



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



# **Medical Nutrition Therapy IN Diabetes:**

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# Metabolic Disorders:

- **DM<sub>2</sub>**
- **Pre DM**
- **Fatty Liver**
- **Hyperlipidemia**
- **HTN**
- **Overweight & Obesity**



# **Metabolic Disorders:**

- **CVD**
- **STROKE**
- **CANCER**
- **CKD & ESRD**
- **HEPATIC disorder**
- **PAD**





ACHIEVE DESIRED  
OUTCOMES

ACHIEVE TREATMENT  
TARGETS

RECEIVE CARE

DIAGNOSED

DIABETES

نام شاخص ( درصد )	میزان کشوری			اصفهان			کمترین درصد در استان	بیشترین درصد در استان
	سال ۱۳۸۹	سال ۱۳۹۵	سال ۱۳۹۹	سال ۱۳۸۹	سال ۱۳۹۵	سال ۱۳۹۹	سال ۹۹	سال ۹۹
شیوع فشار خون بالا در افراد بالای ۱۸ سال	۱۹.۱	۲۷	۳۲/۰۳	۱۵/۲	۲۵/۴	۳۳/۶۳	هرمزگان ۲۴/۲	گیلان ۴۳/۵
شیوع قند خون بالا در افراد بالای ۲۵ سال	۷/۵	۹/۵	۱۴/۱۵	۸/۳	۱۱/۶۹	۱۳/۶۸	کرمانشاه ۸/۳	مازندران ۱۹/۸
شیوع پره دیابت در افراد بالای ۲۵ سال	—	۱۸/۱	۲۴/۷۹	—	۱۸/۹۹	۱۸/۳۱	چهارمحال و بختیاری ۱۷/۹	گیلان ۳۴/۵
شیوع کلسترول خون بالا در افراد بالای ۲۵ سال	۲۸	۲۲/۵۹	۳۰/۵۸	۳۷/۸	۲۴/۷۴	۳۵/۱۴	هرمزگان ۱۸/۱	گیلان ۴۱
شیوع اضافه وزن در افراد بالای ۱۸ سال	۴۸/۲	۳۶/۵	۳۵/۵۰	۴۴/۲	۳۸/۶۵	۳۸/۳۵	سیستان بلوچستان ۲۶/۴	تهران ۴۲/۸
شیوع چاقی در افراد بالای ۱۸ سال		۲۲/۲۷	۲۴/۹۶		۲۲/۶	۲۵/۲۹	سیستان بلوچستان ۱۲/۵	گیلان ۳۴/۴
شیوع کم تحرکی در افراد بالای ۱۸ سال بالا	۴۰/۱۲	۵۶/۳	۵۱/۳	۳۸/۴	۵۷/۴۳	۵۲/۰۵	آذربایجان غربی ۳۹/۵	یزد ۶۳/۵
شیوع مصرف دو بار میوه در هفته	۱۲	۱۷/۲	۳۷/۰۷	۷/۳	۲۱/۹۱	۳۷/۱۱	سیستان بلوچستان ۱۴	قزوین ۵۷
شیوع مصرف سه بار سبزی در هفته		۴۲/۱۳	۸/۲۹		۴۸/۷	۶/۹۳	سیستان بلوچستان ۲/۳	بوشهر ۲۷/۳
درصد مصرف مواد دخانی در حال حاضر		۱۴/۵۰	۱۴/۰۱		۱۴/۳۵	۱۶/۲۶	خراسان جنوبی ۶/۷	بوشهر ۱۹/۳
مصرف نمک روزانه (mg/dl)		۱۱/۵	۹/۷۱		۹/۰۵	۹/۴۳	بوشهر ۸/۷	کردستان ۱۰/۴۳



# **The only way to save:**

- **Prevention:**
- **Person-Center Treatment**
- **Integrated Care**
- **Individualize Rehabilitation**

# Criteria for the Diagnosis of Diabetes:

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A1C  $\geq 6.5\%$

*OR*

Fasting plasma glucose (FPG)  
 $\geq 126$  mg/dl

*OR*

Two-hour plasma glucose  $\geq 200$  mg/dl during  
an OGTT

*OR*

A random plasma glucose  $\geq 200$  mg/dl



# Pre diabetes:

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**IFG: 100-125 mg/dl**

**IGT: 140 – 199 mg/dl**

**COMBINE prediabetes: IFG + IGT**

## High risk progression to DM<sub>2</sub>:

- **BMI > 35**
- **FBS > 110mg/dl**
- **2hpp: 173-199**
- **A<sub>1</sub>C : > 6%**
- **GDM His<sub>+</sub>**

- Recommendation 3.13 was added to state that more intensive preventive approaches should be considered for individuals who are at particularly high risk of progression to diabetes.



- Recommendation 3.12 was added to communicate that pharmacotherapy (e.g., weight management, minimizing the progression of hyperglycemia, cardiovascular risk reduction) may be considered to support **person-centered care goals** for people at high risk of developing diabetes.

# Outpatient Visit DM:

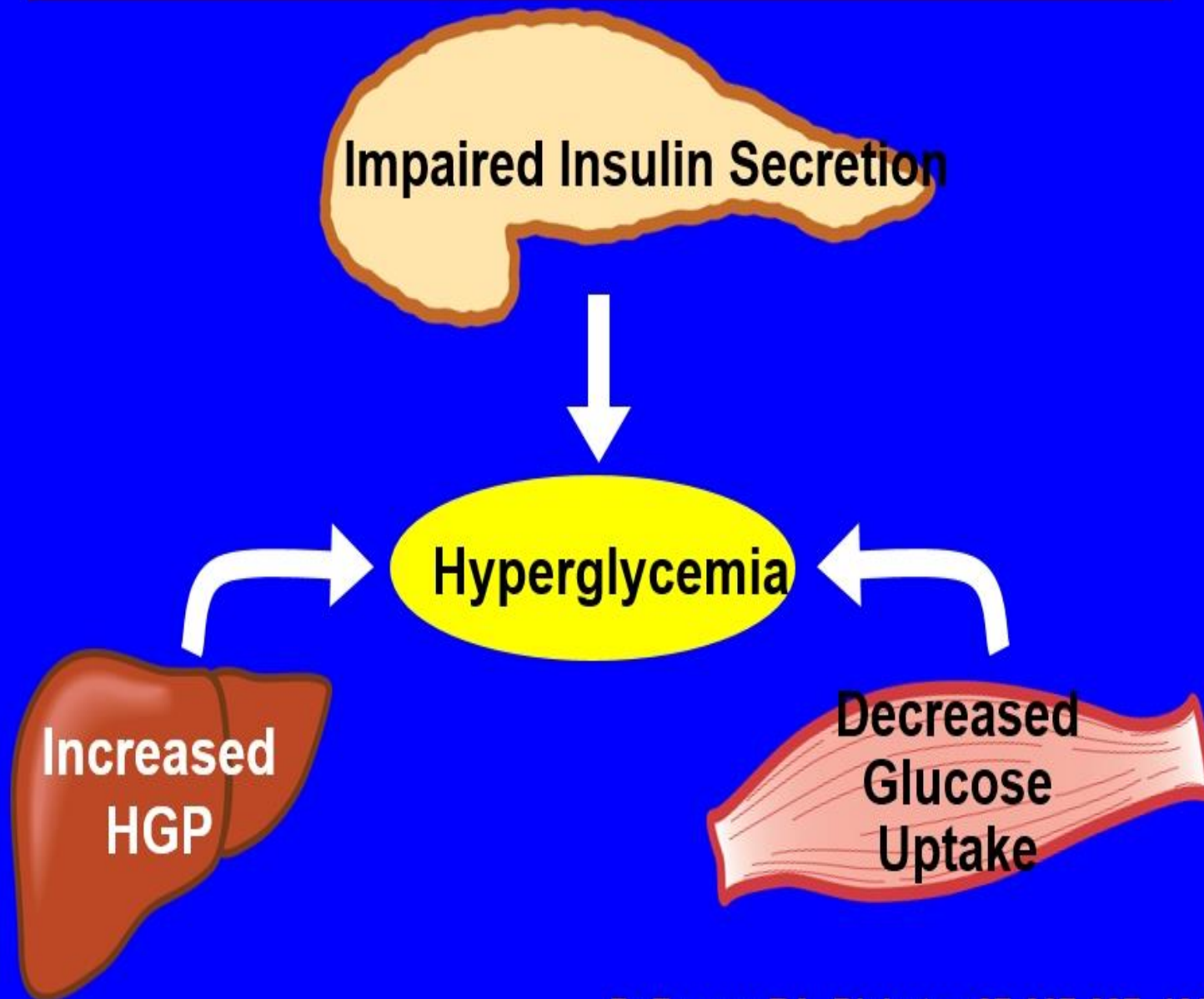
- **General appearance**
  - **Hs**
  - **PE**
  - **Lab**
  - **Referrals**
- 
- **Assessment**
  - **Goal setting**
  - **Treatment plan**

# Classification (continued)

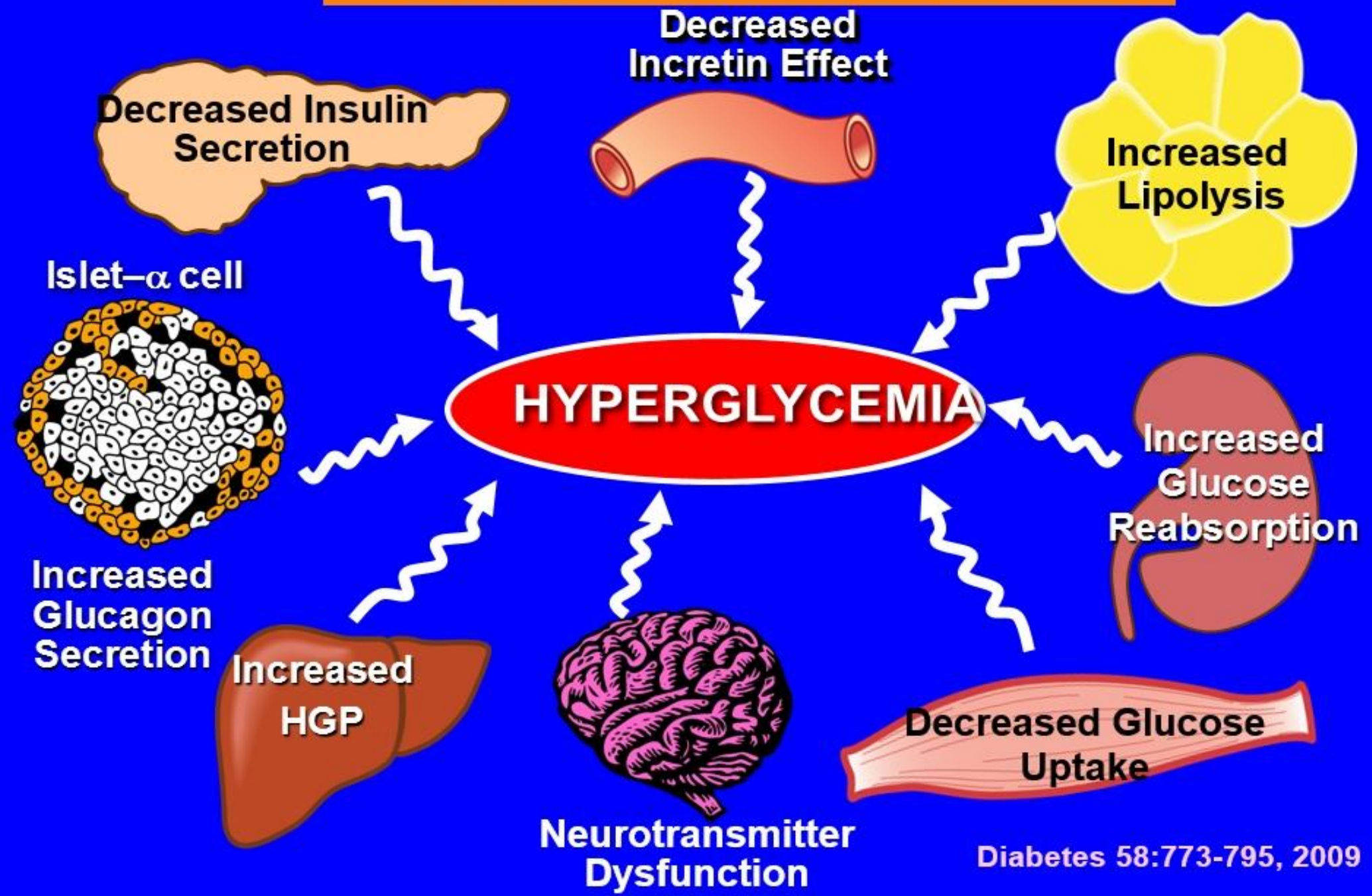
Diabetes can be classified into the following general categories:

1. Type 1 diabetes (due to autoimmune  $\beta$ -cell destruction, usually leading to absolute insulin deficiency, including latent autoimmune diabetes of adulthood)
2. Type 2 diabetes (due to a non-autoimmune progressive loss of adequate  $\beta$ -cell insulin secretion, frequently on the background of insulin resistance and metabolic syndrome)
3. Specific types of diabetes due to other causes, e.g., monogenic diabetes syndromes (such as neonatal diabetes and maturity-onset diabetes of the young), diseases of the exocrine pancreas (such as cystic fibrosis and pancreatitis), and drug- or chemical-induced diabetes (such as with glucocorticoid use, in the treatment of HIV, or after organ transplantation)
4. Gestational diabetes mellitus (diabetes diagnosed in the second or third trimester of pregnancy that was not clearly overt diabetes prior to gestation or other types of diabetes occurring throughout pregnancy, such as type 1 diabetes).

# THE TRIUMVIRATE



# OMINOUS OCTET





# *Management of Type 2 Diabetes Mellitus*

***DX***

***HIS***

***PE***

***LAB + ECG***

***REFFERAL***

***TARGET HBA<sub>1</sub>C***

# HIS:

**Age, DM onset**

**FH**

**Common comorbid:**

**CAD ,HTN, HLP, NAFLD, OSA,  
Micro/Macrovascular com**

**CS & Alcohol**

**PA & Sleep**

**Eating pattern & Weight history& eating disorders**

**Social His & support**

**Medication:**


**Hypoglycemia +/-**

# PE:

- **General appearance\***
- **Weight , WC, BMI**
- **BP : orthostatic +/-**
- **Hand: pulse , skin, nail**
- **Pale +/-**
- **Mouth**
- **Thyroid palpation**
- **Skin exam: acant nig, insulin injection**
- **Foot examination:**

- **Lab**
- **Referrals**
- **Assessment**
- **Goal setting**
- **Treatment plan**

# Laboratory evaluation:

- 
- A1C, if results not available within past 2–3 months
  - If not performed/available within past year
    - Fasting lipid profile, including total, LDL- and HDL-cholesterol and triglycerides
    - Liver function tests
    - Test for urine albumin excretion with spot urine albumin/creatinine ratio
    - Serum creatinine and calculated GFR
    - TSH in type 1 diabetes, dyslipidemia, or women >50 years of age
    - EKG



# Referrals:

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- 
- Annual dilated eye exam
  - Family planning for women of reproductive age
  - Registered dietitian for MNT
  - Diabetes self-management education
  - Dental examination
  - Mental health professional, if needed

# The Risk Calculators:



- **<http://tools.acc.org/ASCVD-Risk-Estimator-Plus>**
- **CKD-EPI Equations for GFR**
- **Fibrosis-4 calculator (FIB-4)**

## Table 4.2—Assessment and treatment plan\*

### Assess risk of diabetes complications

- ASCVD and heart failure history
- ASCVD risk factors (see Table 10.2) and 10-year ASCVD risk assessment
- Staging of chronic kidney disease (see Table 11.1)
- Hypoglycemia risk (Table 4.3)

### Goal setting

- Set A1C/blood glucose target
- If hypertension present, establish blood pressure target
- Diabetes self-management goals (e.g., monitoring frequency)

### Therapeutic treatment plan

- Lifestyle management
- Pharmacologic therapy (glucose lowering)
- Pharmacologic therapy (cardiovascular disease risk factors and renal)
- Use of glucose monitoring and insulin delivery devices
- Referral to diabetes education and medical specialists (as needed)

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ASCVD, atherosclerotic cardiovascular disease. \*Assessment and treatment planning is an essential component of initial and all follow-up visits.

## **Table 4.3—Assessment of hypoglycemia risk**

Factors that increase risk of treatment-associated hypoglycemia

- Use of insulin or insulin secretagogues (i.e., sulfonylureas, meglitinides)
- Impaired kidney or hepatic function
- Longer duration of diabetes
- Frailty and older age
- Cognitive impairment
- Impaired counterregulatory response, hypoglycemia unawareness
- Physical or intellectual disability that may impair behavioral response to hypoglycemia
- Alcohol use
- Polypharmacy (especially ACE inhibitors, angiotensin receptor blockers, nonselective  $\beta$ -blockers)

# Comprehensive Medical Evaluation and Assessment of Comorbidities:

- **Assessment and treatment plan**

- Assessing risk of diabetes complications
- ASCVD and heart failure history
- ASCVD risk factors and 10-year ASCVD risk assessment
- Staging of chronic kidney disease (see Table 11.1)
- Hypoglycemia risk (see Table 4.3)
- Assessment for retinopathy
- Assessment for neuropathy

- **Goal setting**

- Set A1C/blood glucose/time-in-range target
- If hypertension is present, establish blood pressure target
- Diabetes self-management goals

- **Therapeutic treatment plans**

- Lifestyle management
- Pharmacologic therapy: glucose lowering
- Pharmacologic therapy: cardiovascular and renal disease risk factors
- Use of glucose monitoring and insulin delivery devices
- Referral to diabetes education and medical specialists (as needed)



# Assessment:



CVD & HF risk:

- 1- [http://tools.acc.org/ASCVD-Risk-Estimator- Plus](http://tools.acc.org/ASCVD-Risk-Estimator-Plus)
- 2- EF- LVH – Diastolic dysfunction

- CKD risk:

CKD-EPI Equations for GFR

Hepatic Fibrosis:

FIB-4 calculator

Hypoglycemic risk:

Table 4.3

Assessment for retinopathy:

Assessment for neuropathy:

## Goal setting:

- Weight Target
- LDL Target
- BP Target
- A1c Target
- Diabetes self-management goals

# Goal setting:



- **LDL** : <55 ,<70 ,<100      CVD risk
- **BP** : <130/80      CVD & Renal risk
- **Glycemic control** : Cardiorenal & hypoglycemic risk
- Hepatic Fibrosis : **FIB-4** and fibrosis stage
- **Weight Management & behavior therapy**
- Self-management goals

# NAFLD/NASH:

- Significant fibrosis correlated with CAD
- Screening with **FIB-4** score for: DM, PreDM, Cardiometabolic risk factors
- FIB-4 estimated risk of liver cirrhosis.
- FIB-4 : **<1.3** = lower risk  
**>2.67**=high probability of advance fibrosis (**F3 –F4**)

Confirmatory TEST:

## Limitations of FIB-4:

- No valid in  $< 35y$
- Higher cutoff in age  $> 65y$  :  $1.9 - 2$      $instat > 1.3$

# Patient Case 3

**Name:** Rita E (female)

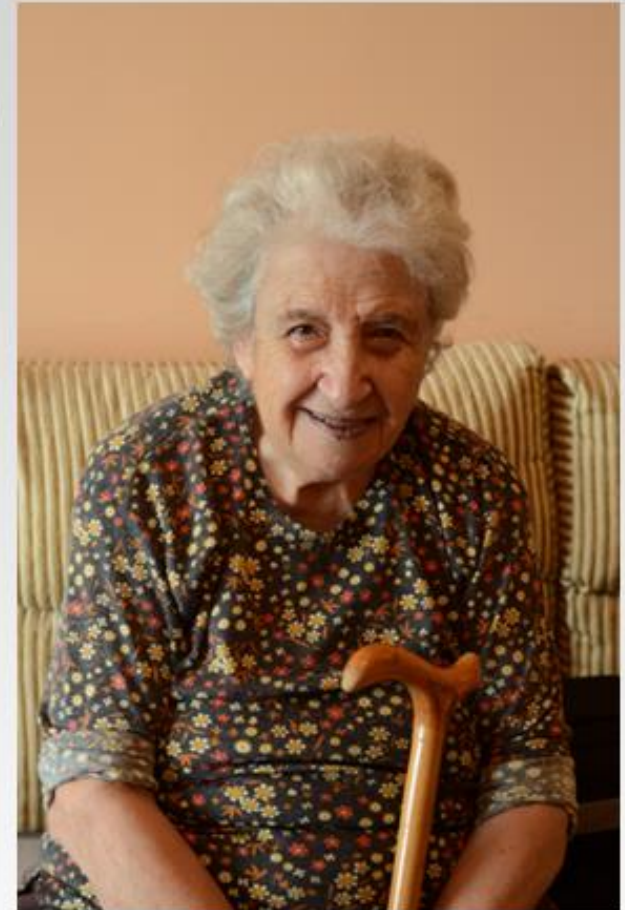
**Age:** 85

**Diabetes History:**

Diagnosed with T2D 10 years ago

**Profile:**

- Reduced renal function (eGFR: 45 mL/min)
- History of angina
- Living alone; passive/sedentary
- Increasing thirst and having to get up at night to pass water; tired
- HbA1c of 8.5% on metformin (1000 mg bid)



# Patient Case No. 1: Mike

- 47-year-old man diagnosed with T2D 7 years ago
- Initially treated without pharmacological agents
- FPG improved from 189 mg/dl to 166 mg/dl in 6 months
- HbA<sub>1c</sub> barely improved from 8.1% to 7.9%





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# Which phenotypes?



# Which phenotypes?



- **Established CVD or very high risk for CVD**
- **HF :preserved/Mild reduced/Reduced EF**
- **CKD :Albuminuria + ;    Albuminuria –**
- **NAFLD /NASH**
- **Pancreatitis History**

# Which phenotypes?

- **Overweight , Obese**
- **Hypoglycemic risk**
- **Eating disorder**
- **Cognition disease**
- **FRX risk**
- **COST considerations**

# Lifestyle Therapy:



- **Medical nutrition therapy**
- **Regular physical activity**
- **Sufficient amounts of sleep**
- **Behavioral support**
- **Smoking cessation and avoidance of all tobacco products.**

# Goals of Nutrition Therapy for Adults With Diabetes

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Achieve and maintain body weight goals

- Attain individualized glycemic, blood pressure, and lipid goals
- Delay or prevent the complications of diabetes

- MNT is associated with A1C absolute decreases of 1.0–1.9% for people with type 1 diabetes and 0.3–2.0% for people with type 2 diabetes.

# **Eating Disorder:**

- **Binge eating**
- **Night eating**
- **Insulin omission**
- **Bulimia**
- **Anorexia Nervosa**
- **Food craving**

- **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 plan.

- Eating pattern(s) or food pattern(s).
- The totality of all foods and beverages consumed over a given period of time.

- Examples of eating patterns include:

Mediterranean style

Dietary Approaches to Stop Hypertension (DASH),  
low-carbohydrate vegetarian

plant based



- 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 the person with diabetes and the RDN.
- The eating plan could incorporate an eating pattern combined with a strategy or method to direct some of the choices.
- Eating plans are based on the individual's usual eating style.

- **Dietary approach**

- Method or strategy to individualize a desired eating pattern and provide a practical tool(s) for developing healthy eating patterns. Examples of dietary approaches include the:
  - plate method,
  - carbohydrate choice,
  - carbohydrate counting,
  - highly individualized behavioral approaches

- Evidence suggests that there is not an ideal percentage of calories from carbohydrate, protein, and fat for people with diabetes.
- Therefore, macronutrient distribution should be based on an individualized assessment of current eating patterns, preferences, and metabolic goals.

- Until the evidence around benefits of different eating patterns is strengthened, health care professionals should **focus on the core dimensions common among patterns**: inclusion of
- Non starchy vegetables, whole fruits, legumes, whole grains, nuts, seeds, and low-fat dairy products and minimizing consumption of meat, sugars sweetened beverages, sweets, refined grains, and ultra processed foods.

- 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.

- Dietary Approaches/Methods Few head-to-head studies have compared different dietary approaches.
  - In a systematic review and meta-analysis of carbohydrate counting versus other forms of dietary advice (standard education, low glycemic index, and fixed carbohydrate quantities), **no significant differences were seen in A1C levels compared with standard education .**

- In another RCT, a simplified carbohydrate counting tool based on individual glycemic response was noninferior to conventional carbohydrate counting in 85 adults with type 1 diabetes . In a randomized crossover trial, **carbohydrate counting** and **qualitative meal size** (low, medium, and high carbohydrate) were compared.
- Time in range was 74% for carbohydrate counting and 70.5% for the quantitative meal size estimates

- An RCT found that two meal-planning approaches ([diabetes plate method](#) and [carbohydrate counting](#)) were effective in helping achieve **improved A1C** .
- The diabetes plate method is a commonly used visual approach for providing basic meal planning guidance in type 1 and type 2 diabetes.
- This simple graphic (featuring a 9-inch plate) shows how to portion foods (one-half of the plate for non-starchy vegetables, one-quarter of the plate for protein, and one-quarter of the plate for carbohydrates).



- Carbohydrate counting is a more advanced skill that helps plan for and track how much carbohydrate is consumed at meals and snacks.
- Meal planning approaches should be customized to the individual, including their numeracy and food literacy level. Health numeracy refers to understanding and using numbers and numerical concepts in relation to health and self management.

# Intermittent fasting or time-restricted eating:

- Intermittent fasting or time-restricted eating as strategies for weight and glucose management have been studied and have gained popularity.
- Intermittent fasting is an umbrella term that includes three main forms of restricted eating: alternate-day fasting (energy restriction of 500–600 calories on alternate days), the 5:2 diet (energy restriction of 500– 600 calories on consecutive or nonconsecutive days with usual intake the other five), and time-restricted eating (daily calorie restriction based on window of time of 8–15 h).
- Each produces mild to moderate weight loss (3–8% loss from baseline) over short durations (8–12 weeks) with no significant differences in weight loss when compared with continuous calorie restriction.
- People with diabetes who are on insulin and/or secretagogues should be medically monitored during the fasting period.

Table 5.1—Medical nutrition therapy recommendations

	Recommendations
Effectiveness of nutrition therapy	<p>5.9 An individualized medical nutrition therapy program as needed to achieve treatment goals, provided by a registered dietitian nutritionist, preferably one who has comprehensive knowledge and experience in diabetes care, is recommended for all people with type 1 or type 2 diabetes, prediabetes, and gestational diabetes mellitus. <b>A</b></p> <p>5.10 Because diabetes medical nutrition therapy can result in cost savings <b>B</b> and improved cardiometabolic outcomes, <b>A</b> medical nutrition therapy should be adequately reimbursed by insurance and other payers. <b>E</b></p>
Energy balance	<p>5.11 For all people with overweight or obesity, behavioral modification to achieve and maintain a minimum weight loss of 5% is recommended. <b>A</b></p>
Eating patterns and macronutrient distribution	<p>5.12 For diabetes prevention and management of people with prediabetes or diabetes, recommend individualized meal plans that keep nutrient quality, total calories, and metabolic goals in mind, <b>B</b> as data do not support a specific macronutrient pattern.</p> <p>5.13 Food-based dietary patterns should emphasize key nutrition principles (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) in people with prediabetes and diabetes. <b>B</b></p> <p>5.14 Consider reducing overall carbohydrate intake for adults with diabetes to improve glycemia, as this approach may be applied to a variety of eating patterns that meet individual needs and preferences. <b>B</b></p>

## Carbohydrates

- 5.15 Emphasize minimally processed, nutrient-dense, high-fiber sources of carbohydrate (at least 14 g fiber per 1,000 kcal). **B**
- 5.16 People with diabetes and those at risk are advised to replace sugar-sweetened beverages (including fruit juices) with water or low-calorie or no-calorie beverages as much as possible to manage glycemia and reduce risk for cardiometabolic disease **B** and minimize consumption of foods with added sugar that have the capacity to displace healthier, more nutrient-dense food choices. **A**
- 5.17 Provide education on the glycemic impact of carbohydrate, **A** fat, and protein **B** tailored to an individual's needs, insulin plan, and preferences to optimize mealtime insulin dosing.
- 5.18 When using fixed insulin doses, individuals should be provided with education about consistent patterns of carbohydrate intake with respect to time and amount while considering the insulin action time, as it can result in improved glycemia and reduce the risk for hypoglycemia. **B**

## Protein

- 5.19 For people with type 2 diabetes, consider avoiding carbohydrate sources high in protein when treating or preventing hypoglycemia, as ingested protein appears to increase insulin response without increasing plasma glucose concentrations. **B**

## Dietary fat

- 5.20 Counsel people with diabetes to consider an eating plan emphasizing elements of a Mediterranean eating pattern, which is rich in monounsaturated and polyunsaturated fats and long-chain fatty acids such as fatty fish, nuts, and seeds, to reduce cardiovascular disease risk **A** and improve glucose metabolism. **B**

Micronutrients and herbal supplements	<p>5.21 Dietary supplementation with vitamins, minerals (such as chromium and vitamin D), herbs, or spices (such as cinnamon or aloe vera) are not recommended for glycemic benefits. Health care professionals should inquire about intake of supplements and counsel as needed. <b>C</b></p> <p>5.22 Counsel against <math>\beta</math>-carotene supplementation, as there is evidence of harm for certain individuals and it confers no benefit. <b>B</b></p>
Alcohol	<p>5.23 Advise adults with diabetes who consume alcohol to not exceed the recommended daily limits (one drink per day for adult women and two drinks per day for adult men). <b>C</b> Advise abstainers to not start to drink, even in moderation, solely for the purpose of improving health outcomes. <b>C</b></p> <p>5.24 Educating people with diabetes about the signs, symptoms, and self-management of delayed hypoglycemia after drinking alcohol, especially when using insulin or insulin secretagogues, is recommended. The importance of monitoring glucose after drinking alcoholic beverages to reduce hypoglycemia risk should be emphasized. <b>B</b></p>
Sodium	<p>5.25 Counsel people with diabetes to limit sodium consumption to <math>&lt;2,300</math> mg/day. <b>B</b></p>
Nonnutritive sweeteners	<p>5.26 Counsel people with prediabetes and diabetes that water is recommended over nutritive and nonnutritive sweetened beverages. However, the use of nonnutritive sweeteners as a replacement for sugar-sweetened products in moderation is acceptable if it reduces overall calorie and carbohydrate intake. <b>B</b></p>

# Carbohydrates

- Studies examining the 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.

- Systematic reviews and meta-analyses of RCTs
- found carbohydrate-restricted eating patterns, particularly those considered low carbohydrate (<26% total energy), were effective in reducing A1C in the short term(<6 months), with less difference in eating patterns beyond 1 year.



- A systematic review and meta-analysis of RCTs investigating the dose-dependent effects of carbohydrate restriction found each 10% decrease in carbohydrate intake had reductions in levels of A1C, fasting plasma glucose, body weight, lipids, and systolic blood pressure at 6 months, but favorable effects diminished and were **not maintained at follow-up or at greater than 12 months.**



- In addition, very-low-carbohydrate eating plans are not currently recommended for:
- Individuals who are pregnant or lactating, people who have renal disease,
- people with or at risk for disordered eating,
- Those taking **sodium–glucose cotransporter 2 inhibitors** because of the potential risk of euglycemic ketoacidosis.

- Regardless of the amount of carbohydrate in the meal plan, focus should be placed on high-quality, nutrient-dense carbohydrate sources that are high in fiber and minimally processed.
  - The addition of dietary fiber modulates composition of gut microbiota and increases gut microbial diversity.

# Protein

- There is no evidence that adjusting the daily level of protein intake (typically 1–1.5 g/kg body weight/day or 15–20% of total calories) will improve health, and research is inconclusive regarding the ideal amount of dietary protein to optimize either glycemic management or CVD risk .
- Therefore, protein intake goals should be individualized based on current eating patterns. Some research has found successful management of type 2 diabetes with meal plans including slightly higher levels of protein (20–30%), which may contribute to increased satiety.

- Historically, low-protein eating plans were advised for individuals with diabetic kidney disease (DKD) (with albuminuria and/or reduced estimated glomerular filtration rate); however, current evidence **does not suggest that people with DKD need to restrict protein to less than the generally recommended protein intake .**

- 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 glomerular filtration rate declines and may **increase risk for malnutrition** .

- Strong 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 in the Women's Health Initiative cohort study.
- A meta-analysis of 13 RCTs showed replacing animal with plant proteins leads to small improvements in A1C and fasting glucose in individuals with type 2 diabetes .
- Plant proteins are lower in saturated fat and support planetary health.

# Fats

- Evidence suggests that there is not an optimal percentage of calories from fat for people with or at risk for diabetes and that macronutrient distribution should be individualized according to the individual's eating patterns, preferences, and metabolic goals .
- The **type of fats consumed is more important than total amount of fat** when looking at metabolic goals and CVD risk, and it is recommended that the percentage of total calories from saturated fats should be limited.

- It is recommended that the percentage of total calories from saturated fats should be limited .
- Multiple RCTs including people with type 2 diabetes have reported that a **Mediterranean eating pattern** can improve both glycemic management and blood lipids



# EPA:

- However, results from the REDUCE-IT found that supplementation with **4 g/day** of pure eicosatetraenoic acid significantly lowered the risk of adverse cardiovascular events.
- This trial of **8,179** participants, in which over 50% had diabetes, found a 5% absolute reduction in cardiovascular events for individuals with established atherosclerotic CVD taking a preexisting statin with residual hypertriglyceridemia (**135–499 mg/dL** )

- People with diabetes should be advised to follow the guidelines for the general population for the recommended intakes of saturated fat, dietary cholesterol, and trans fat.

# Micronutrients and Supplements:

- Without underlying deficiency, there is no benefit from **herbal** or **non herbal** (i.e., vitamin or mineral) supplementation for people with diabetes.
- Routine **antioxidant** supplementation (such as vitamins E and C) is not recommended due to lack of evidence of efficacy and concern related to long-term safety.

# **Micronutrients and Supplements:**

- In addition, there is insufficient evidence to support the routine use of herbal supplements and micronutrients, such as cinnamon , curcumin, vitamin D , aloe vera, or chromium, to improve glycemia in people with diabetes.

- Vitamin D supplementation:
- 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.

- **For special populations, including:**

- pregnant
- lactating individuals,
- older adults,
- vegetarians,
- people following very low-calorie
- low-carbohydrate diets,

a multivitamin may be necessary.

