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Diabetes education, nutrition and exercise

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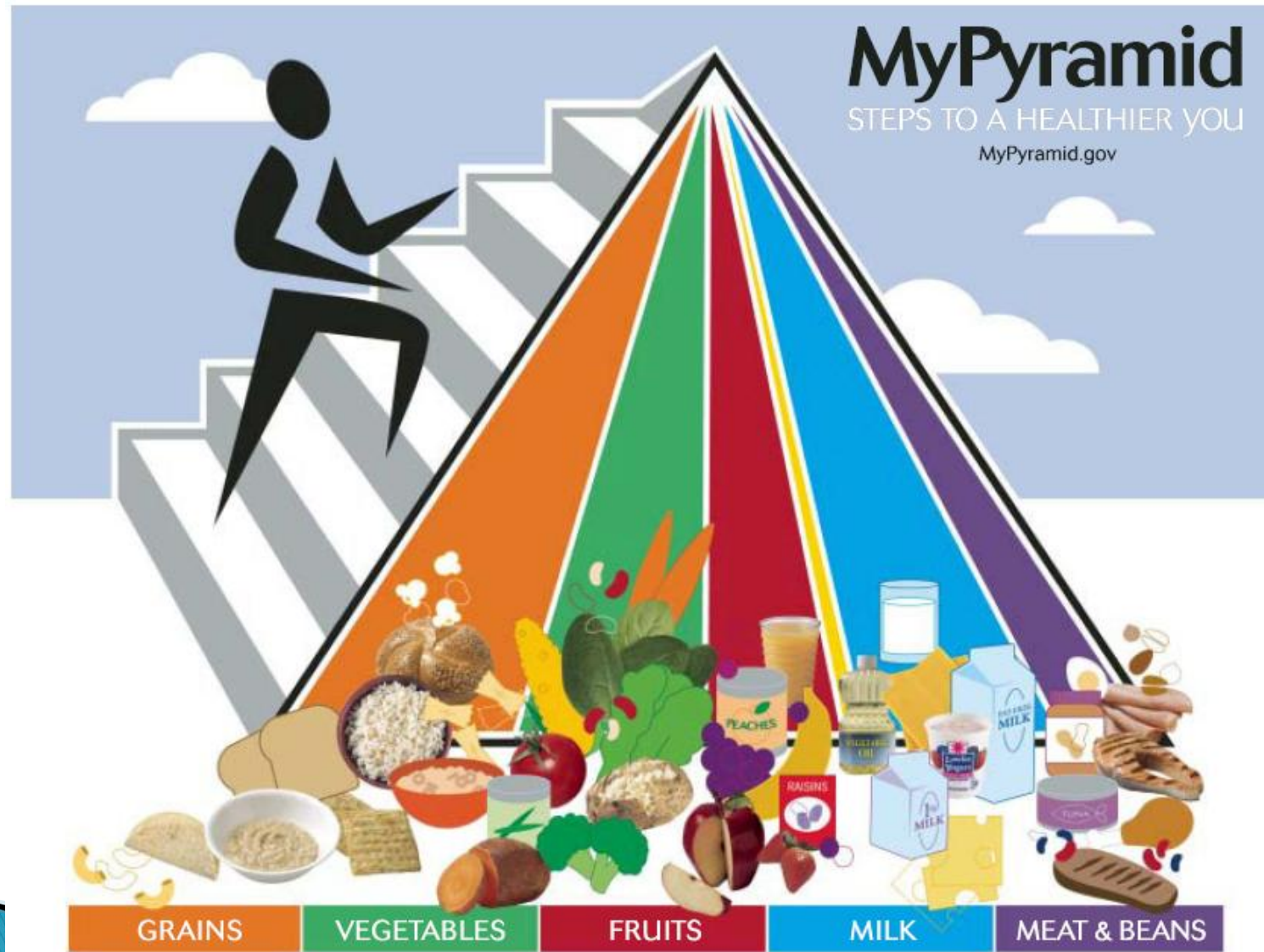Dept. of Internal Medicine and Nephrodiabetology,
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- Nutrition recommendations for a healthy lifestyle for the general public are also appropriate for persons with type 1 diabetes /with integration of an appropriate insulin regimen/

- and for persons with type 2 diabetes /strongly emphasize lifestyle changes/

▸ Diet and nutrition are important factors in the promotion and maintenance of good health throughout the **entire life course**.

▸ Promoting healthy diets and lifestyles may reduce the global burden of noncommunicable diseases (NCDs)

Ranges of population nutrient intake goals

| Dietary factor	Goal (% of total energy, unless otherwise stated)
Total fat	15–30%
Saturated fatty acids	<10%
Polyunsaturated fatty acids (PUFAs)	6–10%
n-6 Polyunsaturated fatty acids (PUFAs)	5–8%
n-3 Polyunsaturated fatty acids (PUFAs)	1–2%
Trans fatty acids	<1%
Monounsaturated fatty acids (MUFAs)	By difference[a]
Total carbohydrate	55–75%[b]
Free sugars[c]	<10%
Protein	10–15%[d]
Cholesterol	<300 mg per day
Sodium chloride (sodium)[e]	<5 g per day (<2 g per day)
Fruits and vegetables	⩾400 g per day
Total dietary fibre	From foods[f]
Non-starch polysaccharides (NSP)	From foods[f]

GRAINS	VEGETABLES	FRUITS	MILK	MEAT & BEANS
Make half your grains whole	Vary your veggies	Focus on fruits	Get your calcium-rich foods	Go lean with protein
Eat at least 3 oz. of whole-grain cereals, breads, crackers, rice, or pasta every day 1 oz. is about 1 slice of bread, about 1 cup of breakfast cereal, or $\frac{1}{2}$ cup of cooked rice, cereal, or pasta	Eat more dark-green veggies like broccoli, spinach, and other dark leafy greens Eat more orange vegetables like carrots and sweetpotatoes Eat more dry beans and peas like pinto beans, kidney beans, and lentils	Eat a variety of fruit Choose fresh, frozen, canned, or dried fruit Go easy on fruit juices	Go low-fat or fat-free when you choose milk, yogurt, and other milk products If you don't or can't consume milk, choose lactose-free products or other calcium sources such as fortified foods and beverages	Choose low-fat or lean meats and poultry Bake it, broil it, or grill it Vary your protein routine — choose more fish, beans, peas, nuts, and seeds

For a 2,000-calorie diet, you need the amounts below from each food group. To find the amounts that are right for you, go to MyPyramid.gov.

Eat 6 oz. every day	Eat 2$\frac{1}{2}$ cups every day	Eat 2 cups every day	Get 3 cups every day; for kids aged 2 to 8, it's 2	Eat 5$\frac{1}{2}$ oz. every day

Find your balance between food and physical activity

- Be sure to stay within your daily calorie needs.
- Be physically active for at least 30 minutes most days of the week.
- About 60 minutes a day of physical activity may be needed to prevent weight gain.
- For sustaining weight loss, at least 60 to 90 minutes a day of physical activity may be required.
- Children and teenagers should be physically active for 60 minutes every day, or most days.
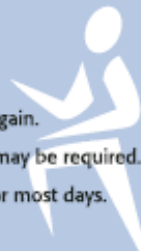
Know the limits on fats, sugars, and salt (sodium)

- Make most of your fat sources from fish, nuts, and vegetable oils.
- Limit solid fats like butter, margarine, shortening, and lard, as well as foods that contain these.
- Check the Nutrition Facts label to keep saturated fats, *trans* fats, and sodium low.
- Choose food and beverages low in added sugars. Added sugars contribute calories with few, if any, nutrients.

Fat

- Total fat energy of at least 20% is consistent with good health.

- Highly active groups with diets rich in vegetables, legumes, fruits and wholegrain cereals may, however, sustain a total fat intake of up to 35% **without** the risk of unhealthy weight gain.

Free sugars

- Free sugars contribute to the overall energy density of diets.

- Free sugars promote a positive energy balance.

- Diets that are limited in free sugars have been shown to reduce total energy intake and induce weight loss.

- Drinks rich in free sugars increase overall energy intake by reducing appetite control.
- **less** of a compensatory reduction of food intake after the consumption of high-sugars drinks than when additional foods of equivalent energy content are provided
- when soft drinks rich in free sugars are consumed - a higher energy intake and a progressive increase in body weight when compared with energy-free drinks

▸ Children with a high consumption of soft drinks rich in free sugars **are more likely** to be overweight and to gain excess weight

Non-starch polysaccharides (NSP)

- Wholegrain cereals, fruits and vegetables are the preferred sources of non-starch polysaccharides (NSP).

- The benefit of fruits and vegetables cannot be ascribed to a single or mix of nutrients and bioactive substances. This is a food category

- The category of tubers (i.e.potatoes, cassava) should not be included in fruits and vegetables.

- For better health /all ages/ - a min. of 30 mins of physical activity of moderate intensity (such as brisk walking) on most, if not all, days of the week.
- Greater health benefits by engaging in physical activity of more vigorous intensity or of longer duration.
- Cardio-respiratory endurance activity should be supplemented with strength-developing exercises at least **twice a week** for adults /to improve musculo-skeletal health/

Summary of strength of evidence on factors that might promote or protect against weight gain and obesity[a]

Evidence	Decreased risk	No relationship	Increased risk
Convincing	Regular physical activity High dietary intake of NSP (dietary fibre)[b]		Sedentary lifestyles High intake of energy-dense micronutrient-poor foods[c]
Probable	Home and school environments that support healthy food choices for children[d] Breastfeeding		Heavy marketing of energy-dense foods[d] and fast-food outlets[d] High intake of sugars-sweetened soft drinks and fruit juices Adverse socioeconomic conditions[d] (in developed countries, especially for women)
Possible	Low glycaemic index foods	Protein content of the diet	Large portion sizes High proportion of food prepared outside the home (developed countries) "Rigid restraint/periodic disinhibition" eating patterns
Insufficient	Increased eating frequency		Alcohol

- A high dietary intake of non-starch polysaccharides (NSP)/dietary fibre **(protective).**
- High intake of NSP (dietary fibre) promotes weight loss
- No differences between fibre type or between fibre consumed in food or as supplements, however different level of long-term satiety.

▸ High intake of energy-dense micronutrient-poor foods (**causative**).

▸ Energy-dense foods tend to be high in fat (e.g. butter, oils, fried foods), sugars or starch, while energy-dilute foods have a high water content (e.g. fruits and vegetables)

- A variety of popular weight-loss diets that restrict food choices may result in reduced energy intake and short term weight loss in individuals but most do not have trial evidence of long-term effectiveness and nutritional adequacy and therefore **cannot** be recommended for populations *(WHO).*

- energy from fat **is no more fattening**

Goals of medical nutrition therapy in DM

- Attain and maintain optimal metabolic outcomes:
  - Blood glucose levels in the normal range or close to normal – prevent or reduce the risk for complications of diabetes.

  - A lipid and lipoprotein profile that reduces the risk for macrovascular disease.

  - Blood pressure levels that reduce the risk for vascular disease.

Goals of medical nutrition therapy in DM

◦ Prevent and treat the chronic complications of diabetes. Prevention and treatment of obesity, dyslipidemia, cardiovascular disease, HA, and nephropathy.

◦ Improve health through healthy food choices and physical activity.

◦ Address individual nutritional needs taking into consideration personal and cultural preferences and lifestyle while respecting the individual's wishes and willingness to change.

Goals of medical nutrition therapy – specific situations

▸ For youth with T1DM, to provide adequate energy to ensure normal growth and development, integrate insulin regimens into usual eating and physical activity habits.

▸ For youth with T2DM, to facilitate changes in eating and physical activity habits that **reduce insulin resistance and improve metabolic status.**

Goals of medical nutrition therapy – specific situations

- For pregnant and lactating women, to provide adequate energy and nutrients needed for optimal outcomes.

- For older adults, to provide for the nutritional and psychosocial needs of an aging individual.

Goals of medical nutrition therapy – specific situations

- For individuals treated with insulin or insulin secretagogues, to provide self-management education for **treatment (and prevention) of hypoglycemia**, acute illnesses, and exercise-related blood glucose problems.

- For individuals at risk for diabetes, **to decrease risk** by encouraging physical activity and promoting food choices that facilitate moderate weight loss or at least prevent weight gain

- In DM physical activity leads to a number of beneficial physiological changes that:
- favorably affect muscle
- liver insulin sensitivity
- muscle glucose uptake and utilization
- overall glycemic control

Guiding statement	'MNT=medical nutrition therapy.
Prediabetes American Diabetes Association, 2007 (47)	Reduced calorie, low-fat diet plus regular physical activity can lead to improvements in glucose tolerance, blood pressure, and lipid profile Modest weight loss (5-7% of starting weight) and prevention of weight gain is an important therapeutic objective Physical activity plays an important role in weight maintenance and prevention of weight-regain

Medications

Insufficient evidence to support use of drug therapy

Monitoring

Follow-up monitoring every 1 to 2 years
Ongoing monitoring of weight status

Medical nutrition therapy

Type 2 diabetes
Sigal and colleagues, 2004 (2)
Albright and colleagues, 2000 (22)
American Diabetes Association, 2007 (47)

weight-regain
Meal planning, physical activity, plus glucose-lowering medication(s) lead to optimal glucose-lowering as well as improvements in blood pressure and lipid profile

Modest weight loss (5-7% of starting weight) and prevention of weight gain is an important therapeutic objective

Physical activity plays an important role in weight maintenance and prevention of weight-regain

Extra food for increased activity should be used judiciously if weight loss is a goal and is generally unnecessary for individuals on medications that do not increase hypoglycemia risk

For individuals on insulin or insulin secretagogues: additional carbohydrate should be consumed if the BG is <100 mg/dL (5.6 mmol/L); 15 g rapidly absorbable carbohydrate should be available for treatment and prevention of hypoglycemia (BG <70 mg/dL) (3.9 mmol/L) during prolonged activity

Medications

Metformin, thiazolidinediones or α-glucosidase inhibitors alone do not increase hypoglycemia risk

Insulin secretagogues and insulin are associated with higher risk of exercise-related hypoglycemia

Dosages of insulin or secretagogues can be reduced preexercise to reduce likelihood of recurrent hypoglycemia in those at risk

Monitoring

BG[b] monitoring before and after exercise supports understanding of glycemic response to activity

Pre- and postexercise monitoring is advised for individuals on insulin or secretagogues

Type 1 diabetes
Wasserman and
    colleagues, 1994
    (25)
Franz, 2002 (45)
American Diabetes
    Association, 2007
    (47)

Monitoring

Frequent SMBG[c] before, during, and after exercise helps determine glycemic responses to exercise, appropriate self-management decisions, and the effectiveness of these decisions

SMBG should be performed every 1 to 2 hours postexercise to assess the BG response to activity and support decisions about adjustments in food intake and insulin dosages

Frequent postexercise monitoring, including during the night (eg, at 3:00 AM), is an advisable precautionary measure for preventing delayed-onset hypoglycemia

Medical nutrition therapy

Carbohydrate supplementation is often necessary for maintaining target-range glucose levels with exercise, especially if activity is spontaneous or unplanned, long duration, or high intensity

Intake of additional carbohydrate is indicated when the preexercise BG is <100 mg/dL (5.6 mmol/L); 15 g rapidly absorbable carbohydrate should be available for treatment of hypoglycemia [BG <70 mg/dL (3.9 mmol/L)]

As a starting guideline: 15-30 g carbohydrate consumed every 30-60 min of exercise; depending on exercise intensity* reduces hypoglycemia risk and supplies fuel for exercise; 1.5 g carbohydrate/kg body weight consumed 30 minutes after intense/competitive exercise and again 1-2 h later may prevent postexercise hypoglycemia and replenish glycogen stores

Medications

Insulin sensitivity and responsiveness are altered by exercise, therefore, skill in adjusting insulin dosages can increase exercise safety and performance

Intensive insulin therapy allows optimal flexibility and accuracy of insulin dose adjustments

Familiarity with the time course of insulin action and delivery methods is necessary before offering advice about insulin adjustments

A 30% to 50% reduction in the dosage of insulin acting during the time of exercise is generally accepted as a safe starting guideline

Greater (up to 80%) reductions may be needed for prolonged or extreme exercise

Reductions in insulin dosages may be necessary for an extended time (up to 36 hours) after intense or prolonged exercise

Supplemental insulin may be indicated to correct preexercise hyperglycemia [BG>240 mg/dL (13.5 mmol/L)] prior to initiation of exercise.

Supplemental insulin to correct transient BG elevations following intense, short- duration exercise is not generally indicated

Classification of overweight in adults according to BMI[a]

Classification	BMI (kg/m^2)	Risk of comorbidities
Underweight	<18.5	Low (but risk of other clinical problems increased)
Normal range	18.5–24.9	Average
Overweight	⩾25.0	
Pre-obese	25.0–29.9	Increased
Obese class I	30.0–34.9	Moderate
Obese class II	35.0–39.9	Severe
Obese class III	⩾40.0	Very severe

Prevention:

- promote an active lifestyle;
- limit television viewing;
- promote the intake of fruits and vegetables;
- restrict the intake of energy-dense, micronutrient-poor foods (e.g. packaged snacks);
- restrict the intake of sugars-sweetened soft drinks.

GI

- A numerical index given to a carbohydrate-rich food that is based on the average increase in blood glucose levels occurring after the food is eaten.

- The glycemic index of a food is defined as the area under the two hour blood glucose response curve (AUC) following the ingestion of a fixed portion of carbohydrate (usually 50 g). The AUC of the test food is divided by the AUC of the standard (either glucose or white bread, giving two different definitions) and multiplied by 100.
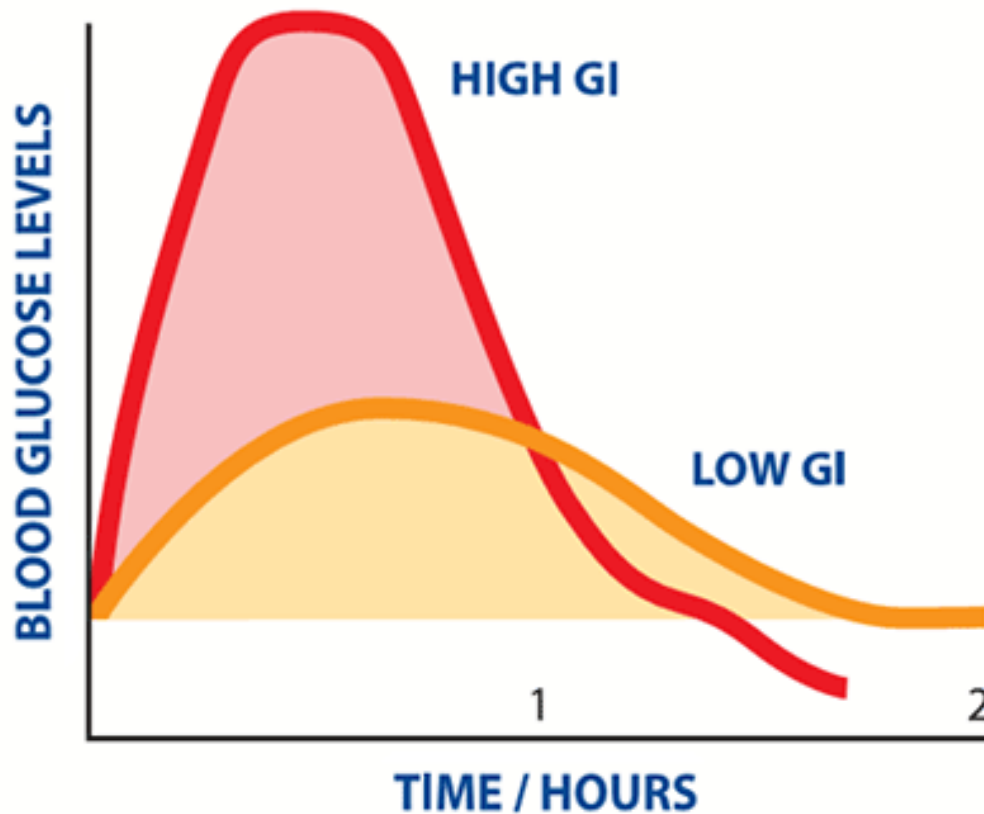
The amount of carbohydrate in the reference and test food must be the same.

Classification	GI range	Examples
Low GI	55 or less	most fruits and vegetables (except potatoes and watermelon), grainy breads, pasta, legumes/pulses, milk, yogurt, products extremely low in carbohydrates (some cheeses, nuts), fructose
Medium GI	56–69	whole wheat products, basmati rice, sweet potato, table sugar
High GI	70 and above	corn flakes, rice krispies, baked potatoes, watermelon, croissants, white bread, extruded breakfast cereals, most white rices (e.g. jasmine), straight glucose (100)

Limitations and criticisms

- The GI does not take into account other factors besides glycemic response, such as insulin response

- The GI is significantly altered by the type of food, its ripeness, processing, the length of storage, cooking methods, and its variety (white potatoes are a notable example, ranging from moderate to very high GI even within the same variety)

- The glycemic response is different from one person to another, and even in the same person from day to day

- The number of grams of carbohydrate impacts blood sugar levels more than the GI. A **food with a low GI may have a high carbohydrate content** or vice versa;

- Most of the values on the **GI do not show** the impact on glucose levels **after two hours.** Some diabetics may still have elevated levels after four hours.

- The GI of foods is determined under experimental conditions after an overnight fast, and might not apply to foods consumed later during the day

GL

- The glycemic load (GL) is a ranking system for carbohydrate content in food portions based on their glycemic index (GI) and the portion size. Glycemic load or GL combines both the quality and quantity of carbohydrate in one 'number'.

- The best way to predict blood glucose values of different types and amounts of food.

Food	Glycemic index	Carbohydrate content (by weight)	Glycemic Load	Insulin index[7][8][9]
Baguette, white, plain (France)	95	50%	48	—
Banana, Mean of 10 studies	52	20%	10	81
Carrots, Mean of 4 studies	47	7.5%	3.5	—
Corn tortilla (Mexican)	52	48%	25	—
Potato, Mean of 5 studies	50	19%	9.3	121
Rice, boiled white, mean of 12 studies	64	24%	15.4	79
Watermelon	72	5%	3.6	—

- Nutrition requirements during pregnancy and lactation are <u>similar</u> for women with and without diabetes.

- Medical nutrition therapy for gestational diabetes focuses on food choices for appropriate weight gain, normoglycemia, and absence of ketones.

- For some women with gestational diabetes, modest energy and carbohydrate restriction may be appropriate.