بسم الله الرحمن الرحيم

دانشگاه علوم پزشکی و خدمات بهداشتی درمانی شهید بهشتی

مروری بر رژیم غذایی در بیماران مبتلا به دیابت نوع ۲ تحت درمان قرصهای خوراکی پایین آورنده قند خون

سمیه حسین پور نیازی

مرکزتحقیقات تغذیه و غدد درون ریز

پژوهشکده علوم غدد درون ریز و متابولیسم

دانشگاه علوم پزشکی شهید بهشتی

آبان ۱۴۰۴

Important of Medical Nutrition Therapy (MNT)

- Because type 2 diabetes is *progressive*, behavior modification alone may not be adequate to maintain euglycemia over time.
- *After pharmacotherapy is initiated*, *nutrition therapy continues* to be an important component of ongoing diabetes self-management
- Diabetes-specific MNT should assess and monitor medication changes in relation to the nutrition care plan.

MNT *(cont'd)*

Lifestyle vs. metformin

After 10 years follow up, diabetes incidence rates:

- ✓ lifestyle intervention group: **4.8** cases in 100 people/year
- ✓ metformin group: **7.8** cases in 100 people/year
- ✓ placebo group: **11.9** cases in 100 people/year

Prevent or delay diabetes after 10 years follow-up

- Misra A. Lancet, 2009;234:45-78

MNT *(cont'd)*

- Individuals who have pre-diabetes/diabetes should receive individualized ***MNT***

  - ***MNT*** → ↓ up to 1.9% **HbA1c** in ***type 1 diabetes***
  - ***MNT*** → ↓ up to 2.0% **HbA1c** in ***type 2 diabetes***
  - ***MNT*** → ↓ 15-25mg/dl **LDL-C** in ***diabetic patients***

- Meta analysis support a role for MNT in treating **hypertension**

- ADA. Diabetes care 2019; 42 (s1): 731-54.
- ADA. Diabetes care 2025; 30 (s1): s48-64

رژیم درمانی در دیابت نوع ۱

Plasma blood glucose and A1C goals for

Values by age	Plasma blood glucose goal range (mg/dl)		A1C	Rationale
	Before meals	Bedtime/overnight		
Toddlers and preschoolers (<6 years)	100–180	110–200	<8.5 (but >7.5) %	• High risk and vulnerability to hypoglycemia
School age (6–12 years)	90–180	100–180	<8%	• Risks of hypoglycemia and relatively low risk of complications prior to puberty
Adolescents and young adults (13–19 years)	90–130	90–150	<7.5%*	• Risk of hypoglycemia • Developmental and psychological issues

Key concepts in setting glycemic goals:

- Goals should be individualized and lower goals may be reasonable based on benefit–risk assessment
- Blood glucose goals should be higher than those listed above in children with frequent hypoglycemia or hypoglycemia unawareness
- Postprandial blood glucose values should be measured when there is a disparity between preprandial blood glucose values and A1C levels

*A lower goal (<7.0%) is reasonable if it can be achieved without excessive hypoglycemia

Carbohydrate counting *(cont'd)*

Insulin carbohydrate ratio:

- Adults: **1 unit of insulin** for every **10 to 15 grams of carbohydrate**
- School-age child: **1 unit of insulin** for every **20 to 30 grams of carbohydrate**

However:
careful monitoring of blood glucose and individual response should be evaluated to individualize the ratio.

Kulkarni, KH; Carbohydrate Counting: A practical meal planning option for people with diabetes; Clin Diab 2005 23, (3) 120-22

Assessment

- Hypoglycemia in children
- All children and adolescents should have height and weight plotted on the CDC growth curves at each clinic visit
- Thyroid function (serum TSH levels) should be monitored at diagnosis and every 1–2 years thereafter or obtained at any time growth rate is abnormal

Assessment *(cont'd)*

- Evaluation for celiac disease should be considered if there is unsatisfactory weight gain that cannot be explained by poor metabolic control.

Goals of NT for children and adolescents

- Provide individualized nutrition therapy with guidance on appropriate energy and nutrient intake to ensure optimal growth and development
- Assess and consider changes in food preferences over time and incorporate changes into recommendations
- Promote healthy lifestyle habits while considering and preserving social, cultural, and physiological well being
- Achieve and maintain the best possible glycemic control
- Achieve and maintain appropriate body weight and promote regular exercise

رژیم درمانی در دیابت نوع ۲

Management of the T2DM

Reduction of underlying causes:

1) Weight reduction

2) Diet therapy

3) Increase physical activity

3) Stop cigarette smoking

Management of the T2DM: weight loss

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Review

Nutritional Recommendations for Type 2 Diabetes: An International Review of 15 Guidelines

Liangying Hou MM [a,b,1]; Long Ge PhD [b,c,1]; Qi Wang MPH [b,c]; Juanjuan He MB [b]; Tianzhu Qin MB [b]; Liujiao Cao MM [d]; Changhao Cao MB [b]; Diru Liu PhD [e]; Xingrong Liu PhD [b]; Kehu Yang MD [a,b,f,*]

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Key Messages

- Nutritional recommendations from different clinical practice guidelines may be inconsistent, and little is known about their quality.
- Nutritional recommendations remain varied and inconsistent, and are largely based on low-quality evidence (nonrandomized studies or expert opinions).

ARTICLE INFO

Article history:

ABSTRACT

Management of the T2DM: weight loss

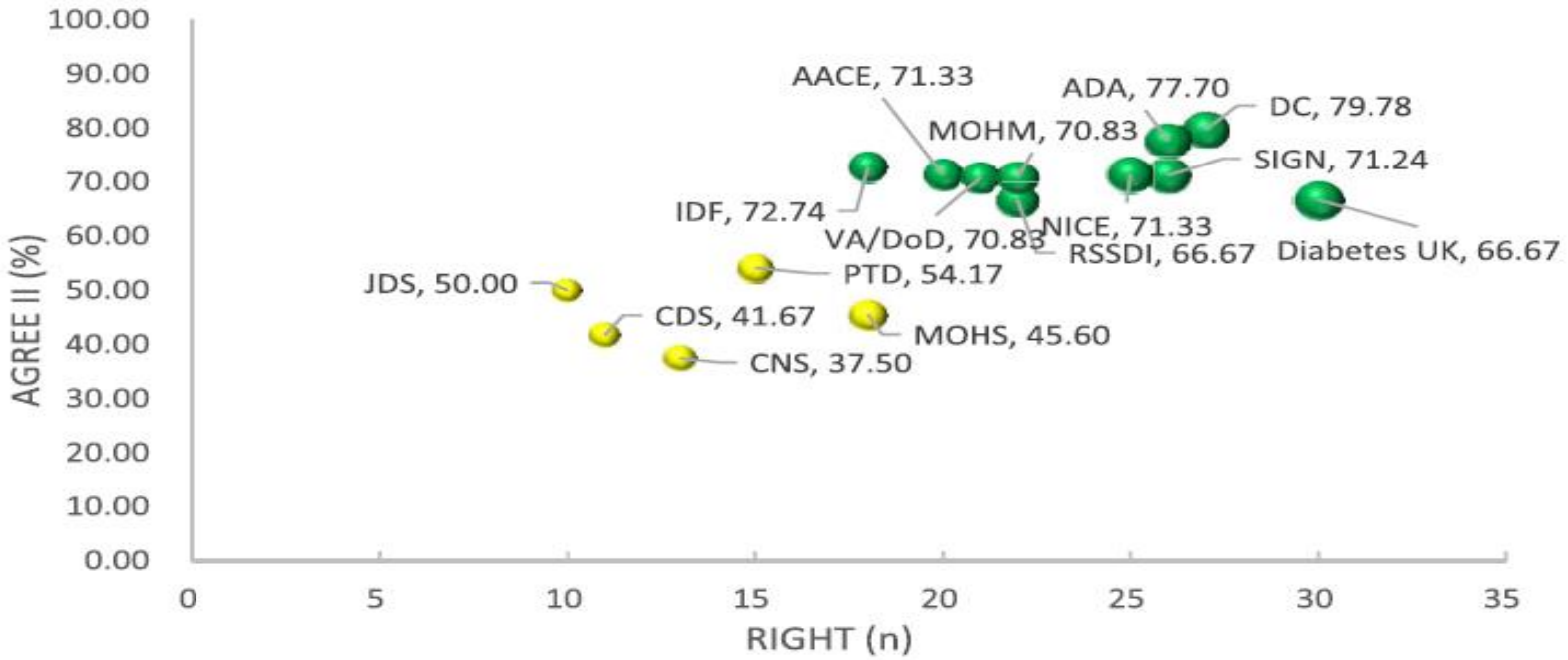

Figure 2. Grading and analysis of reporting and methodologic quality of CPGs for T2DM. Colours represent differing quality levels of CPGs. Green: high-quality CPGs; yellow: middle-level CPGs. The size of the sphere represents the number of reported RIGHT checklist items of each CPG. *CPG*, clinical practice guidelines; *T2DM*, type 2 diabetes mellitus.

Management of the T2DM: weight loss

Body weight and energy balance

Seven CPGs (35–41) include recommendations that support lifestyle modification to achieve modest weight loss and energy balance. One nutrition-specific CPG and 4 broad CPGs recommend a modest weight loss of 5% to 10% of initial body weight in individuals with T2DM and overweight or obesity (Grade B, Level 2+) (40).

Management of the T2DM: weight loss

While steatohepatitis and cirrhosis occur in lean people with diabetes and are believed to be linked to genetic predisposition, insulin resistance, and environmental factors (218–220), there is ample evidence to implicate excess visceral and overall adiposity in people with overweight and obesity in the pathogenesis of the disease (221,222). Obesity in the setting of type 2 diabetes worsens insulin resistance and steatohepatitis, promoting the development of cirrhosis (223). Therefore, clinicians should enact evidence-based interventions (as discussed in Section 5, "Facilitating Positive Health Behaviors and Well-being to Improve Health Outcomes") to promote healthy lifestyle change and weight loss for people with overweight or obesity and NAFLD. A minimum weight loss goal of 5%, preferably ≥10% (224, 225), is needed to improve liver histology, with fibrosis requiring the larger weight reduction to promote change (225–227). Individualized, structured weight loss and exercise programs offer greater benefit

درصد کاهش وزن و انرژی دریافتی بر اساس نمایه توده بدن

BMI (kg/m2)	weight loss %	Energy deficit
25-27	5%	500 Kcal
27-35	7%	700 kcal
>35	10-15%	1000 kcal
>40	20%	1000 kcal

Management of the T2DM

Reduction of underlying causes:

1) Weight reduction

2) Diet therapy

3) Increase physical activity

3) Stop cigarette smoking

Management of the T2DM: weight loss

Moving away from emphasizing macronutrients, and micronutrients

- Instead: focusing on foods
  - Promoting *nutrient-dense food choices*, defined as foods high in micronutrients while being relatively low in calories (e.g., *vegetables, fruits, and legumes*)
- ***More broadly, dietary patterns***

5. Facilitating Positive Health Behaviors and Well-being to Improve Health Outcomes: Standards of Care in Diabetes—2025

*American Diabetes Association Professional Practice Committee**

Diabetes Care 2025;48(Suppl. 1):S86–S127 | https://doi.org/10.2337/dc25-S005

Nutrition, and Health" (138).

Eating Patterns and Meal Planning

For an understanding of nutrition and diabetes, it is important to clarify the differences between food patterns, eating plans, and approaches. These are terms that are often used interchangeably, but they are different and relevant in individualizing nutrition care plans (139).

- **Eating pattern(s) or food pattern(s).** The totality of all foods and beverages consumed over a given period of time. An eating pattern can be ascribed to an individual, but it is also the term used in prospective cohort and observational nutrition studies to classify and study nutrition patterns. Examples of eating patterns include Mediterranean style, Dietary Approaches to Stop Hypertension (DASH), low-carbohydrate vegetarian, and plant based (139).
- **Eating/meal plan (historically referred to as a diet).** An individualized guide to help plan when, what, and how much to eat on a daily basis, completed by

ferent eating patterns is strengthened, health care professionals should focus on the core dimensions common among patterns: inclusion of nonstarchy vegetables, whole fruits, legumes, whole grains, nuts, seeds, and low-fat dairy products and minimizing consumption of meat, sugar-sweetened beverages, sweets, refined grains, and ultraprocessed foods (143,144).

Evidence for eating patterns has been informed by RCTs, prospective cohort studies, systematic reviews, and network meta-analysis. Those most frequently referenced include Mediterranean, DASH, low-fat, carbohydrate-restricted, vegetarian, and vegan eating patterns. As stated previously, there is insufficient evidence to select one over the other (137,141,142,145–154). Ultimately, ongoing diabetes and nutrition education paired with appropriate support to implement and sustain health behaviors is recommended (103).

Meal Planning

Referral to and ongoing support from an RDN is essential to assess the overall nutrition status of, and to work collaboratively with, the person with diabetes to

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GUIDELINES

Evidence-based European recommendations for the dietary management of diabetes

The Diabetes and Nutrition Study Group (DNSG) of the European Association for the Study of Diabetes (EASD)[1]

Traditional dietary patterns and therapeutic diets in diabetes management

Recommendations

- A variety of dietary patterns emphasising the consumption of whole grains, whole vegetables and fruit, legumes, nuts, seeds and non-hydrogenated non-tropical vegetable oils, while minimising the consumption of meat (especially red and processed meat), sugar-sweetened beverages, sweets and refined grains are recommended. These patterns include:
  - Mediterranean dietary pattern to improve glycaemia and other cardiometabolic risk factors (⊕⊕⊕⊖ Moderate) and reduce risk of CVDs and all-cause mortality (⊕⊕⊖⊖ Low to ⊕⊕⊕⊖ Moderate).
  - Nordic dietary pattern to improve BMI (⊕⊕⊕⊕ High) and other cardiometabolic risk factors (⊕⊕⊖⊖ Low to ⊕⊕⊕⊖ Moderate) and reduce the risk of CVDs (⊕⊕⊖⊖ Low to ⊕⊕⊕⊖ Moderate).
  - Vegetarian dietary pattern to improve glycaemia and other cardiometabolic risk factors (⊕⊕⊕⊖ Moderate).

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(41) and 2017 Department of Veterans Affairs / Department of Defense (VA/DoD) (43) guidelines recommend a Mediterranean diet (general features include a high consumption of fruits, vegetables, legumes, nuts, seeds, cereals, and whole grains, and moderate-to-high consumption of olive oil [as the principal source of fat]; low-to-moderate consumption of dairy products, fish, and poultry; and low consumption of red meat, as well as a low-to-moderate consumption of wine, mainly during meals) to improve glycemic control (Grade B, Level 2; strong recommendation). The 2018 DC (41) also recommends vegan or vegetarian diets (vegetable, fruit, cereal grains, legumes, nuts, and seeds form the basis of this dietary approach, whereas carbohydrates can vary from 60% to 75% of energy intake) in the Dietary Approaches to Stop Hypertension (DASH) diet (emphasizes vegetables, fruits, and low-fat dairy products, and includes whole grains, poultry, fish, and nuts).

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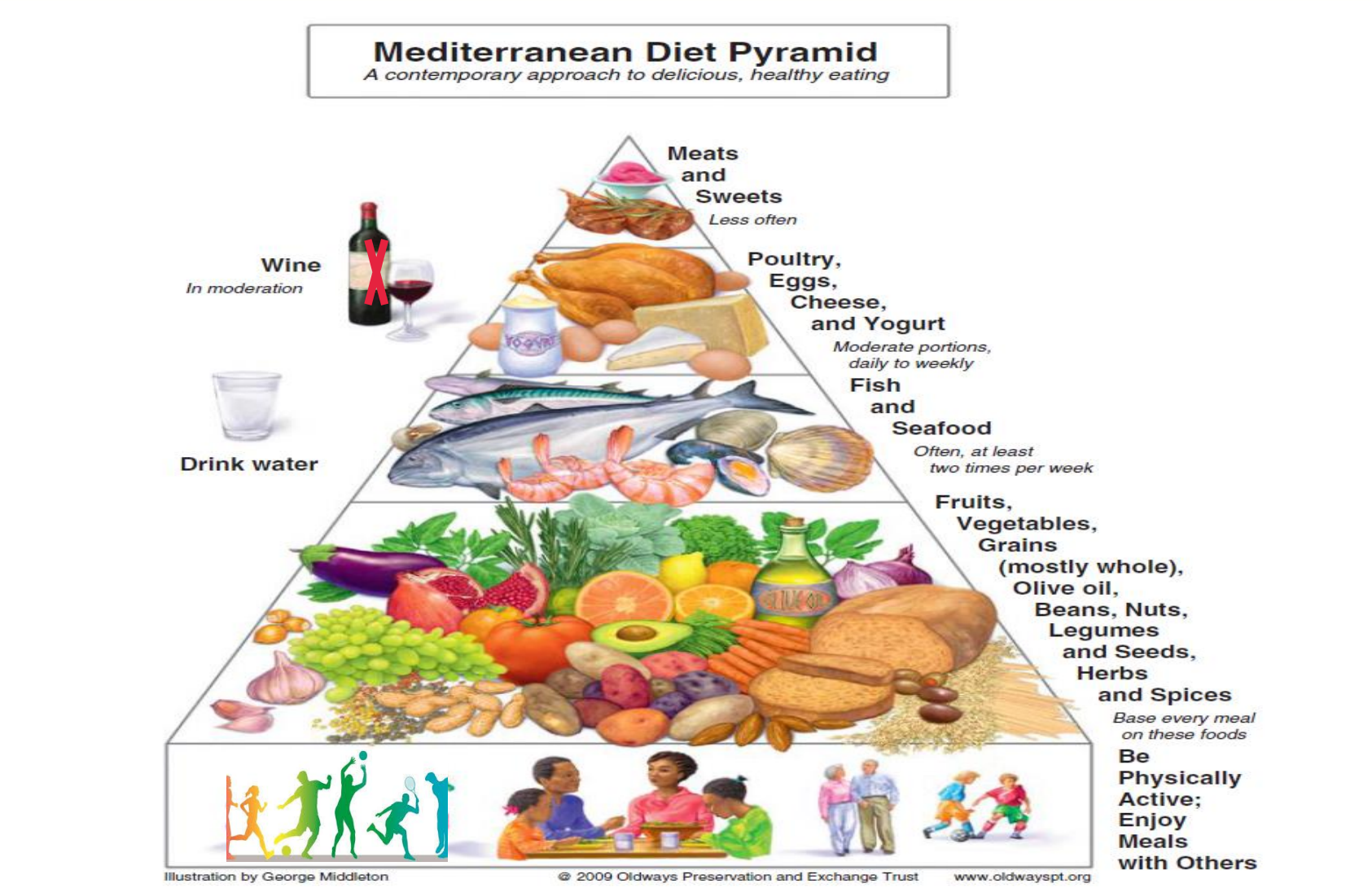
ARTICLE

Diets for weight management in adults with type 2 diabetes: an umbrella review of published meta-analyses and systematic review of trials of diets for diabetes remission

Chaitong Churuangsuk[1,2] · Julien Hall[1] · Andrew Reynolds[3,4] · Simon J. Griffin[5,6] · Emilie Combet[1] · Michael E. J. Lean[1,4]

Results We identified 19 meta-analyses of weight-loss diets, involving 2–23 primary trials (n = 100–1587), published 2013–2021. Twelve were 'critically low' or 'low' AMSTAR 2 quality, with seven 'high' quality. Greatest weight loss was reported with very low energy diets, 1.7–2.1 MJ/day (400–500 kcal) for 8–12 weeks (high-quality meta-analysis, GRADE low), achieving 6.6 kg (95% CI −9.5, −3.7) greater weight loss than low-energy diets (4.2–6.3 MJ/day [1000–1500 kcal]). Formula meal replacements (high quality, GRADE moderate) achieved 2.4 kg (95% CI −3.3, −1.4) greater weight loss over 12–52 weeks. Low-carbohydrate diets were no better for weight loss than higher-carbohydrate/low-fat diets (high quality, GRADE high). High-protein, Mediterranean, high-monounsaturated-fatty-acid, vegetarian and low-glycaemic-index diets all achieved minimal (0.3–2 kg) or no difference from control diets (low to critically low quality, GRADE very low/moderate). For type 2 diabetes remission, of 373 records, 16 met inclusion criteria. Remissions at 1 year were reported for a median 54% of participants in RCTs including initial low-energy total diet replacement (low-risk-of-bias study, GRADE high), and 11% and 15% for meal replacements and Mediterranean diets, respectively (some concerns for risk of bias in studies, GRADE moderate/low). For ketogenic/very low-carbohydrate and very low-energy food-based diets, the evidence for remission (20% and 22%, respectively) has serious and critical risk of bias, and GRADE certainty is very low.

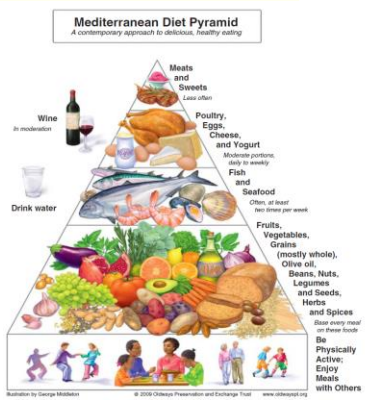


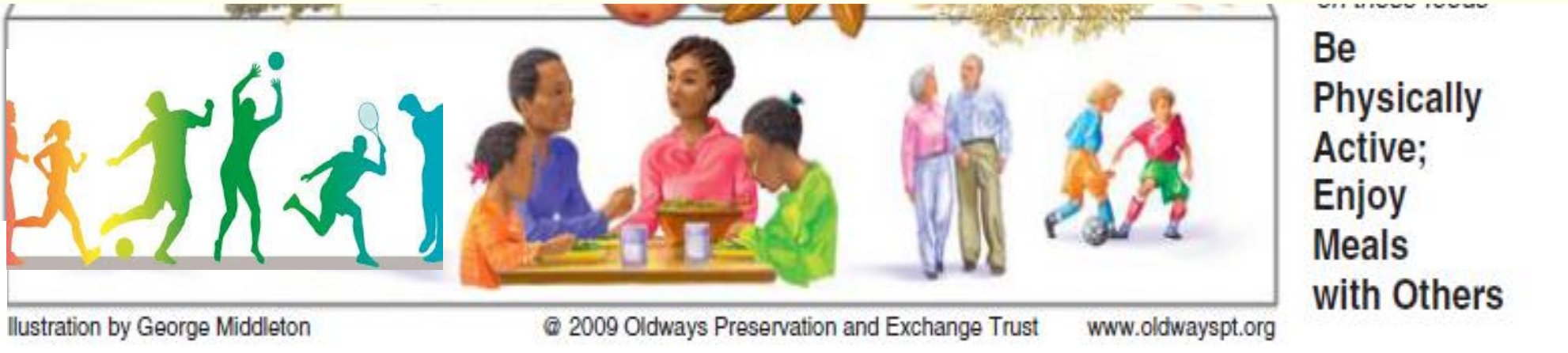
- Krause's food & nutrition care process,14th edition; 2017, p 657-9

Mediterranean diet

Feature of Mediterranean diet:

- Enjoying meals with family and friends
- Getting plenty of exercise





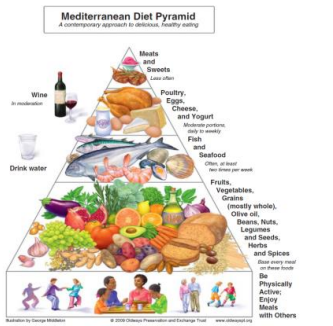
Krause's food & nutrition care process, 14th edition; 2017, p 657-9

Mediterranean diet *(cont'd)*

Feature of Mediterranean diet *(cont'd)*:

a. Fruit and vegetables

- An abundance and variety of plant foods should make up the majority of your meals
- Strive for **7 to 10 servings** a day of veggies and fruits
- Greater number of servings of fruits and vegetables (mostly fresh) with an emphasis on **root vegetables and greens vegetables**



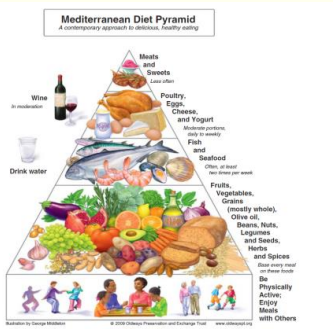
Krause's food & nutrition care process, 14th edition; 2017, p 657-9

Mediterranean diet *(cont'd)*

Feature of Mediterranean diet *(cont'd)*:

b. Grains :

- Are typically whole grain
- **Bread** is an important part of the diet
  - (Usually contain very few unhealthy trans fats)



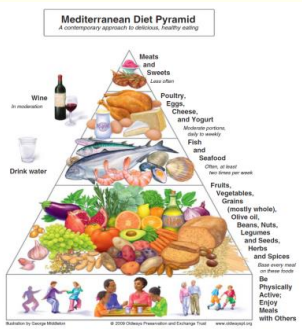
Krause's food & nutrition care process, 14th edition; 2017, p 657-9

Mediterranean diet *(cont'd)*

Features of the diet *(cont'd)*:

c. FAT and OILS

- Moderate in **total fat** (**32% to 35%**)
- High in PUFA (especially omega-3)
- High levels of MUFA such as olive oil
- Use of canola oil, olive oil, nut oil
- Relatively low in saturated fat (9% to 10%)



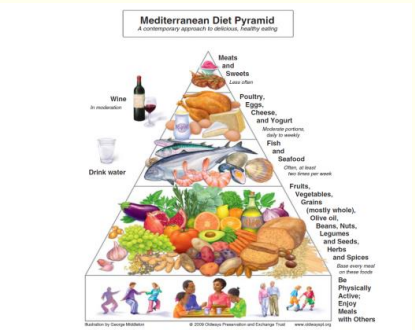
Krause's food & nutrition care process,14th edition; 2017, p 657-9

Mediterranean diet and dyslipidemia *(cont'd)*

Features of the diet *(cont'd)*:

c. FAT and OILS (cont'd)

- **Olive** or **canola** oil as a healthy replacement for butter or margarine
- Try **tahini** as a dip or spread
- The **type of fats consumed** is more important than total amount of fat (looking at metabolic goals and CVD risk)
- Mediterranean-style diet: effective alternative to a diet low in total fat and high in carbohydrates



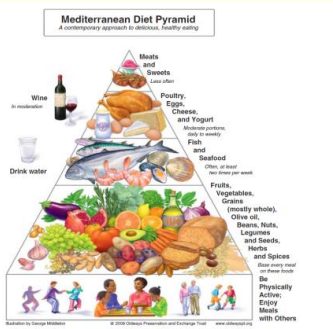
Krause's food & nutrition care process, 14th edition; 2017, p 657-9

Mediterranean diet and dyslipidemia *(cont'd)*

Features of the diet *(cont'd)*:

d. Nuts and seed:

- high in fat : 80% from fat
- high in calories: should not be eaten in large amounts
- **Avoid** *candied* or *honey-roasted* and *salted* nuts



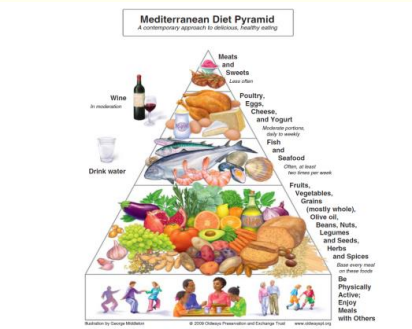
Krause's food & nutrition care process, 14th edition; 2017, p 657-9

Mediterranean diet and dyslipidemia *(cont'd)*

Features of the diet *(cont'd)*:

d. Beans and legumes:

- high in soluble fiber and low GI
- 1 serving/ day



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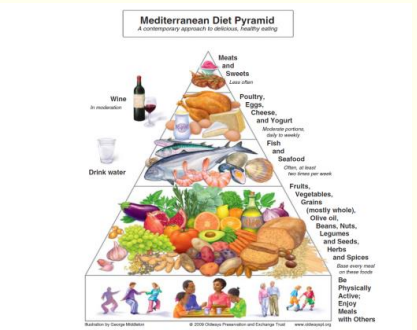
Mediterranean diet and dyslipidemia *(cont'd)*

Features of the diet *(cont'd)*:

e. Herbs and spices:

- Using **herbs and spices** instead of **salt** to flavor foods and meals
- Herbs and spices make ***food tasty*** and are also rich in ***health-promoting substances***.



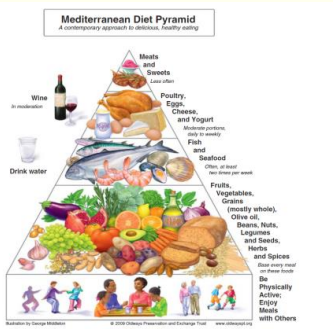
Krause's food & nutrition care process,14th edition; 2017, p 657-9

Mediterranean diet and dyslipidemia *(cont'd)*

Features of the diet *(cont'd)*:

e. Fish and seafood:

- Fatty fish- such as salmon
- Rich sources of omega-3 fatty acids
- Fish is eaten on a regular basis (once or twice a week)
- Avoid fried fish



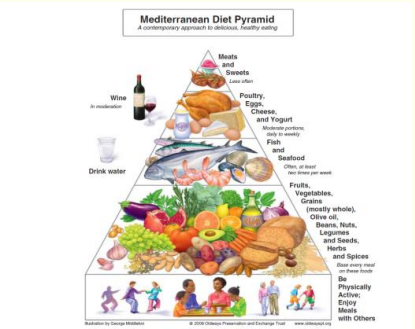
Krause's food & nutrition care process,14th edition; 2017, p 657-9

Mediterranean diet and dyslipidemia *(cont'd)*

Features of the diet *(cont'd)*:

f. Dairy products:

- Limit higher fat dairy products (whole or 2 percent milk, cheese and ice cream)
- Switch to skim milk, fat-free yogurt and low-fat cheese



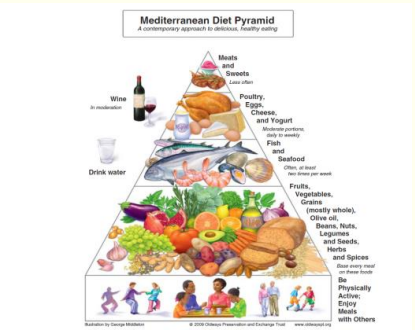
Krause's food & nutrition care process,14th edition; 2017, p 657-9

Mediterranean diet and dyslipidemia *(cont'd)*

Features of the diet *(cont'd)*:

g. MEAT:

- Substitute **fish and poultry** for **red meat**
- When eaten, make sure it's **lean** and keep portions small
- Also avoid **sausage**, and other **high-fat meats**



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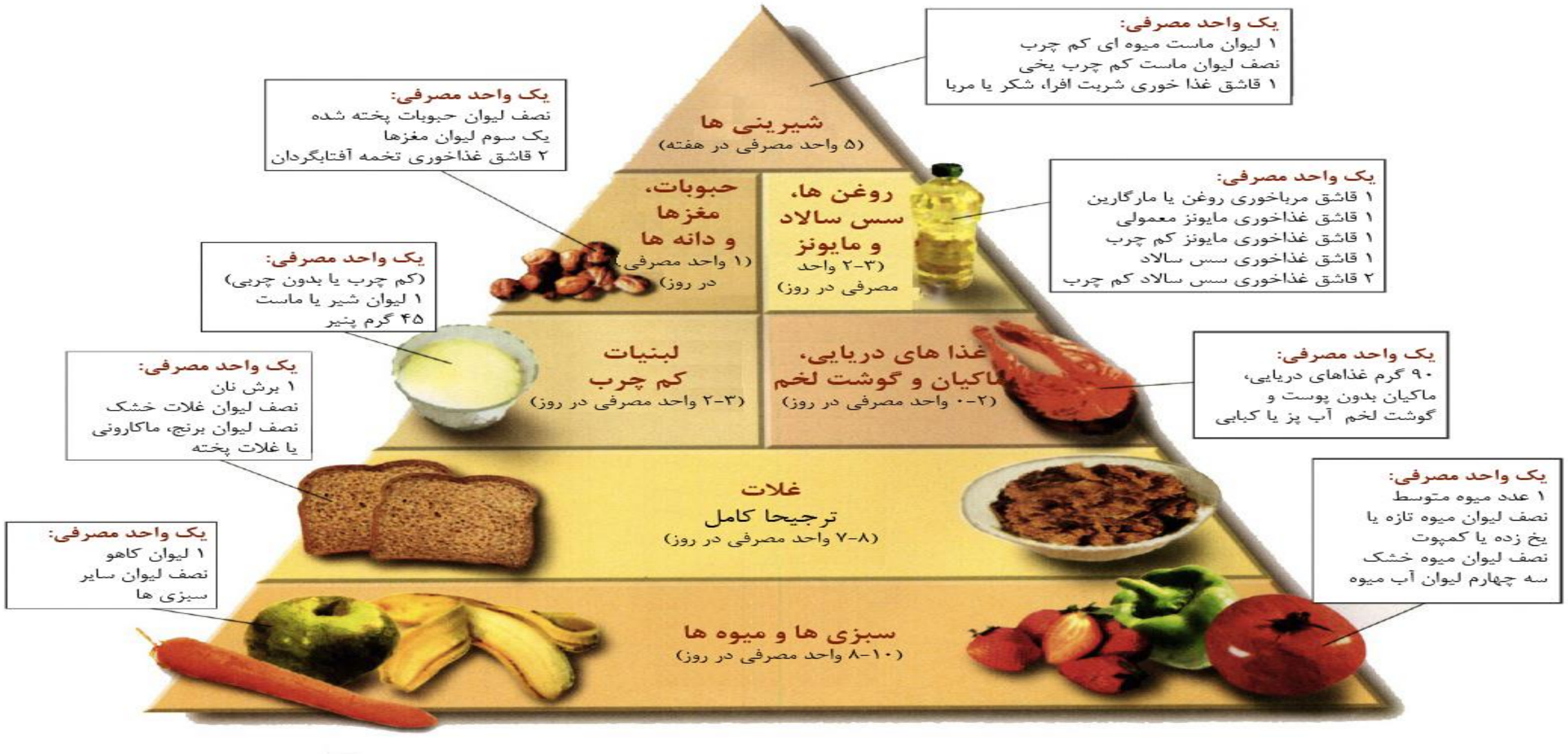
Lifestyle recommendation in T2DM *(cont'd)*

Dietary pattern recommended :

- **Mediterranean diet:** as being low in saturated fat and high in vegetable oils, observed in Greece and Southern Italy during the 1960s
- **DASH dietary pattern:** a lifelong approach to healthy eating that's designed to help treat or prevent high blood pressure

Khanji et al. Int J Cardiol.2018 ;263:142-151.

هرم راهنمای غذایی DASH



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GUIDELINES

Evidence-based European recommendations for the dietary management of diabetes

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Energy-balance and weight management in diabetes management

Recommendations

- People with diabetes who have overweight or obesity should be supported with evidence-based treatments to achieve and maintain weight loss. ⊕⊕⊕⊕ High

- Neither extreme high-carbohydrate, nor very-low-carbohydrate ketogenic diets are recommended for weight loss. ⊕⊕⊕⊕ High

[48]. A step-down approach starting with 4200 kJ/day or 5000 kJ/day (1000–1200 kcal/day) is commonly advocated with obesity. Although all diet types are similarly effective for weight management, health risks could differ among weight-loss diets. For example, very-low-carbohydrate ketogenic diets have been associated with hypoglycaemia, ketoacidosis, and vitamin and mineral inadequacies, and both extreme high-carbohydrate and low-carbohydrate ketogenic diets have been associated with greater mortality [50–56].

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ARTICLE

Diets for weight management in adults with type 2 diabetes: an umbrella review of published meta-analyses and systematic review of trials of diets for diabetes remission

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Results We identified 19 meta-analyses of weight-loss diets, involving 2–23 primary trials (n = 100–1587), published 2013–2021. Twelve were 'critically low' or 'low' AMSTAR 2 quality, with seven 'high' quality. Greatest weight loss was reported with very low energy diets, 1.7–2.1 MJ/day (400–500 kcal) for 8–12 weeks (high-quality meta-analysis, GRADE low), achieving 6.6 kg (95% CI −9.5, −3.7) greater weight loss than low-energy diets (4.2–6.3 MJ/day [1000–1500 kcal]). Formula meal replacements (high quality, GRADE moderate) achieved 2.4 kg (95% CI −3.3, −1.4) greater weight loss over 12–52 weeks. Low-carbohydrate diets were no better for weight loss than higher-carbohydrate/low-fat diets (high quality, GRADE high). High-protein, Mediterranean, high-monounsaturated-fatty-acid, vegetarian and low-glycaemic-index diets all achieved minimal (0.3–2 kg) or no difference from control diets (low to critically low quality, GRADE very low/moderate). For type 2 diabetes remission, of 373 records, 16 met inclusion criteria. Remissions at 1 year were reported for a median 54% of participants in RCTs including initial low-energy total diet replacement (low-risk-of-bias study, GRADE high), and 11% and 15% for meal replacements and Mediterranean diets, respectively (some concerns for risk of bias in studies, GRADE moderate/low). For ketogenic/very low-carbohydrate and very low-energy food-based diets, the evidence for remission (20% and 22%, respectively) has serious and critical risk of bias, and GRADE certainty is very low.

Effect of a ketogenic diet versus Mediterranean diet on glycated hemoglobin in individuals with prediabetes and type 2 diabetes mellitus: The interventional Keto-Med randomized crossover trial

Christopher D Gardner,[1] Matthew J Landry,[1] Dalia Perelman,[1] Christina Petlura,[1] Lindsay R Durand,[1] Lucia Aronica,[1] Anthony Crimarco,[1] Kristen M Cunanan,[2] Annie Chang,[1] Christopher C Dant,[1] Jennifer L Robinson,[1] and Sun H Kim[3]

[1]Stanford Prevention Research Center, Department of Medicine, School of Medicine, Stanford University, Stanford, CA, USA; [2]Quantitative Sciences Unit, Department of Medicine, Stanford University, Stanford, CA, USA; and [3]Division of Endocrinology, Gerontology and Metabolism, Department of Medicine, Stanford University Medical Center, Stanford, CA, USA

Our study is unique in comparing 2 low-carb diets—the well-formulated ketogenic diet (WFKD) and the Mediterranean-plus diet (Med-Plus)—that both incorporate 3 key nutrition messages endorsed by diabetes organizations (1, 2): including nonstarchy vegetables, restricting added sugars, and limiting refined grains. The main differences between the 2 diets involve legumes, fruits, and whole, intact grains, which are avoided for the WFKD and included for the Med-Plus. These 3 food groups are consistently recommended by national and international public health organizations based on extensive evidence of cardiovascular benefits of fiber, antioxidants, and the vitamins and minerals characteristic of those food groups (2, 12–15). We hypothesized that after 12 weeks on each diet, glycated hemoglobin (HbA1c) values would not be different, but would

Conclusions: HbA1c values were not different between diet phases after 12 weeks, but improved from baseline on both diets, likely due to several shared dietary aspects. The WFKD led to a greater decrease in triglycerides, but also had potential untoward risks from elevated LDL cholesterol and lower nutrient intakes from avoiding legumes, fruits, and whole, intact grains, as well as being less sustainable. This trial was registered at clinicaltrials.gov as NCT03810378. *Am J Clin Nutr* 2022;116:640–652.

Lifestyle recommendation in T2DM *(cont'd)*

Very-low-carbohydrate diets (ketogenic diets) is not recommended:

- Lack of observed benefit in type 2 diabetes prevention and management
- Increased LDL-C levels
- Hypoglycaemia
- ketoacidosis
- Vitamin and mineral inadequacies
- Difficult to follow in the long run
- There is lack of evidence on long-term effects
- low *(<40% total energy)* and high *(>70% total energy)* intakes of carbohydrate are associated with greater *premature mortality*

DNSG. Diabetologia (2023) 66:965–985

Lifestyle recommendation in T2DM *(cont'd)*

If people with diabetes themselves choose to reduce carbohydrate to very low intakes:

- Done with ***health professional support***
- To ensure that *micronutrient* and *fiber* intakes remain adequate
- *Saturated fat intake* is not increased above *10%* of total energy intake
- Providing ***patient education*** on *beneficial sources of carbohydrates (from whole grains, vegetables, fruit and legumes) and fat (unsaturated rather than saturated)* is highly recommended.

DNSG. Diabetologia (2023) 66:965–985

Lifestyle recommendation in T2DM *(cont'd)*

Very-low-carbohydrate eating plans are not currently recommended:

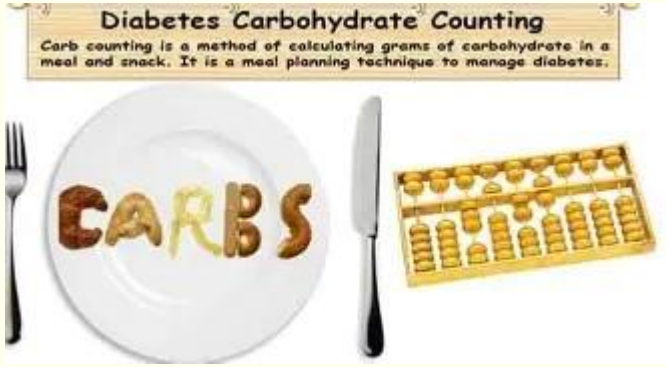
- Pregnant or lactating
- Children
- kidney disease
- disordered eating
- Sodium–glucose cotransporter 2 (SGLT2) inhibitors because of the potential risk of ketoacidosis (canagliflozin, dapagliflozin, empagliflozin, and ertugliflozin,)

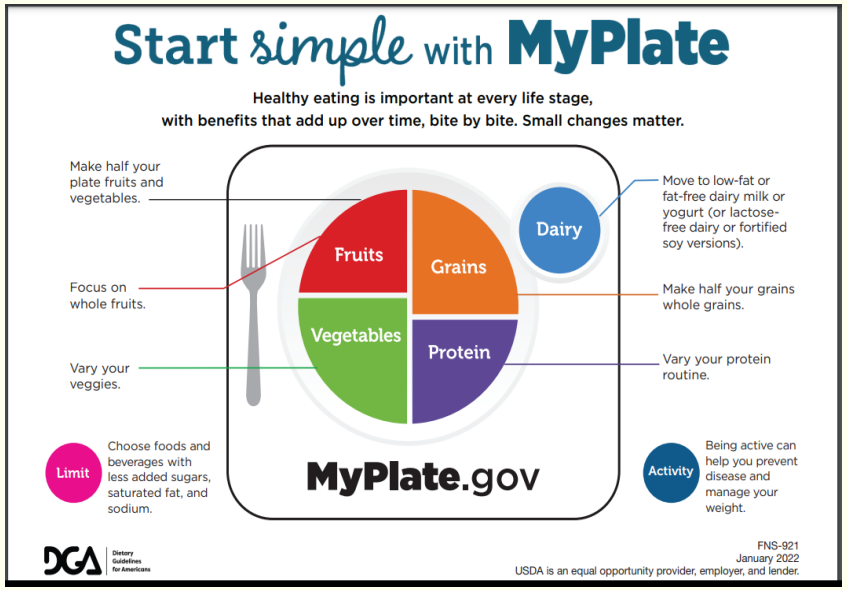
Meal-planning approaches

Lifestyle recommendation in T2DM *(cont'd)*

Two meal-planning approaches: effective in *achieve improved A1C*

1. ***Carbohydrate counting***
2. ***Diabetes plate method***





Carbohydrate counting

- *Aim*
- *Effectiveness*
- *Often used for:*
- *Starchy foods*
- *Carbohydrate distribution in meals*
- *Insulin carbohydrate ratio*

FOOD & NUTRITION

Carb Counting and Diabetes

Carbohydrate counting

Goals:

- Managing blood glucose levels

Effectiveness:

- Significant reduction in A1C by 0.8% without an increase in hypoglycemic events or weight gain

Often used:

by all diabetic patients

Especially:

- Insulin injection, **twice or more times** a day
- Those who take about the same amount of insulin at the same time every day (called a "fixed regimen").

Krause's Food & nutrition Therapy 2017
Diabetes Care. 2011;34:823–827
Diabet. Med. 2014;31:886–896

Carbohydrate counting *(cont'd)*

TABLE 30-8 Macronutrient and Caloric Values for Food Lists*

The following chart shows the macronutrients and calories from each list.

Food List	Carbohydrate (grams)	Protein (grams)	Fat (grams)	Calories
Carbohydrates				
Starch: breads, cereals and grains, starchy vegetables, crackers, snacks, and beans, peas, and lentils	15	3	1	80
Fruits	15	—	—	60
Milk and milk substitutes	12	8	0-3	100
Fat-free, low-fat, 1%	12	8	5	120
Reduced-fat, 2%	12	8	8	160
Whole				
Sweets, desserts, and other carbohydrates	15	Varies	Varies	Varies
Nonstarchy vegetables	5	2	—	25
Proteins				
Lean	—	7	2	45
Medium-fat	—	7	5	75
High-fat	—	7	8	100
Plant-based protein	—	7	Varies	Varies
Fats	—	—	5	45
Alcohol (1 alcohol equivalent)	Varies	—	—	100

Non-starchy vegetables like lettuce, cucumbers, broccoli, and cauliflower have very little carbohydrate and minimal impact on blood glucose.

Krause's Food & nutrition Therapy 2017

Carbohydrate counting *(cont'd)*

	Meal/Snack/Time										
Food Group	Breakfast 7:30 AM	Snack 10:00	Lunch 12:00	Snack 3:00	Dinner 6:30	Snack 10:00	Total servings/ day	CHO (g)	Protein (g)	Fat (g)	Calories
Starches	2	1	2–3	1	2–3	1–2	10	15 150	3 30	1 10	80
Fruit	1		1		1	0–1	3	15 45			60
Milk							2	12 24	8 16	1 2	100
Vegetables								5 10	2 4		25
Meats/ Substitutes			2–3		3–4		6		7 42	5(3) 30	75(55)
Fats	1	0–1	1–2	0–1	1–2	0–1	5			5 25	45
CHO Choices	3–4 CHO	1 CHO	3–4 CHO	1 CHO	4–5 CHO	1–2 CHO	Total grams	229	92	67	
	1900–2000 calories 230 g CHO-50% 90 g protein-20% 65 g fat-30%						Calories/ gram	X4= 916	X4= 368	X9= 603	Total calories 1900–2000
							Percent calories	50	19	30	

١٥ %

١٠ %

25 %

10 %

30 %

10 %

Calculations are based on medium-fat meats and skim/very low-fat milk. If diet consists predominantly of low-fat meats, use the factor 3 g, instead of 5 g fat; if predominantly high-fat meats, use 8 g fat. If low-fat (2%) milk is used, use 5 g fat; if whole milk is used, use 8 g fat.

Krause's Food & nutrition Therapy 2017

Carbohydrate counting *(cont'd)*

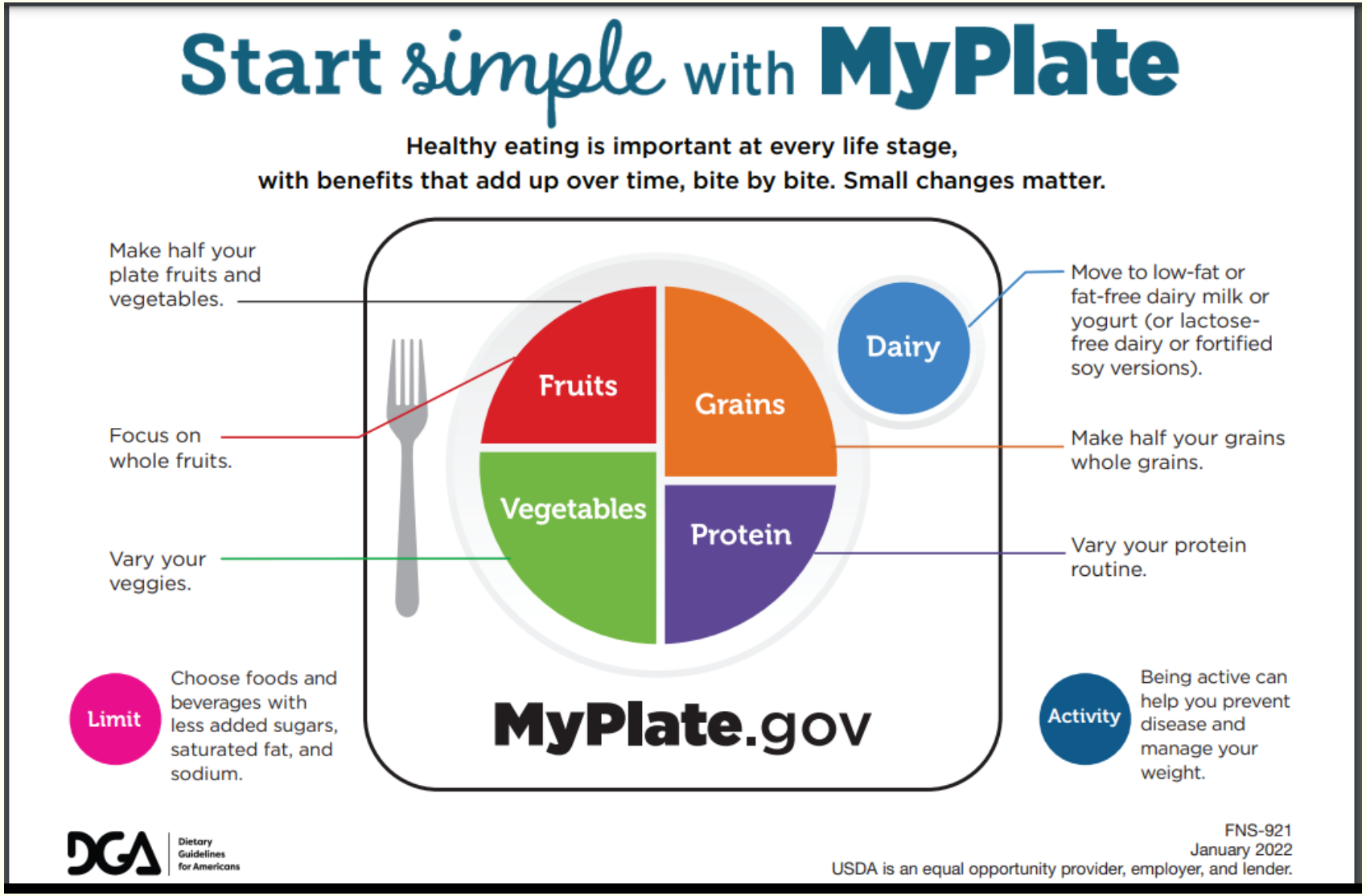
Insulin carbohydrate ratio:

- Adults: **1 unit of insulin** for every **10 to 15 grams of carbohydrate**
- School-age child: **1 unit of insulin** for every **20 to 30 grams of carbohydrate**

However:

careful monitoring of blood glucose and individual response should be evaluated to individualize the ratio.

Kulkarni, KH; Carbohydrate Counting: A practical meal planning option for people with diabetes; Clin Diab 2005 23, (3) 120-22


Start simple with MyPlate
Healthy eating is important at every life stage,
with benefits that add up over time, bite by bite. Small changes matter.
Make half your plate fruits and vegetables.
Focus on whole fruits.
Vary your veggies.
Fruits
Grains
Vegetables
Protein
Dairy
Move to low-fat or fat-free dairy milk or yogurt (or lactose-free dairy or fortified soy versions).
Make half your grains whole grains.
Vary your protein routine.
MyPlate.gov
Limit
Choose foods and beverages with less added sugars, saturated fat, and sodium.
Activity
Being active can help you prevent disease and manage your weight.
DGA
Dietary Guidelines for Americans
FNS-921
January 2022
USDA is an equal opportunity provider, employer, and lender.

Focus on whole fruits like fresh, frozen, canned, or dried.

Buy fruits to have them available to add to your meal or eat as a snack. If you buy juice, select 100% fruit juice.

Eat a variety of vegetables and add them to mixed dishes like casseroles, sandwiches, and wraps.

Fresh, frozen, and canned count, too. Look for "reduced sodium" or "no-salt-added" on the label.

Choose whole-grain versions of common foods such as bread, pasta, and tortillas.

Not sure if it's whole grain? Check the ingredients list for the words "whole" or "whole grain."

Eat a variety of protein foods such as beans, soy, seafood, lean meats, poultry, and unsalted nuts and seeds.

Select seafood twice a week. Choose lean cuts of meat and ground beef that is at least 93% lean.

Choose low-fat (1%) or fat-free (skim) dairy. Get the same amount of calcium and other nutrients as whole milk, but with less saturated fat and calories.

Lactose intolerant? Try lactose-free milk or a fortified soy beverage.

Daily Food Group Targets — Based on a 2,000 Calorie Plan

Visit MyPlate.gov/MyPlatePlan for a personalized plan.

2 cups

1 cup counts as:

1 small apple
1 large banana
1 cup grapes
1 cup sliced mango
½ cup raisins
1 cup 100% fruit juice

2½ cups

1 cup counts as:

2 cups raw spinach
1 cup cooked collard, kale, or turnip greens
1 small avocado
1 large sweet potato
1 cup cooked beans, peas, or lentils
1 cup cut cauliflower

6 ounces

1 ounce counts as:

1 slice of bread
½ cup cooked oatmeal
1 small tortilla
½ cup cooked brown rice
½ cup cooked couscous
½ cup cooked grits

5½ ounces

1 ounce counts as:

1 ounce cooked lean chicken, pork, or beef
1 ounce tuna fish
¼ cup cooked beans, peas, or lentils
1 Tbsp peanut butter
2 Tbsp hummus
1 egg

3 cups

1 cup counts as:

1 cup dairy milk or yogurt
1 cup lactose-free dairy milk or yogurt
1 cup fortified soy milk or yogurt
1½ ounces hard cheese
1 cup kefir

Choose foods and beverages with less added

Lifestyle recommendation in T2DM *(cont'd)*

- *Carbohydrate counting* is a *more advanced skill* that helps plan for and track how much carbohydrate is consumed at meals and snacks.
- Optimal amount of carbohydrate intake for people with diabetes are inconclusive, although *monitoring carbohydrate* intake is a *key strategy* in reaching glucose goals in people with type 1 and type 2 diabetes
- Regardless of the amount of carbohydrate in the meal plan, focus should be placed on high-quality, minimally processed, nutrient-dense carbohydrate sources high in fiber

Dietary Inflammatory Index (DII) *cont'd*

2. EAT A LOW GLYCEMIC DIET

	GI	GL
Vegetables		
Beets, canned	64	5
Carrots (avg)	47	3
Parsnip	97	12
Peas (green, avg)	48	3
Potato		
Baked (avg)	85	26
Boiled	88	16
French fries	75	22
Microwaved	82	27
Pumpkin	75	3
Sweet corn	60	11
Sweet potato (avg)	61	17
Rutabaga	72	7
Yam (avg)	37	13

Dietary Inflammatory Index (DII) *cont'd*

2. EAT A LOW GLYCEMIC DIET

Legumes		
Baked beans (avg)	48	7
Broad beans	79	9
Butter beans	31	6
Chickpeas (avg)	28	8
Cannellini beans (avg)	38	12
Kidney beans (avg)	28	7
Lentils (avg)	29	5
Soy beans (avg)	18	1

Dietary Inflammatory Index (DII) *cont'd*

2. EAT A LOW GLYCEMIC DIET

Fruit		
Apple (avg)	38	6
Apricot (dried)	31	9
Banana (avg)	51	13
Cherries	22	3
Grapefruit	25	3
Grapes (avg)	46	8
Kiwi fruit (avg)	53	6
Mango	51	8
Orange (avg)	48	5
Papaya	59	10
Peach (avg)		
Canned (natural juice)	38	4
Fresh (avg)	42	5
Pear (avg)	38	4
Pineapple	59	7
Plum	39	5
Raisins	64	28
Cantaloupe	65	4
Watermelon	72	4

Food	N	GI[a], Mean ± SE	GI Classification	Serving Size (g)	Available Carbohydrate[b] (g/serving)	GL (per serving)
Bread						
Lavash	12	72 ± 7	High GI	30	18	13
Taftoon	12	79 ± 9	High GI	30	17.67	14
Barbari	12	99 ± 8	High GI	30	17.19	17
Sangak[c]	12	82 ± 6	High GI	30	16	13
Rye	11[d]	84 ± 7	High GI	30	13	11
Barley	11[d]	66 ± 6	Moderate GI	30	14.16	9
Rice						
White rice (Tarom)	11[e]	71 ± 10	High GI	30	24	17
Brown rice (Tarom)	12	65 ± 6	Moderate GI	30	22	14
Lentils:White rice, 1:2	11[e]	79 ± 7	High GI	30	19.5	15.4
Lentils:Brown rice,1:2	11[d]	55 ± 4	Low GI	30	18	10

ON THIS PAGE

Lifestyle recommendation in T2DM *(cont'd)*

protein to less than the generally recom-mended protein intake (129). Reducing the amount of dietary protein below the recommended daily allowance of 0.8 g/kg is not recommended because it does not alter glycemic measures, cardiovascular risk measures, or the rate at which eGFR declines and may increase risk for malnutrition (129).

Growing evidence suggests higher plant protein intake and replacement of animal protein with plant protein is associated with lower risk of all-cause and cardiovascular mortality. A meta-analysis of 13 RCTs showed that replacing animal proteins with plant proteins leads to small improvements in A1C and fasting glucose in adults with type 2 diabetes (130). A 2023 systematic review and meta-analysis of 13 RCTs and 7 cohort studies concluded that there is limited-suggestive evidence to support replacing animal protein with plant-based protein based on a moderate degree of bias in cohort studies (131). However, a prospective observational study of more than 11,000 community-dwelling adults over 22 years of follow-up reported that

poultry, and limited added sugars, sugary beverages, sodium, highly processed foods, refined carbohydrates, saturated fats, and fatty or processed meats.

People with diabetes should be advised to follow the guidelines for the general population for the recommended intakes of saturated fat, cholesterol, and *trans* fat (76). In a 12-week double-blinded randomized controlled feeding study among 61 adults with overweight and obesity, without diabetes, higher intakes of saturated fat, compared with polyunsaturated fat, were found to increase liver fat deposition (140). A 2021 systematic review and meta-analysis including over 22,500 prospective study participants followed for 9.8 years reported that replacing saturated fats with other macronutrients, such as polyunsaturated fats, was associated with reduced CVD occurrence (141). *Trans* fats should be avoided. In addition, as foods high in saturated fats are progressively decreased, they should be replaced with foods high in unsaturated fats and not with refined carbohydrate foods (142).

Evidence does not conclusively sup-

Sodium

As for the general population, people with diabetes are advised to limit their sodium consumption to <2,300 mg/day (50,148). Sodium intake has been shown to mediate glucose metabolism in a number of studies and affect eGFR, so limiting sodium intake is a valuable strategy for people with diabetes with or without kidney disease (148,149). In their post hoc analysis of the DASH-sodium RCT, Morales-Alvarez et al. reported that participants randomized to the low-sodium DASH eating pattern (containing ∼1,150 mg sodium/day [50 mmol sodium/day]) had change in eGFR of −3.10 mL/min/1.73 m^2 (95% CI −5.46 to −0.73) after 4 weeks compared with 3,450 mg sodium/day (150 mmol sodium/day) (150).

Limiting sodium intake is most easily achieved through reducing consumption of processed and ultraprocessed foods, which are major contributors of sodium intake. Encouraging people to avoid adding salt to foods and during cooking can also help. Sodium recommendations should consider palatability,

Influence of diet on insulin sensitivity

Total fatty acids (>40%)	-
trans Fatty acids	-
Monounsaturated fatty acids	+
Fiber cereal	+
Low glycemic index	+
Salt	-
Simple sugars (>10% energy)	-

(+): Increases insulin sensitivity
(-): Decreases insulin sensitivity

Hoyas I. J Clin Med. 2019 Sep; 8(9): 1301.

Lifestyle recommendation in T2DM *(cont'd)*

spective observational study of more than 11,000 community-dwelling adults over 22 years of follow-up reported that those with higher intakes of plant foods and lower intakes of animal foods had lower diabetes risk (132). Plant proteins are lower in saturated fat, higher in fiber, and also support planetary health (133).

Fats

There is no optimal percentage of calories from fat for people with or at risk for diabetes, and macronutrient distribution should be individualized according to the individual's eating patterns, preferences, and metabolic goals (50). The type of fats consumed is more important than total amount of fat when looking at metabolic goals and CVD risk, and the percentage of total calories from saturated fats should be limited (76,134–136). Multiple RCTs including people with type 2 diabetes have reported that a Mediterranean eating pattern can improve both glycemic management and blood lipids (137–139). The Mediterranean eating pattern is based on the traditional eating habits in the countries bordering the Mediterranean Sea. Although

unsaturated fats and not with refined carbohydrate foods (142).

Evidence does not conclusively support recommending n-3 (eicosapentaenoic acid and docosahexaenoic acid) supplements for all people with diabetes for the prevention or treatment of cardiovascular events (50,143). In individuals with type 2 diabetes, two systematic reviews with n-3 and n-6 fatty acids concluded that the dietary supplements did not improve glycemic management (144,145). In the ASCEND (A Study of Cardiovascular Events iN Diabetes) trial, when compared with placebo, supplementation with n-3 fatty acids at a dose of 1 g/day did not lead to cardiovascular benefit in people with diabetes without evidence of CVD (146). However, results from the Reduction of Cardiovascular Events with Icosapent Ethyl-Intervention Trial (REDUCE-IT) found that supplementation with 4 g/day of pure eicosapentaenoic acid significantly lowered the risk of adverse cardiovascular events. REDUCE-IT included 8,179 participants, of whom over 50% had diabetes, and found a 5% absolute reduction in cardiovascular events for individuals with established

adding salt to foods ing can also help. Sodium recommendations should consider palatability, availability, affordability, clinical appropriateness, and the difficulty of achieving low-sodium recommendations in a nutritionally adequate eating plan.

Micronutrients and Other Supplements

Despite lack of evidence of benefit from dietary supplements, consumers continue to take them. Estimates show that up to 59% of people with diabetes in the U.S. use supplements (151). Without underlying deficiency, there is no benefit from herbal or other (i.e., vitamin or mineral) supplementation for people with diabetes (50,152).

Federal law in the U.S. broadly defines dietary supplements as products having one or more dietary ingredients, including vitamins, minerals, herbs or other botanicals, amino acids, enzymes, tissues from organs or glands, or extracts of these (153). It should also be noted that dietary supplements are not regulated like other over-the-counter medications or prescription drugs in the

ADA NUTRITION GUIDELINE

MICRONUTRITION, HERBAL SUPPLEMENT

Vitamin, Mineral supplementation: no benefit in patients without underlying deficiencies	
Antioxidants (vitamins E, C; Carotene)	Not advised due to lack of evidence efficacy and concern to long term safety
Micronutrients (chromium, magnesium, Vitamin D)	Insufficient evidence to recommend routine use to improve glycemic control in patients with diabetes
Cinnamon Other herbs/ supplements	Insufficient evidence to support use for diabetes treatment
Individualize meal planning: optimize food choices to meet recommended micronutrient dietary allowance/intake	

ADA. Diabetes care 2020; 40 (S1): S53-43

Lifestyle recommendation in T2DM *(cont'd)*

found no benefit or mixed results (161–163). Furthermore, adopting healthy lifestyle habits, including the eating patterns recommended herein, are strongly advised. Additional research is needed to define individual characteristics, clinical indicators, and appropriate dosages if and when vitamin D supplementation might benefit people with type 1 or type 2 diabetes.

There is insufficient evidence to support the routine use of herbal supplements and micronutrients, such as cinnamon (164), curcumin (e.g., turmeric), aloe vera, or chromium to improve glycemia in people with type 1 or type 2 diabetes (50).

Metformin is associated with vitamin B12 deficiency per a report from the Diabetes Prevention Program Outcomes Study (DPPOS), which suggests that periodic testing of vitamin B12 levels should be considered in people taking metformin, particularly in those with anemia or peripheral neuropathy (165) (see Section 9, "Pharmacologic Approaches to Glycemic Treatment").

For special populations, including preg-

vegetarians, and people following very-

توصیه به دریافت گروه های غذایی در افراد مبتلا به دیابت نوع ۲

Evaluation of the Quality of Evidence of the Association of Foods and Nutrients With Cardiovascular Disease and Diabetes

A Systematic Review

Five dietary factors (whole grains, yogurt, fiber, cereal fiber, and polyunsaturated fatty acid replacing carbohydrate) had protective associations, whereas 8 (potatoes, unprocessed red meat, processed meat, SSBs, glycemic index, glycemic load, protein, and animal protein) had harmful associations with diabetes. The protective association was largest for yogurt (RR, 0.74; 95% CI, 0.60-0.86 per 244 g/d),[64] and other protective associations ranged from 0.70 to 0.90. Glycemic index (RR, 1.27; 95% CI, 1.15-1.40 per 10 units),[67] glycemic load (RR, 1.26; 95% CI, 1.15-1.37 per 80 g/d/2000 kcal),[67] and SSBs (RR, 1.19; 95% CI, 1.13-1.24 per 244 g/d)[65] were estimated to be the most harmful associations (**Figure 2**, **Figure 3**, and **Figure 4**).

هرم راهنمای غذایی ایرانی

یک واحد نان و غلات: یک کف دست بدون انگشت(معادل ۳۰گرم)، انواع نان ها یا نان لواش ۴ کف دست یا نصف لیوان برنج یا ماکارانی پخته

یک واحد سبزی: یک لیوان سبزی برگی یا نصف لیوان سبزی پخته یا سبزی خام خرد شده یا یک عدد سیب زمینی یا گوجه فرنگی یا پیاز یا خیار متوسط

یک واحد میوه: یک عدد میوه متوسط مانند سیب، پرتقال و .... یا نصف لیوان آب میوه تازه و طبیعی یا نصف لیوان میوه های ریز مثل توت یا یک چهارم لیوان میوه خشک

یک واحد شیر و فرآورده ها: یک لیوان شیر یا یک لیوان ماست کم چرب یا ۶۰-۴۵ پنیر(۲ قوطی کبریت پنیر) یا ۲ لیوان دوغ

یک واحد گوشت: ۶۰گرم گوشت لخم پخته شده یا دو قطعه خورشتی یا نصف ران متوسط یا نصف سینه متوسط مرغ یا دو عدد تخم مرغ

یک واحد حبوبات: نصف لیوان حبوبات پخته یا یک سوم لیوان انواع مغزها(گردو، فندق، بادام، پسته و تخمه

http://www.fao.org/nutrition/education/food-based-dietary-guidelines/regions/countries/iran/en/

Lifestyle recommendations for dyslipidemia

Table 9 Summary of nutrition and lifestyle interventions to lower circulating levels of LDL-C and TG*

Interventions for Lowering LDL-C	Intervention for Lowering TG**
↓ SFAs, TFAs, and dietary cholesterol	↓ Added sugars and refined starches
↑ UFAs intake (5% TDE replacement for SFAs)	↓ Alcohol
↓ Body weight (5-10%), if overweight/obese	↓ Body weight (5-10%), if overweight/obese
↑ Protein, especially plant protein (3-5% TDE)	↑ Protein, especially plant protein (3-5% TDE)
↑ Viscous fiber intake (5-10 g/day)	↑ EPA+DHA intake (2-4 g/day)
↑ Plant stanols/sterols (2 g/day)	↑ Physical activity (≥150 minutes/week)†

*The dietary strategies summarized are within the context of an overall healthy lifestyle that includes a recommended dietary pattern, adequate physical activity, avoidance of tobacco products, adequate sleep quantity and quality, and psychosocial stress management.

**In addition to the interventions listed, individualize the macronutrient composition of the dietary pattern. Many patients will achieve TG reduction with dietary fat intake in the range of 20-40% TDE, whereas a lower fat diet (<20% TDE) may be needed in a small number of patients to maintain TG <750 mg/dL.

†≥150 min/week of moderate-intensity activity (e.g., brisk walking), ≥75 min/week of vigorous-intensity activity (e.g., jogging or running), or the equivalent combination, plus 2-3 days/week of muscle strengthening exercises.[4,5,7,8,143]

Abbreviations: DHA=docosahexaenoic acid; EPA=eicosapentaenoic acid; LDL-C=low-density lipoprotein cholesterol; SFAs=saturated fatty acids; TDE=total daily energy; TG=triglyceride; TFAs=*trans* fatty acids; UFAs=unsaturated fatty acids.

Please cite this article as: Kirkpatrick et al, Nutrition interventions for adults with dyslipidemia: A clinical perspective from the national lipid association, Journal of Clinical Lipidology, https://doi.org/10.1016/j.jacl.2023.05.099

سبک زندگی در افراد مبتلا به دیابت نوع ۲

- مصرف ۳ وعده غذایی اصلی و ۲ تا ۴ میان وعده در طول روز در حجم کم
- مشخص نمودن **ساعات مشخص** در روز جهت مصرف وعده های غذایی و میان وعده‌ها و عدم حذف هر کدام از وعده ها و میان وعده ها
- مصرف میان وعده آخر شب (مانند مصرف یک لیوان شیر در هنگام خواب)
- استفاده از مواد غذایی حاوی کربوهیدرات حاوی مواد مغذی و فیبر بیشتر مانند استفاده از نان‌های سنگگ و تافتون به جای نان لواش یا استفاده از برنج قهوه‌ای به جای برنج سفید، یا استفاده روزانه نصف لیوان حبوبات پخته شده
- مصرف روزانه حداقل ۵ واحد از میوه ها و سبزی های تازه در برنامه غذایی (بخشی از این سبزیجات از سبزی‌های برگ سبز مانند سبزی‌خوردن، کاهو، کلم، کرفس و نیز سبزیجات ریشه‌ای مانند هویج، ترب، شلغم باشد. همچنین به جای آب میوه از میوه استفاده نمایید)

سبک زندگی در افراد مبتلا به دیابت نوع ۲

- مصرف روزانه نصف لیوان از حبوبات پخته شده در برنامه غذایی (مانند عدسی را در وعده صبحانه یا خوراک لوبیا را در وعده ناهار یا شام یا استفاده از غذاهای حاوی حبوبات مانند آش)
- مصرف منابع غذایی غنی از امگا ۳ مانند ماهی، دانه‌ها و مغزدانه‌ها مانند گردو نیز ارده در برنامه غذایی
- استفاده از روغن‌های مفید مانند روغن زیتون و روغن کنجد برای سالاد و روغن‌های کانولا و گلزا برای پخت و پز
- حذف یا کاهش مصرف منابع غذایی حاوی اسیدهای چرب اشباع و ترانس مانند مصرف کره، چربی گوشت قرمز، پوست مرغ، لبنیات پرچرب، بستنی، شکلات، نارگیل، شیر نارگیل، روغن نارگیل و روغن پالم و روغن جامد و نیمه جامد هیدروژنه، غذاهای سرخ شده، غذاهای آماده مانند پیتزا و ساندویچ، کراکر، اسنک‌ها، نان‌های فانتزی و انواع شیرینی، کره گیاهی

سبک زندگی در افراد مبتلا به دیابت نوع ۲

- توصیه به کاهش وزن ۷ تا ۱۰ از وزن بدن در طی ۶ ماه از طریق رعایت یک رژیم غذایی کاهش وزن توام با افزایش فعایت بدنی در صورت ابتلا بودن به اضافه وزن و چاقی
- استفاده از مواد غذایی تخمیرشده مانند کفیر و ماست و مواد غذای پره‌بیوتیک مانند موز، پیاز، سیر، کاسنی و آرتیشو در برنامه غذایی
- کاهش مصرف نمک (مصرف روزانه ۱ قاشق چای‌خوری نمک در برنامه غذایی) و کاهش مصرف مواد غذایی با محتوای سدیم بالا نظیر غذاهای شور، کالباس و سوسیس، پنیر پیتزا، چیپس، پفک و غذاهای کنسروی
- استفاده از چاشنی‌ها و طعم‌دهنده‌ها مانند آبلیمو و سرکه به جای نمک

سبک زندگی در افراد مبتلا به دیابت نوع ۲

- کاهش مصرف نوشیدنی‌های شیرین شده مانند نوشابه و آب میوه، غذاهای پروسه شده با مقادیر زیاد غلات تصفیه شده و قند و شکر، عسل و مربا و نیز مواد غذایی حاوی قند و شکر مانند انواع کیک و شیرینی‌ها و سایر تنقلات شیرین
- عدم مصرف مکمل‌ها (مانند ویتامین D یا کروم) یا داروهای گیاهی و ادویه‌ها (مانند دارچین)، یا مکمل‌های آنتی‌اکسیدان مانند ویتامین E و C جهت کنترل قند خون
- عدم تهیه شیرین کننده‌های مصنوعی مانند آسپارتام، ساخارین، اسه‌سولفام کا، و سوکرالوز را برای کنترل قند خون و وزن


از توجه شما سپاسگزارم

PHYSICAL ACTIVITY

Physical activity

Exercise is essential in **all ages** group for:

- *weight management*
- enhanced physical and psychologic *fitness*
- better *work capacity*
- improved *body composition*
- and *increased HDL cholesterol values*

Exercise offers even greater benefits for persons with type 1 or 2 diabetes

ADA. Diabetes care 2017; 40 (S1): S53-43

Modern nutrition in health and disease. 2014

Physical activity *(cont'd)*

- Maintaining the exercise regimen sustains this enhanced insulin sensitivity on a long-term basis.
- Anaerobic exercise and aerobic exercise both have benefits. However, a combination of these modes may have the greatest effects on insulin sensitivity.
- Physical activity also reduces hemoglobin A1c by about **10** to **20**% .
- Exercise and lower body weight must be sustained to maintain these benefits.

ADA. Diabetes care 2017; 40 (S1): S53-43

Modern nutrition in health and disease. 2014

Physical activity *(cont'd)*

- Physical activity should be an integral part of the treatment plan for diabetes
- At least **150 min/week** of moderate physical activity (**50- 70%** of max heart rate)
- Or at least **90 min/week** of vigorous aerobic exercise (**>70%** of max heart rate)
- Distributed over at least **3 days/week**, with no more than 2 consecutive days without activity.

Krause's Food & nutrition Therapy.2008, p:781

ADA. Diabetes care 2017; 40 (S1): S53-43

Physical Activity *(cont'd)*

Increase of duration and frequency :

- **30 – 45** min moderate aerobic activity, **3 – 5** days/week
- At least **1** hour/ day of moderate (walking)
- **30** min/day vigorous (jogging)
- Engage in 2–3 sessions/week of resistance exercise on nonconsecutive days

To achieve successful long-term weight loss

ADA. Diabetes care 2017; 40 (S1): S53-43

CHO Consumption in Physical Activity

- Add **15 g CHO** for every **30 to 60 min** of activity over and above normal routines
- Moderate exercise for less than **30 min** rarely requires any additional CHO or insulin adjustment if only the blood glucose level is less than 100 mg/dl
- If pre-exercise glucose level are **<100 mg/dl** CHO should ingest

Krause's Food & nutrition Therapy.2008

CHO consumption in physical activity (*cont'd*)

Supplementary CHO is generally not needed:

- in individuals who are not treated with insulin or insulin secretagogues
- Vigorous activity should probably be avoided in the presence of ketosis
- Consuming CHO after exercise → ↓ hypoglycemia

Krause's Food & nutrition Therapy.2008

Exercise In Diabetic Long-Term Complications

- Non-weight-bearing activities such as swimming, bicycling, or arm exercises recommended in sever *peripheral neuropathy*.
- Vigorous aerobic or resistance exercise may be contraindicated in diabetic *retinopathy*.
- No need for any specific exercise restrictions for people with *diabetic kidney disease* (there is no evidence)

ADA. Diabetes care 2017; 40 (S1): S53-43

Physical activity *(cont'd)*

Hypoglycemia is one of the most common risks.

- Check blood glucose levels before and after exercising, consume 15 to 30 g carbohydrate every 30 minutes of exercise, warm up and cool down properly.

- Decrease pre-meal insulin by 20 to 50% and decrease long-acting insulin, avoid injecting short-acting insulin in an extremity that will be vigorously exercised, consume snacks after exercise.

Krause's Food & nutrition Therapy.2008
ADA. Diabetes care 2017; 40 (S1): S53-43

Physical activity *(cont'd)*

Effect of structured exercise

Control weight

↑ Insulin sensitivity

↑ Well-being

↓ HbA1c Significantly

↓ CVD risk factors

↓ TG level

↓ Blood pressure

↓ Regular & long term fitness program

↓ 15-20% usual total dosage of insulin

ADA. Diabetes care 2017; 40 (S1): S53-43