy.aspx

Pharmacologic treatment

- Pharmacological therapy is prescribed when:
  - MNT, Physical activity, and lifestyle intervention in a woman with GDM cannot achieve or maintain target blood glucose
  - The rate of fetal growth is higher than normal
- There is no conclusive evidence to recommend an optimal time to begin pharmacotherapy.
- Studies have suggested 1-2 weeks after the initiation of MNT and the glycemic levels remain elevated.

Pharmacologic treatment

- Women with GDM who attained a fasting glucose <95 mg/dl within 2 weeks of diet prescription were less likely to require insulin or oral medication.

- If 30% of the targeted plasma glucose levels are exceeded (FPG>95 mg/dl, 1-h PG over 140 mg/dl, 2-h PG over 120 mg/dl) it is a first criteria for introducing pharmacotherapy.

Diabetes Care 2018;41:1343–1345.

Pharmacologic options

- Insulin is the first-line of medical treatment
- Oral antihyperglycemic agents (metformin or glyburide) : an alternative when nutritional therapy fails, and women decline or are unable to safely manage insulin therapy.
- Metformin should be avoided in hypertension, preeclampsia, or in case of risk for lower intrauterine growth (ADA).
- In the United States, oral antihyperglycemic agents have not been recommended or approved for the treatment of GDM (FDA).

Management Postpartum

- The last vital step that must not be missed is screening the mother at 6-8 weeks postpartum for type 2 diabetes.

- 2-hour OGTT every three years

Prevention of GDM

- There are no widely accepted preventive strategies for GDM
- Weight management before pregnancy and controlled gestational weight gain are the most important parameters
- A Cochrane report states that a combined diet and exercise programme can be useful in preventing GDM in high-risk women.
- Based on a meta-analysis: mild-moderate exercise started in the first trimester can reduce the risk of GDM.

Current Diabetes Reports 2019; 19:73.
Ann Nutr Metab 2020;76(suppl 3):17–29.
Diabetol Metab Syndr. 2022;14(1):83.

Nutritional Supplementation for the Prevention /Treatment of GDM

There is limited evidence that nutritional supplementation of :

- Myoinositol
- Probiotics
- Vitamins D
- Magnesium
- Selenium
- Zinc
- Fatty acids

could improve glycemic control or prevent GDM ???

Current Diabetes Reports 2019; 19:73
Nutrition Reviews 2017;75: 32–50
J Diabetes Metab Disord. 2022 Jan 13;21(1):951-970

Vitamin D & GDM prevention

- Based on the findings of five trials : vitamin D supplementation may reduce the risk of developing GDM by 50% (95%CIs= 12-72%; low-certainty evidence).

- Currently, WHO has no general recommendation for vitamin D supplementation in all pregnant women, but in women with low serum vitamin D, a daily intake of 200 IU (5 μg) has been suggested.

- Since the prevalence of vitamin D insufficiency is high in pregnant women in Iran, assessing the vitamin D status in early prenatal visits and supplementation with vitamin D should be considered a cost-effective strategy.

J Diabetes Metab Disord. 2022 Jan 13;21(1):951-970

مطالعه موردی

خانمی ۳۵ ساله در هفته ۲۴ بارداری با تشخیص GDM

- ✓ وزن کنونی: ۷۸ کیلوگرم
- ✓ وزن پیش از بارداری: ۶۸ کیلوگرم
- ✓ قد: ۱۶۰ سانتیمتر

✓ Lab data: FBS:108 mg/dl 2hpp:135 mg/dl

Past medical history: آنمی

Drug history: مکمل مولتی ویتامین، مکمل کلسیم، مکمل آهن

Social history: لیسانس مهندسی کامپیوتر می باشد و در حال حاضر در یک شرکت از ساعت ۹ صبح تا ۵ بعد از ظهر مشغول به کار می باشد. این بارداری اولین بارداری وی می باشد.

Habit history: هیچ گونه مصرف سیگار، مخدر و الکل ندارد.

Family history: پدر وی از سن ۴۳ سالگی مبتلا به دیابت و مادر وی از سن ۵۵ سالگی مبتلا به پرفشاری خون شده است.

مطالعه موردی

یک روز یاد آمد غذایی وی به شرح زیر می باشد:

صبحانه (حدود ساعت ۷/۳۰ صبح): یک عدد تخم مرغ نیمرو، یک عدد نان لواش، چای شیرین (حدود ۴ تا ۵ قاشق مرباخوری شکر)، یک قاشق غذاخوری خامه و ۲ قاشق مرباخوری عسل

میان وعده: یک لیوان شیرکاکائو، یک برش کیک، یک عدد نان لواش به همراه یک قوطی کبریت پنیر، ۲ تا ۳ عدد کاکائو به همراه چای

ناهار (حدود ساعت ۳/۳۰ بعد از ظهر): یک پرس کامل کباب کوبیده به همراه کره ، یک پیاله ماست موسیر به همراه یک قوطی ماء الشعیر طعم دار

میان وعده: حدود ۲ تا ۳ برش هندوانه، یک لیوان شیرکاکائو، یک برش کیک، ۲ تا ۳ عدد کاکائو به همراه چای

شام (حدود ساعت ۳۰/۹ شب): یک عدد ساندویچ همبرگر (به همراه گوجه و خیار)، یک قوطی ماء الشعیر طعم دار

میان وعده: یک کاسه ماست خوری تخمه، ۲ لیوان شیر تا هنگام خواب، ۶ عدد خرما

مطالعه موردی

ارزیابی وضعیت نمایه توده بدنی

- نمایه توده بدنی پیش از بارداری بیمار ۲۶/۶ بوده است که در محدوده اضافه وزن می باشد.
- افزایش وزن توصیه شده برای زنان باردار بر پایه نمایه توده بدنی پیش از بارداری ۱۱/۵- ۷ کیلوگرم می باشد.
- در حال حاضر در هفته ۲۴ بارداری با وزن ۷۸ کیلوگرم، ۱۰ کیلوگرم وزن اضافه نموده است که بیشتر از حد انتظار است (افزایش مورد انتظار وزن بر اساس هفته بارداری: ۶/۷ کیلوگرم)

مطالعه موردی

محاسبه وزن مناسب برای تعیین انرژی مورد نیاز:

Ideal Body Weight (IBW) = 22.5 × 1.6 ×1.6 = 57.6 kg

Adjusted Ideal Body Weight (AIBW) = (Actual Body Weight - IBW) × 0.25 + IBW

AIBW = (68 – 57.6) × 0.25 + 57.6 = 60.2kg ≈ **60kg**

مطالعه موردی

محاسبه انرژی مورد نیاز با استفاده از AIBW با معادله هریس بندیکت:

Basal Energy Expenditure (BEE) = 0.95 × AIBW × 24

BEE = 0.95× 60× 24 = **1368 Kcal**

Physical Activity Energy (PAE) = BEE × PA Level

PAE = 1368 × 30% = **410 Kcal**

Thermogenic Effect of Food (TEF) = 10 % × (BEE + PAE)

TEF = 10% × 1778 = **178 Kcal**

Total Energy Expenditure (TEE) = BEE + PAE + TEF

TEF = 1368 + 410+178 = **1956**

مطالعه موردی

انرژی مورد نیاز بیمار در سه ماهه دوم بارداری:

1956 + 340 = **2296kcal**

محاسبه گرم کربوهیدرات ، پروتئین و چربی (درشت مغذی ها):

Pro =17% 1956 × 17% = 332 ÷ 4 = **83g**

83 + 25 = **108g** (108 × 4) ÷ 2300 = **19%**

FAT=30% 2300 × 30% = 690 ÷ 9 = **77g**

CHO = 51% 2300× 51% = 1173 ÷ 4 = **293g**

محاسبه انرژی مورد نیاز با استفاده وزن فعلی

BMI prior to pregnancy (kg/m2)	Energy requirement (kcal/kg/d)
Underweight (<18.5)	35-40
Normal (18.5-24.9)	30-34
Overweight (25-29)	25-29
Obese (30-39.9)	Maximum 24

1950-2263 kcal/d

جدول تلفیق واحدهای مصرفی توصیه شده گروه های غذایی هرم با سیاهه جانشینی

گروه غذایی	واحد	کربوهیدرات (گرم)	پروتئین (گرم)	چربی (گرم)
لبنیات کم چرب (۱/۵٪)	۳	۳×۱۲=۳۶	۳×۸=۲۴	۳×۵=۱۵
سبزی ها	۴	۴×۵=۲۰	۴×۲=۸	-
میوه ها	۵	۵×۱۵=۷۵	-	-
قندهای ساده	۳	۳×۵=۱۵	-	-
		۲۹۳-۱۴۶=۱۴۷		
غلات	۱۰	۱۰ = ۱۵ ÷ ۱۳۷	۱۰×۳=۳۰	-
			۱۰۸-۶۲=۴۶	
گوشت و جانشین هایش	۷	-	۷ ~ ۷ ÷ ۴۶	۷ × ۳=۲۱
				۷۷-۳۶=۴۱
چربی	۸	-	-	۸ = ۵ ÷ ۴۱

توزیع کربوهیدرات در وعده های غذایی

سپس واحدهای به دست آمده را در جدول توزیع عادلانه واحدها تقسیم می نماییم. قبل از این مرحله، میزان گرم کربوهیدرات رژیم غذایی را طبق جدول زیر تقسیم می نماییم.

گروه های غذایی	صبحانه	میان وعده	ناها ر	میان وعده	شام	قبل از خواب
کربوهیدرات(٪)	۱۵	۱۲/۵	۲۲/۵	۱۲/۵	۲۲/۵	۱۵
کربوهیدرات (g)	۴۴	۳۷	۶۶	۳۷	۶۶	۴۴
شمارش کربوهیدرات	۳	۲/۵	۴	۲/۵	۴	۳

توزیع گروه های غذایی در وعده های غذایی

گروه های غذایی	صبحانه	میان وعده	ناها ر	میان وعده	شام	قبل از خواب
لبنیات کم چرب (۱/۵٪)	–	–	۱	–	۱	۱
سبزی ها	–	۱	۱	۱	۱	–
میوه ها	–	۲	–	۲	–	۱
قندهای ساده	۱	۱	–	۱	–	–
غلات	۳	–	۳	–	۳	۱
گوشت و جانشین هایش	۱	–	۳	–	۳	–
چربی	۲	–	۳	–	۲	–
شمارش کربوهیدرات	۳/۵	۲/۵	۴	۲/۵	۴	۳

نمونه رژیم غذایی

صبحانه (۸:۳۰): ۳ کف دست نان سنگک+۱ قوطی کبریت پنیر + چای +۱ ق. م. عسل یا مربا+ ۴ عدد مغز گردو +

میان وعده (۱۰:۳۰): یک عدد گلابی متوسط + ۴ عدد زردآلو + یک عدد هویج+ چای +۱ ق. م. عسل

ناهار (۱۳): ۱۵ قاشق غذاخوری سر صاف برنج + ۴-۳ عدد کباب تابه ایی(۹۰ گرم)+ ۳ ق. غ روغن مایع کانولا برای پخت غذا+ یک لیوان ماست کم چرب (۱/۵٪)+ نصف لیوان اسفناج پخته

عصرانه (۱۶:۳۰): ۲ عدد سیب گلاب + یک عدد هلو + ۱ عدد خیار+ چای+ یک حبه قند

شام (۲۰:۳۰): ۲ کف دست نان سنگگ + ۱ عدد سیب زمینی پخته+ یک ران کامل مرغ+ یک لیوان سبزیجات پخته+۲ ق .غ روغن مایع + یک لیوان ماست کم چرب (۱/۵٪)

قبل از خواب (۲۲): یک عدد شلیل+ یک لیوان شیر کم چرب (۱/۵٪) + ۲ عدد بیسکویت ساده