Diabetes mellitus

Contents

Introduction

- **Diabetes Mellitus (DM) is a chronic metabolic disorder characterized by elevated blood glucose levels due to defects in insulin secretion, insulin action, or both.**
- **Diabetes leads to disturbances in carbohydrate, fat, and protein metabolism and may result in long-term damage to organs such as the heart, kidneys, eyes, nerves & blood vessels.**

Burden of Diabetes

🌎 **Global Burden:** Affects **~537 million adults (20–79 years)** worldwide

Nearly **44–50% remain undiagnosed**

Major contributor to **cardiovascular disease, kidney failure, blindness**

IN Indian Burden

India has **~101 million people with diabetes making it one of the countries with the largest diabetes burden globally.**

Prevalence: **~11–12% in adults**

Prediabetes: **~15% population** (high future risk)

Urban prevalence > rural; rapidly increasing in younger age groups

Signs and Symptoms

The classical symptoms of diabetes are known as the three Ps:

- Polyuria – frequent urination
- Polydipsia – excessive thirst
- Polyphagia – excessive hunger

Other symptoms include:

- Unexplained weight loss
- Fatigue and weakness
- Blurred vision
- Slow wound healing
- Recurrent infections (skin, urinary tract, fungal infections)
- Tingling or numbness of hands and feet

When to suspect Diabetes

Diabetes should be suspected in the following situations:

- Adults ≥30 years with risk factors
- Presence of classical symptoms (polyuria, polydipsia, polyphagia)
- Random blood glucose ≥200 mg/dL
- Recurrent infections or delayed wound healing
- Family history of diabetes
- Unexplained weight loss

Importance of Diabetes Screening

🔍 **Early detection: Many individuals with diabetes remain asymptomatic in early stages.**

🛡 **Prevention of complications: Early diagnosis reduces the risk of complications such as cardiovascular disease, kidney failure and blindness.**

💰 **Reduction in healthcare costs: Early detection and management prevent hospital admissions and expensive treatments.**

😊 **Improved quality of life: Early lifestyle modification and treatment slow disease progression.**

⚕ **Identification of prediabetes: Screening allows early preventive interventions before diabetes develops.**

Who should be screened

Adults ≥30 years of age should undergo screening for diabetes, especially if risk factors are present.

High-risk groups include:

- Overweight or obese individuals
- Family history of diabetes
- Hypertension
- Sedentary lifestyle
- Women with gestational diabetes
- Individuals with abdominal obesity

Screening and Confirmatory test

Screening Tests

- 🧪 **Random Blood Glucose (RBG)**
- 🧪 **Urine Glucose (RBG)**

Confirmatory Tests

- 🧪 **Fasting Blood Glucose (FBG)**
- 🧪 **Oral Glucose Tolerance Test (OGTT)**
- 🧪 **HbA1c Test**

Steps of Checking Capillary Blood Glucose at Home

1. **Wash hands with soap and water and dry them. Insert the test strip into the glucometer.**
2. **Clean the fingertip with an alcohol swab and allow it to dry.**
3. **Use a lancet to prick the side of the fingertip.**
4. **Allow a drop of blood to touch the test strip placed in the glucometer.**
5. **Wait a few seconds for the blood glucose value to appear on the screen and record it. (3)**

Steps of Checking Capillary Blood Glucose at Home

Diagnostic Criteria for Diabetes Mellitus

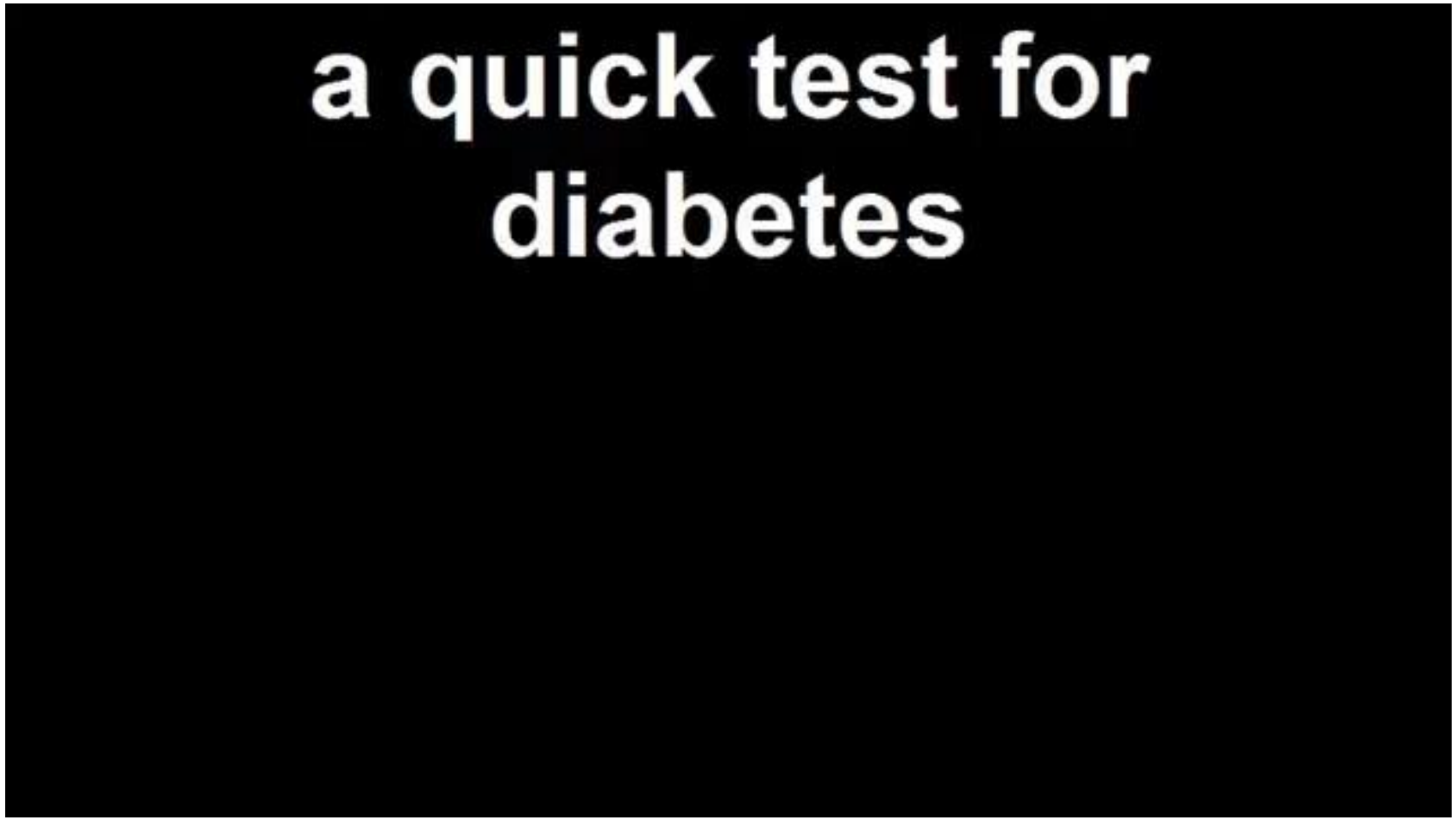
Test	Diagnostic Value
Fasting Plasma Glucose	≥126 mg/dL (after 8 hours fasting)
Random Blood Glucose	≥200 mg/dL with symptoms
Oral Glucose Tolerance Test	≥200 mg/dL
HbA1c	≥6.5%

These diagnostic criteria are recommended by international diabetes guidelines.

Urine Sugar Examination (Dipstick Method)

1. Collect fresh midstream urine in a clean container.
2. Dip the urine glucose dipstick into the sample for about 1–2 seconds.
3. Remove excess urine by gently tapping the strip.
4. Wait 30–60 seconds for color development.
5. Compare the color change with the standard color chart provided on the strip container.

Urine Sugar Examination (Dipstick Method)



Urine Sugar Examination (Dipstick Method)

Dipstick Result	Approximate Glucose Level
Negative	No glucose detected
Trace	~100 mg/dL
+	~250 mg/dL
++	~500 mg/dL
+++	~1000 mg/dL

Repeated positive urine sugar (≥+) should prompt blood glucose testing for confirmation of diabetes.

Urine sugar testing is mainly used as a screening tool in community settings.

Risk factors of Diabetes

Non-Modifiable Risk Factors	Modifiable Risk Factors
Age (>40 years)	Obesity (BMI ≥25 kg/m^2), Central Obesity
Family history (first-degree relative)	Less Physical inactivity
Ethnicity (South Asians high risk)	Unhealthy diet (high sugar/fat)
History of gestational diabetes	Tobacco use
	Alcohol consumption
	Stress

Non-Modifiable Risk Factors (Diabetes)

Age: Risk increases after **40 years** due to insulin resistance

Family History: 2–4 times higher risk in first-degree relatives

Ethnicity: South Asians more prone due to central obesity

History of GDM: Women have higher future risk of type 2 diabetes

Family History

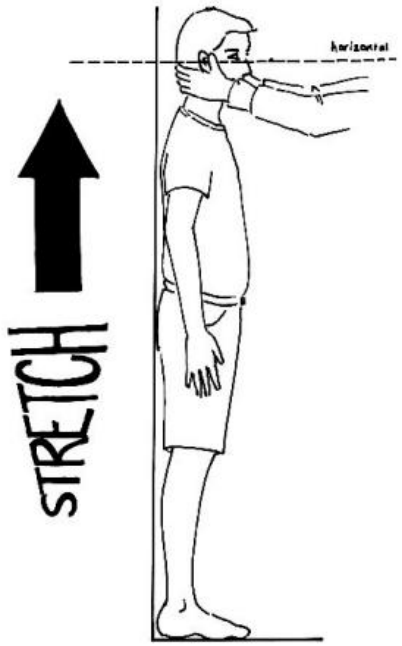
- **First-Degree Relatives (FDR):** Closest biological relatives with **no intermediary** → Share **~50% genes**
- **Second-Degree Relatives (SDR):** One relative in between → Share **~25% genes**
- Risk is more for inherited diseases in First degree relatives compared to second degree relatives
- Thus need of screening increased for First degree relatives with DM

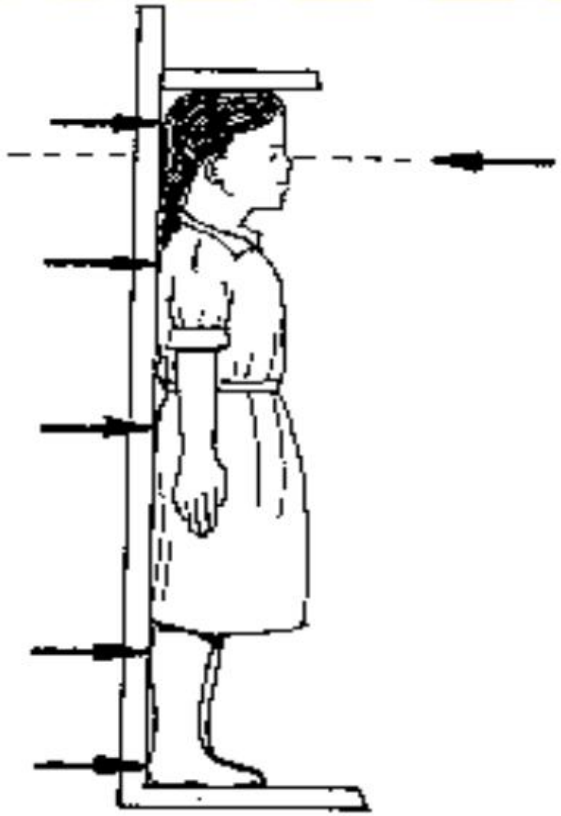
Degree	Definition	Genetic Share	Includes
First Degree	Direct biological relatives (no one in between)	~50%	Parents, Full siblings, Children
Second Degree	One relative in between	~25%	Grandparents, Grandchildren, Aunts/Uncles, Nieces/Nephews, Half-siblings

Obesity

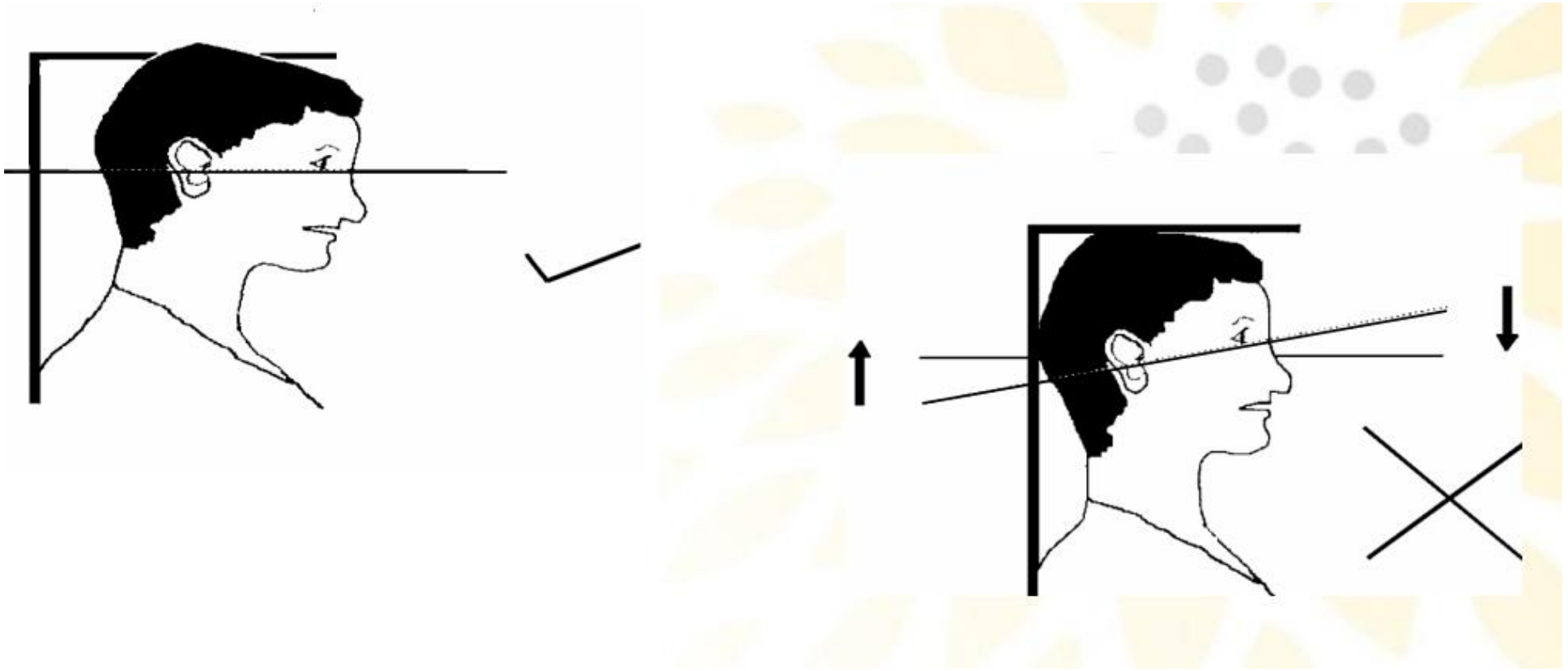
- **Definition:** Excess fat causing insulin resistance
- **Criteria:** BMI ≥25 kg/m² (Indians), Waist >90 cm (M), >80 cm (F)
- **Mechanism:** ↑ Free fatty acids → ↓ insulin sensitivity
- **Key Message:** 5–10% weight loss → ↓ diabetes risk significantly

Measuring Height





Measuring Height



Measuring Weight

Body Mass Index (BMI)

BMI = Weight (kg) ÷ Height (m^2)

BMI Classification for Asian populations:

BMI	Category
<18.5	Underweight
18.5–22.9	Normal
23–24.9	Overweight
≥25	Obese

Waist circumference/ Central obesity

This will be measured at the level of umbilicus

Cut offs: Male: 90 cm and Female: 80 cm

Physical activity

- **Definition:** <150 min/week activity
- **Mechanism:** ↓ glucose utilization → ↑ insulin resistance
- **Recommendation:** 30 min/day brisk activity
- **Key Message:** Exercise reduces diabetes risk by **30–40%**

Classification of Physical activities

Metabolic Equivalent (MET) is a unit used to estimate the **energy expenditure of physical activities** relative to resting metabolic rate.

*** 1 MET** is defined as the **energy expended while sitting quietly at rest i.e., 1 kcal/kg/hour.**

Category	MET Range	Description	Examples	Talk Test
Sedentary Work	≤ 1.5 METs	Minimal movement; sitting or lying	Desk work, driving, computer use	Can sing easily
Light Work	1.6 – 3.0 METs	Mild activity; no significant ↑ HR	Cooking, slow walking, light chores	Can sing comfortably
Moderate Work	3.0 – 6.0 METs	Noticeable ↑ heart rate, mild sweating	Brisk walking, mopping, gardening	Can talk, not sing
Vigorous Work	> 6.0 METs	High-intensity effort; rapid breathing	Construction work, heavy lifting, farming	Only few words possible

Unhealthy Diet

- **High intake of sugar, refined carbs, saturated fats**
- **Low fiber (<25 g/day)**
- **Mechanism:** Causes obesity + insulin resistance
- **Recommendation:** Whole grains, fruits (≥400 g/day), low sugar
- **Key Message:** Balanced diet prevents diabetes

Tobacco and Alcohol

Tobacco:

Causes insulin resistance + vascular damage

Alcohol:

Safe limit: ≤140 ml/week (men), ≤70 ml/week (women)

Excess → ↑ blood sugar fluctuations

Indian Diabetes Risk Score (IDRS)

The Indian Diabetes Risk Score (IDRS) was developed by the Madras Diabetes Research Foundation to identify individuals at high risk of diabetes in community settings. It uses four simple parameters:

- Age
- Abdominal obesity
- Physical activity
- Family history of diabetes

IDRS Scoring

Age	Score
<35 years	0
35–49 years	20
≥50 years	30

Waist Circumference	Score
Female <80 cm / Male <90 cm	0
Female 80–89 cm / Male 90–99 cm	10
Female ≥90 cm / Male ≥100 cm	20

Family History	Score
No diabetic parents	0
One diabetic parent	10
Both diabetic parents	20

Activity Level	Score
Regular exercise + strenuous work	0
Regular exercise or strenuous work	20
No exercise + sedentary work	30

IDRS interpretation

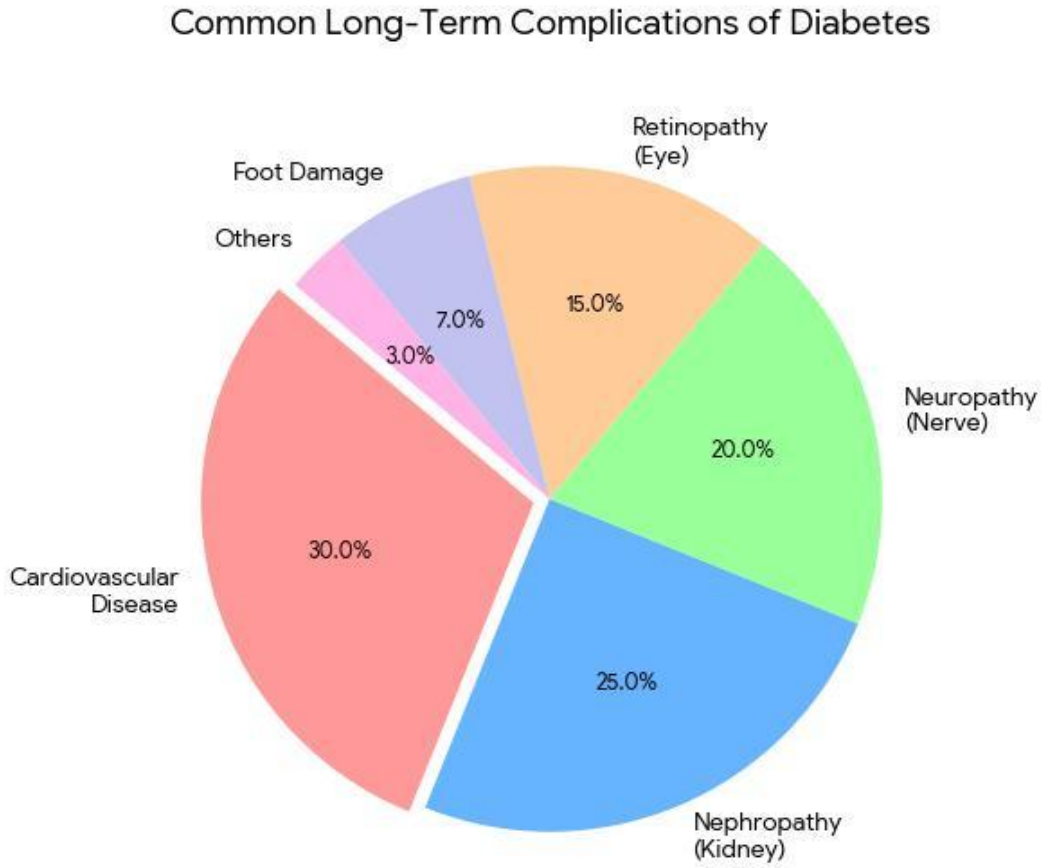
Score	Risk Level
<30	Low risk
30–50	Moderate risk
≥60	High risk

IDRS is widely used in community screening programs in India because it is simple, inexpensive and does not require laboratory tests.

Complications of Diabetes

Complication	Description
Retinopathy	Vision loss due to retinal damage
Nephropathy	Kidney damage
Neuropathy	Nerve damage (burning feet)
CAD/Stroke	Atherosclerosis
Diabetic foot	Ulcers, gangrene

Prevalence of Diabetes Complications



Early Detection of Complications

Complication	Early Signs (Community Level)
Retinopathy	Blurred vision **Vision screening**
Neuropathy	Tingling, numbness **Monofilament test**
Nephropathy	Feet Swelling, frothy urine **Urine albumin test**
CAD	Chest pain, Exertion, Breathlesness **Blood pressure, ECG referral**
Foot ulcers	Non-healing wounds **Foot examination**

Prevention of Complications

Step	Recommendation
Blood sugar control	HbA1c <7%
Diet	🍭 Reduce sugar intake and avoid sweetened beverages and refined carbohydrates. 🥦 Eat high-fiber foods, Include vegetables, fruits, whole grains and pulses to improve glycemic control
Exercise	At least 30 minutes of brisk walking daily for 5 days per week.
Weight	Maintain BMI 18.5–23 kg/m^2 and waist circumference below recommended limits
Foot care	Daily inspection

Prevention of Complications

Step	Recommendation
Screening	🔎 Regular annual eye and kidney screening. Adults should check blood glucose annually after age 30.
Life style	🚭 Avoid smoking and alcohol consumption 🧘 Stress management: Practice yoga or meditation and maintain 7–8 hours of sleep daily.
Medication adherence	💊 Medication adherence Take prescribed medications regularly and monitor blood glucose levels.

Recommended Diet for Diabetes

Definition of One Serving	
Food	**One Serving**
Vegetables	1 cup raw or ½ cup cooked
Fruits	1 medium fruit
Whole grains	½ cup cooked grains
Pulses	½ cup cooked
Milk	200 ml

Recommended Intake

- 🥦 **Vegetables: 4–5 servings/day**
- 🍎 **Fruits: 2–3 servings/day**
- 🌾 **Whole grains: 6–8 servings/day**
- 🫘 **Pulses/legumes: 2 servings/day**
- 🥛 **Low-fat milk or curd: 1–2 servings/day**

Recommended Diet for Diabetes

Category	Foods to Limit (High GI >70)	Foods to Prefer (Low GI <55)
Cereals & Grains	White rice, polished rice, maida, white bread	Brown rice, whole wheat, oats, barley, millets (ragi, jowar)
Breakfast Foods	Cornflakes, puffed rice (poha), instant cereals	Oats porridge, vegetable upma, dalia
Snacks	Biscuits, cakes, pastries, chips	Nuts (almonds, peanuts), roasted chana
Fruits	Watermelon, ripe banana, pineapple	Apple, orange, guava, pear

Recommended Diet for Diabetes

Category	Foods to Limit (High GI >70)	Foods to Prefer (Low GI <55)
Vegetables	Potato, sweet potato (large amounts)	Green leafy vegetables, broccoli, beans, cucumber
Sugars & Sweets	Sugar, jaggery, honey, sweets, soft drinks	Avoid or minimal use; use **non-nutritive sweeteners if needed**
Beverages	Sweetened tea/coffee, fruit juices, sodas	Unsweetened tea, black coffee, buttermilk, lemon water
Processed Foods	Fast food, refined flour products	Home-cooked, high-fiber foods

References

1. Park K. Park's Textbook of Preventive and Social Medicine. 27th ed. Jabalpur: Banarsidas Bhanot Publishers; 2023.
2. World Health Organization. Global Report on Diabetes. Geneva: WHO; 2016.
3. American Diabetes Association. Standards of Care in Diabetes—2024. Diabetes Care. 2024;47(Suppl 1):S1–S350.
4. Mohan V, Deepa R, Deepa M, Somannavar S, Datta M. A simplified Indian Diabetes Risk Score for screening undiagnosed diabetic subjects. J Assoc Physicians India. 2005;53:759-763.

Thank you…