DIET THERAPY IN DIABETES

By…
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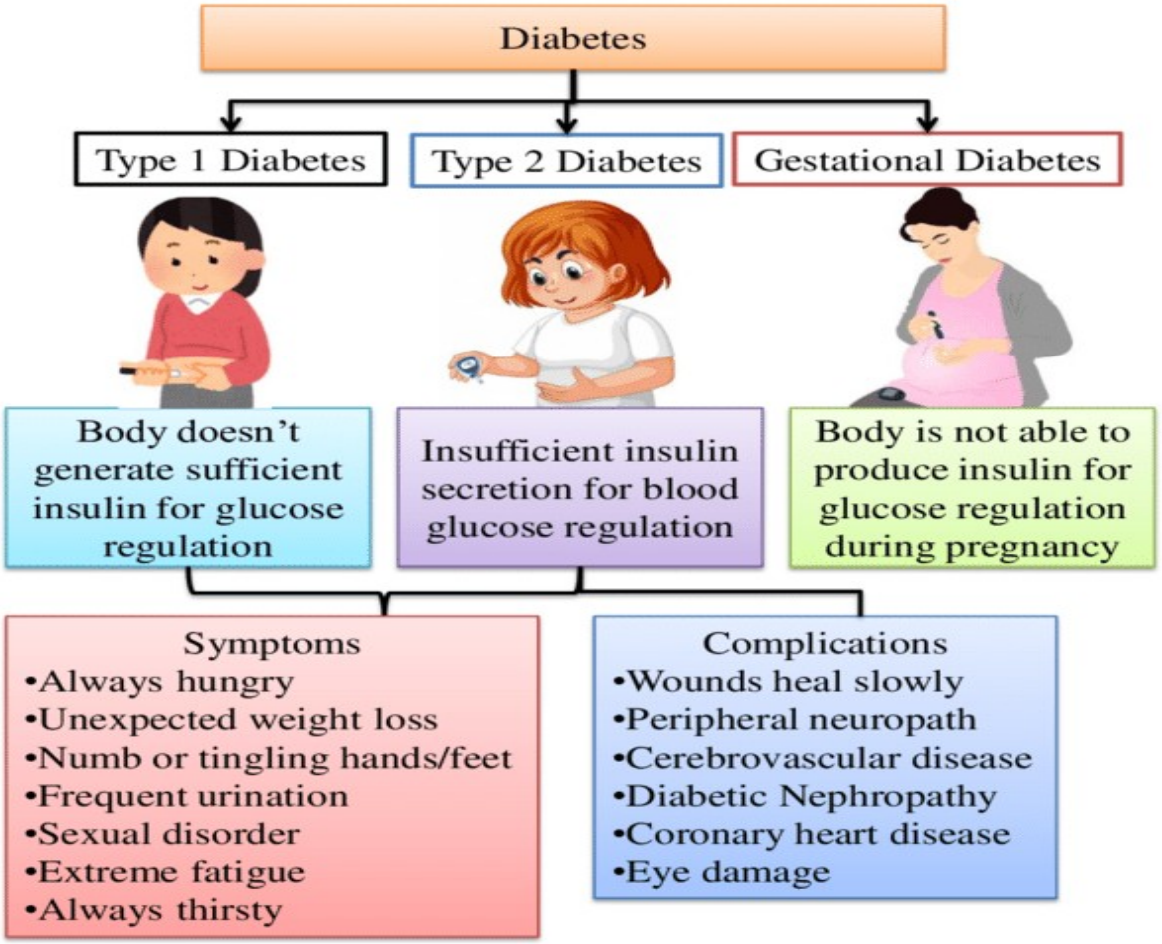
Introduction

Diabetes is chronic metabolic disease where the body has trouble to controlling the blood glucose levels, either by not producing enough insulin or by not using insulin properly. Thus can leads to serious health issues over time, affecting the heart, blood vessels, eyes, kidneys and nerves.

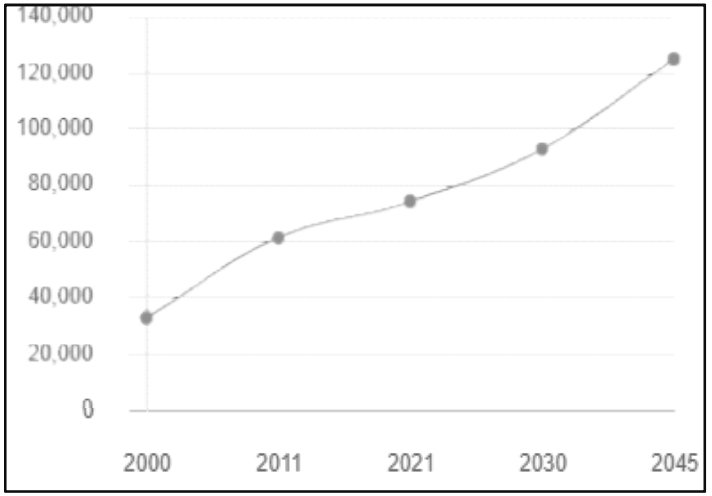
Types of Diabetes



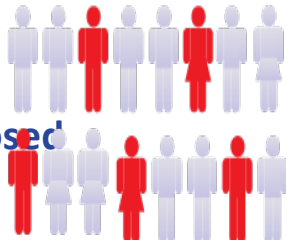
Prevalence of Diabetes in India

The **prevalence of diabetes** in Ind
NCREASING YEAR BY Y

According to the International Diab
Federation (IDF, tenth edition, 202
NDIA - SECOND COU **with th**
largest number of adults (aged 20-
with diabetes, after China



Approximately
ONE IN TWO ADU
were found to be **undiagnosed**
with diabetes in India



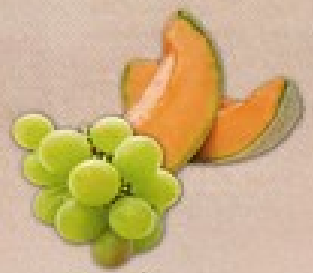
Contributing Factors:

- **Asian Indian Phenotype:** Central obesity, visceral fat
- **Lifestyle Changes:** Urbanization, dietary transitions, and sedentary behaviour
- Low fiber intake, excess refined carbs,

The Non-Communicable Disease Prevention Program & National NCD Monitoring targets to "halt the rise in prevalence of diabetes" by the year 2025

International Diabetes Federation. IDF Diabetes Atlas, 10th edn. Brussels, Belgium: 2021. Available at: https://www.diabetesatlas.org

MyPlacemat for Diabetes



Fruit

Free Foods

Milk

Fats & Oils

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SCOPE OF TALK

- DIAGNOSIS
- RISK FACTORS
- COMPLICATIONS
- MNT IN ALL TYPES OF DIABETES

Recommendations

- Dietary recommendations from the ICMR concur with those from the RSSDI and emphasize lifestyle-adjusted changes .
- The ICMR recommends adoption of a diet containing carbohydrates (55–60%) including cereals, mixed coarse grains, whole pulses, salads and soybeans; proteins (10–15%) from vegetable sources, low fat milk and milk products, fish and lean meat; fats (20–25%) comprising < 7% of saturated fats and the major proportion from MUFA and polyunsaturated fatty acids (PUFA).
- Other recommendations include consumption of moderate amounts of whole fruits and fiber-rich foods, restricted intake of salt and artificial sweeteners, and avoidance of alcohol and tobacco

TABLE 1

Criteria for the diagnosis of prediabetes and diabetes[1,2]

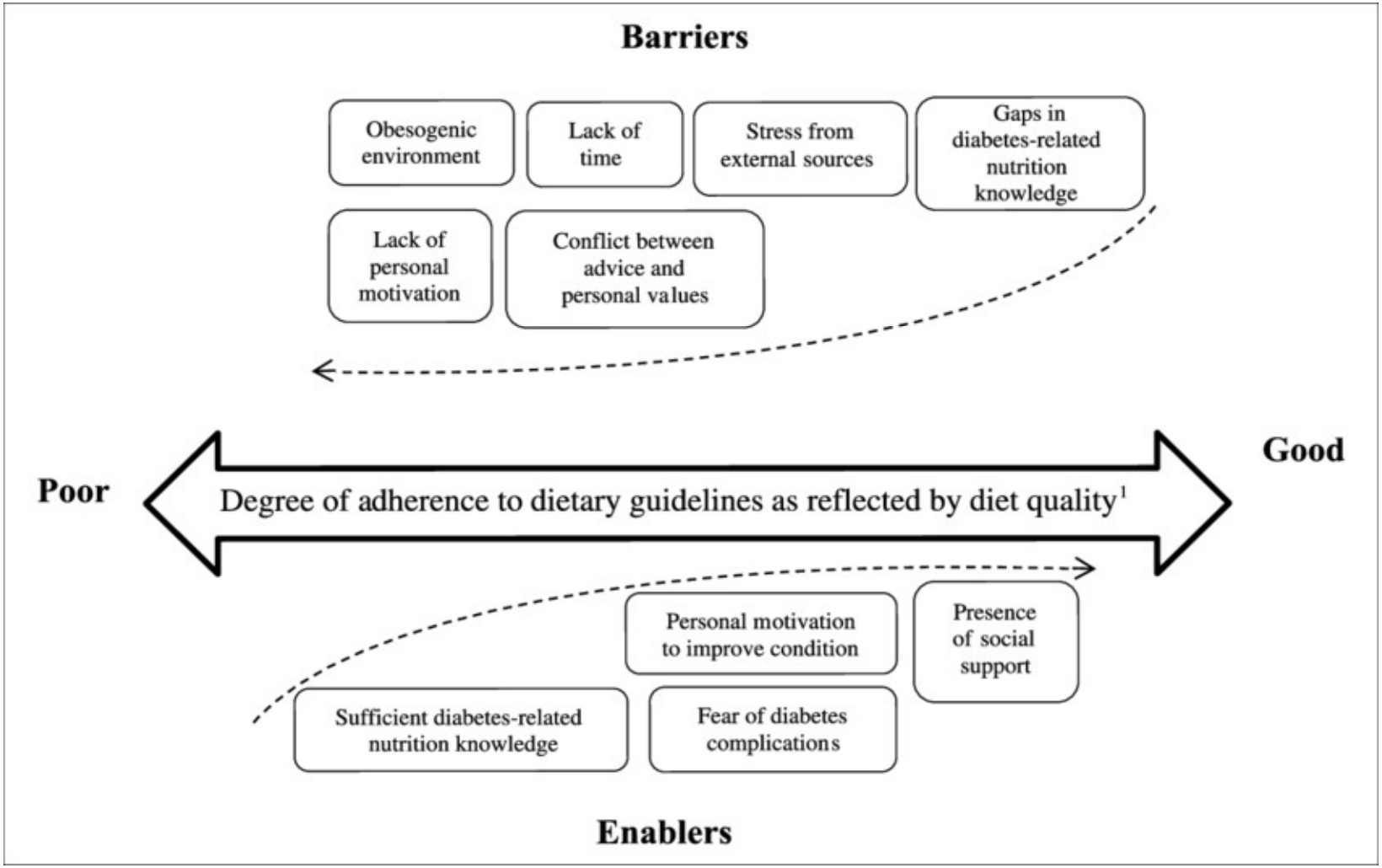
	Prediabetes	Diabetes
A1C	5.7%-6.4%	≥6.5%*
FPG	100-125 mg/dL (5.6-6.9 mmol/L)	≥126 mg/dL (7 mmol/L)*
OGTT	140-199 mg/dL (7.8-11 mmol/L)	≥200 mg/dL (11.1 mmol/L)*
RPG		≥200 mg/dL (11.1 mmol/L)**

FPG, fasting plasma glucose; OGTT, oral glucose tolerance test; RPG, random plasma glucose.

*In the absence of unequivocal hyperglycemia, results should be confirmed by repeating the test.

**Random plasma glucose is diagnostic only in a patient with classic symptoms of hyperglycemia or hyperglycemic crisis.

Diabetes-related-nutrition-knowledge-barriers-and-enablers



Estimation of Food Portion Sizes

Your hands can be very useful in estimating portions. They're always with you, and they're always the same size! When planning a meal, the Canadian Diabetes Association suggests using these portion sizes as a guide:

How many vegetables?

Choose as much as you can hold in both hands

How much milk?

Drink up to 1 cup or 250 ml of low-fat milk with a meal.

How much grains & starches?

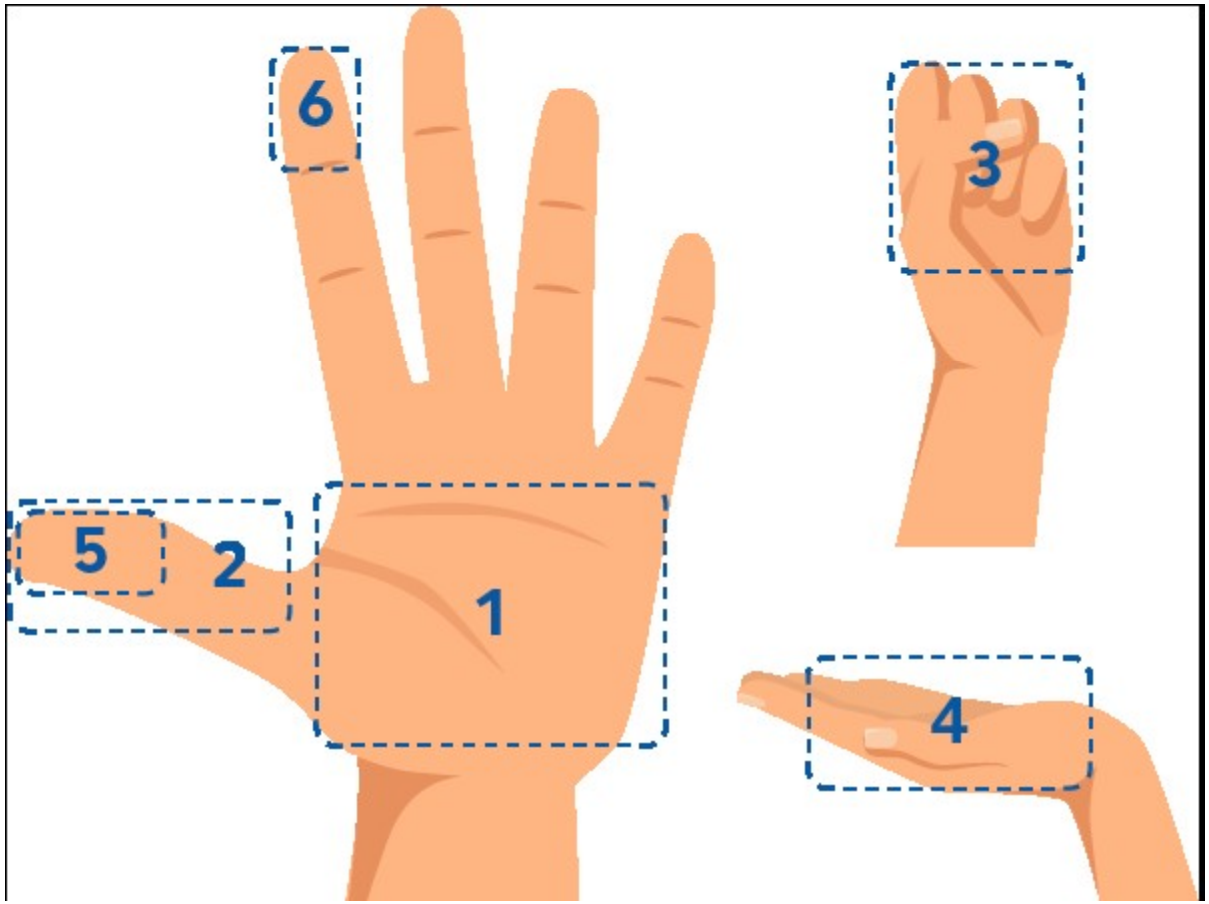
Choose an amount up to the size of your fist.

How much meat & alternatives

Choose an amount the size of your palm and the thickness of your little finger.

How much fruit?

Choose an amount up to the size of your fist.


6
3
5
2
1
4

PREGNANCY

DM PREGNANCY

- Diabetes confers significantly greater maternal and fetal risk largely related to the degree of hyperglycaemia but also related to chronic complications and comorbidities of diabetes.
- Sponteauosabortion,fetalanomalies,preeclampsia,fetal demise,macrosomia,neonatalhypoglycemia,hyperbilirubinemia,neonatalrespiratory distress syndrome
- Increase the risk of obesity, hypertension, and type 2 diabetes in offspring later in life.

T1DM

- Increased risk of hypoglycaemia in the 1st trimester .
- Patient and family education about the prevention, recognition, and treatment of hypoglycaemia is important before, during, and after pregnancy to help to prevent and manage the risks of hypoglycemia.
- Insulin resistance drops rapidly with delivery of the placenta.
- Pregnancy is a ketogenic state, and women with T1D, and to a lesser extent those with T2D, are at risk for diabetic ketoacidosis (DKA) at lower blood glucose levels than in the nonpregnant state.
- DKA carries a high risk of stillbirth.
- Women in DKA who are unable to eat often require 10% dextrose with an insulin drip to adequately meet the higher carbohydrate demands of the placenta and fetus in the third trimester in order to resolve their ketosis.

T2DM

- Type 2 diabetes is often associated with obesity. Recommended weight gain during pregnancy for women with overweight is 15–25 lb and for women with obesity is 10–20 lb . There are no adequate data on optimal weight gain versus weight maintenance in women with BMI >35 kg/m^2.
- Glycemic control is often easier to achieve in women with T2D than in T1D but can require much higher doses of insulin
- T1D insulin requirements drop dramatically after delivery.
- The risk for associated hypertension and other comorbidities may be high in T1D & T2D.
- pregnancy loss appearing to be more prevalent in the 3rd trimester in T2D and 1st trimester in T1D

GDM

- Minimum of 175 g of carbohydrate, a minimum of 71 g of protein, and 28 g of fibre. The diet should emphasize monounsaturated and polyunsaturated fats while limiting saturated fats and avoiding *trans* fats. As is true for all nutrition therapy in patients with diabetes, the amount and type of carbohydrate will impact glucose levels. Simple carbohydrates will result in higher postmeal excursions.

MATERNAL COMPLICATIONS OF GDM

- Gestational hypertension
- Preeclampsia
- Macrosomia (birthweight over 4000 g)
- Cesarean delivery
- CS associated morbidities.

FETAL COMPLICATIONS OF GDM

- Increased risk of macrosomia (incidence of 15%–45%)
- Neonatal hypoglycemia (3%–5%)

  result of increased fetal insulin production in response to maternal hyperglycemia, which can increase the risk of seizures.
- Hyperbilirubinemia (10%–13%)
- Birth trauma
- Respiratory distress syndrome,
- Shoulder dystocia (Reece 2010).
- Long-term complications of infants born to mothers with GDM include increased risk of impaired glucose tolerance, type 2 diabetes, hypertension, obesity, and dyslipidemia.

DIAGNOSIS

- The ADA has recommended the use of either the one- or two-step approach at 24–28 weeks of gestation in pregnant women not previously known to have diabetes.

- The one-step approach involves performing a 75-g OGTT, with plasma glucose measurement when the patient is fasting and at 1 and 2 hours in this group of gravida at 24-28 weeks' gestation.

- OGTT in the morning after an overnight fast of at least 8 hours.

- The diagnosis of GDM is made when any of the following is met or exceeded

- Fasting: 92 mg/dL (5.1 mmol/L)

TREATMENT

- Treatment of gestational diabetes can improve pregnancy outcome and decrease gestational weight gain.
- Many women can achieve euglycemia with nutritional therapy alone.
- 30% percent will require drug therapy.
- Treatment options include nonpharmacologic therapy, insulin, and oral therapy.

GLYCEMIC TARGETS

- Targets recommended by the Fifth International Workshop-Conference on Gestational Diabetes Mellitus (48):

- Fasting glucose 95 mg/dL (5.3 mmol/L) and either One-hour postprandial glucose 140 mg/dL (7.8 mmol/L) or Two-hour postprandial glucose 120 mg/dL (6.7 mmol/L)

MNT

Provide adequate calorie intake

To promote maternal health

Achieve glycaemic goals

Provide adequate gestational weight gain based on maternal body mass index (BMI)

Contribute to fetal well-being

Prevent ketosis

Minimum of 175g of carbohydrate, 71g of protein, and 28g of fiber). In clinical practice, women often require 1800 to 2500 kcal/day.

Meal plan includes three small- to moderate-sized meals and two to four snacks.

- 40 % carbohydrate, 20% protein and 40% fat from total calories.
- Normal BMI (18.5 to 22.9 kg/m^2) caloric intake is 30 kcal/kg/day.
- Overweight (23.0 to 24.9 kg/m^2) & Obese (25.0 to 39.9 kg/m^2 caloric intake is 22 to 25 kcal/kg/day.
- Morbid Obese ≥40.0 kg/m^2, a caloric intake is 12 to 14 kcal/kg/day (present pregnant weight).
- But it is prudent for obese women to consume a minimum of 1800 cal/day to prevent ketosis.
- Underweight (BMI <18.5 kg/m^2) caloric intake is 35 to 40 kcal/kg/day to achieve recommended weight gain, blood glucose goals, and nutrient intake.

- Carbohydrate and calorie intake should be distributed across the meals and snacks to blunt postprandial hyperglycemia, as postprandial hyperglycemia leads to adverse pregnancy outcomes.

- There is deficiency in first phase insulin secretion and due to dawn phenomenon, there is more insulin resistance seen in the start of the day.

- As the pregnancy progresses insulin resistance increases. Distribution of calories at breakfast helps in achieving glycemic targets. Splitting of breakfast into two halves wait for an hour and check glucose and give the other half of bfast.

- This doesn’t require much of insulin to process the sugars.

- The first meal should be low in carbohydrate high in protein to avoid post breakfast spikes in plasma glucose level.

Fibre : Include 25-30g/day which helps in controlling blood glucose, relieves from constipation and improves satiety.

Protein: 1.1g /kg bwt is recommended. Include variety of plant based proteins, low fat dairy products, fish and poultry as a source of protein.

Fats : Reduce saturated fat <7% of total calories.

Add omega 3 fatty acids for fetal brain development.

To avoid trans fats.

Iron—30mg/day, Folic acid 400µg/day, Calcium-1200mg

Noncaloric sweeteners like aspartame, sucralose, and others may be used in moderation.

Saccharine, on the other hand, is known to cross the placenta and is not recommended in pregnancy

Lifestyle modification

Includes nutritional therapy

physical activity

and weight management

Helps in maintaining blood glucose in GDM and helps in good outcome of pregnancy by avoiding complications.

Lactation

- In light of the immediate nutritional and immunological benefits of breastfeeding for the baby, all women including those with diabetes should be supported in attempts to breastfeed. Breastfeeding may also confer longer-term metabolic benefits to both mother (**116**) and offspring (**117**). However, lactation can increase the risk of overnight hypoglycemia, and insulin dosing may need to be adjusted.

CHILDREN & ADOLSECENCE

- Individualized medical nutrition therapy is recommended for children and adolescents with type 1 diabetes as an essential component of the overall treatment plan.

- Monitoring carbohydrate intake, whether by carbohydrate counting or experience-based estimation, is key to achieving optimal glycemic control.

- Dietary management should be individualized: family habits, food preferences, religious or cultural needs, finances, schedules, physical activity, and the patient's and family's abilities in numeracy, literacy, and self-management should be considered. Visits with a registered dietitian nutritionist should include assessment for changes in food preferences over time, access to food, growth and development, weight status, cardiovascular risk, and potential for eating disorders. Dietary adherence is associated with better glycemic control in youth with type 1 diabetes

- Exercise positively impacts metabolic and psychological health in children with type 1 diabetes (**13**). While it affects insulin sensitivity, physical fitness, strength building, weight management, social interaction, mood, self-esteem building, and creation of healthful habits for adulthood, it also has the potential to cause both hypoglycemia and hyperglycemia.

- 60 min of moderate- (e.g., brisk walking, dancing) to vigorous- (e.g., running, jumping rope) intensity aerobic activity daily, including resistance and flexibility training.

- The prevention and treatment of hypoglycemia associated with physical activity include decreasing the prandial insulin for the meal/snack before exercise and/or increasing food intake. Patients on insulin pumps can lower basal rates by ~10–50% or more or suspend for 1–2 h during exercise (**18**). Decreasing basal rates or long-acting insulin doses by ~20% after exercise may reduce delayed exercise-induced hypoglycemia (**19**). Accessible rapid-acting carbohydrates and frequent blood glucose monitoring before, during, and after exercise, with or without continuous glucose monitoring, maximize safety with exercise.

- Blood glucose targets prior to exercise should be 90–250 mg/dL (5.0–13.9 mmol/L). Consider additional carbohydrate intake during and/or after exercise, depending on the duration and intensity of physical activity, to prevent hypoglycemia. For low-to-moderate intensity aerobic activities (30–60 min), and if the patient is fasting, 10–15 g of carbohydrate may prevent hypoglycemia (**20**). After insulin boluses (relative hyperinsulinemia), consider 0.5–1.0 g of carbohydrates/kg per hour of exercise (~30–60 g), which is similar to carbohydrate requirements to optimize performance in athletes without type 1 diabetes (**21**–**23**).

- In addition, obesity is as common in children and adolescents with type 1 diabetes as in those without diabetes. It is associated with higher frequency of cardiovascular risk factors, and it disproportionately affects racial/ethnic minorities in the U.S. (**24**–**28**). Therefore, diabetes care providers should monitor weight status and encourage a healthy diet, exercise, and healthy weight as key components of pediatric type 1 diabetes care.

OBESITY

- Diet, physical activity, and behavioral therapy designed to achieve and maintain ≥5% weight loss is recommended for most patients with type 2 diabetes who have overweight or obesity and are ready to achieve weight loss. Greater benefits in control of diabetes and cardiovascular risk may be gained from even greater weight loss.

- Such interventions should include a high frequency of counselling (≥16 sessions in 6 months) and focus on dietary changes, physical activity, and behavioral strategies to achieve a 500–750 kcal/day energy deficit.

- Behavioral changes that create an energy deficit, regardless of macronutrient composition, will result in weight loss. Dietary recommendations should be individualized to the patient's preferences and nutritional needs

- short-term weight-loss goals, long-term (≥1 year) weight-maintenance programs are recommended when available. Such programs should, at minimum, provide monthly contact and support, recommend ongoing monitoring of body weight (weekly or more frequently) and other self-monitoring strategies, and encourage high levels of physical activity (200–300 min/week).

- Short-term dietary intervention using structured, very-low-calorie diets (800–1,000 kcal/day) may be prescribed for carefully selected patients by trained practitioners in medical settings with close monitoring.

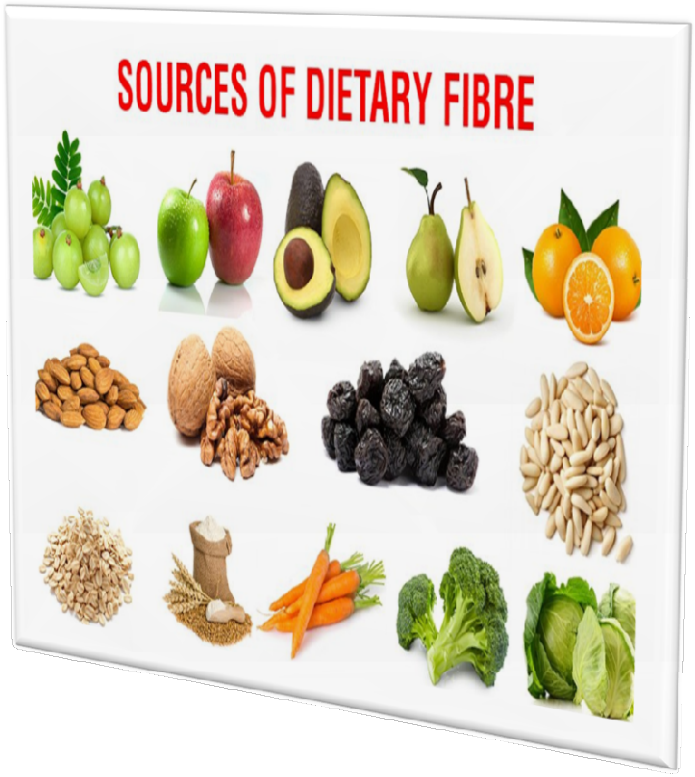
  - ***Standards of Medical Care in Diabetes—2021***

Importance of Fibre

What is Dietary Fiber?

Dietary fibre is defined as **“non-digestible carbohydrate and lignin from plants”**

- ✓ **Non-starch polysaccharides (NSP)** cellulose, hemicelluloses, pectin, gums, mucilages, β-glucans
- ✓ **Resistant oligosaccharides** fructo-oligosaccharides (FOS) galactooligosaccharides (GOS)
- ✓ **Fruits/vegetables/plant fiber**
- ✓ **Resistant starch**
- ✓ **Cereal fiber, bran, Inulin**
- ✓ **Chemically synthesized fiber**



Hijová , Bertková and Štofilová.. Cent Eur J Public Health. 2019 Sep;27(3):251-255. doi: 10.21101/cejph.a5313. PMID: 31580563.

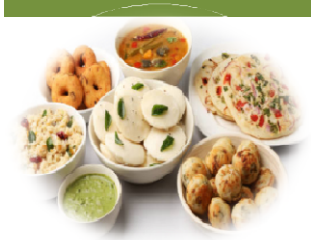
Classification of Dietary Fiber

SOLUBLE FIBER	INSOLUBLE FIBER
Oligosaccharides, beta-glucan, gum, pectin, fibersol, nutriose, inulin	Cellulose, hemicellulose, lignin
Oats (Rolled, Steelcut), Beans, Lentils & Legumes, Barley, Quinoa, Chia seeds, Flax seeds, Vegetables & Fruits	Vegetables & Fruits , Whole Grains, Millets, Legumes, Nuts
Viscous Gel forming Highly fermentable Increases SCFA's production	Non-viscous Non-gel forming Moderately fermentable No relevant effects on SCFA'S

Saboo, et al. (2022). Metab Syndr. 2022;16(5):102480. doi:10.1016/j.dsx.2022.102480

Fiber Needs are Not Met in India

Reasons for low fiber intake



1. Skipping Breakfast

2. Snacking on low fiber/ high calorie/processed foods

3. Lack of awareness on high fiber foods

4. Adopting FAD diets

- Low intake of fruits and vegetables (fiber) is reported in India (ICMR-What India eats)
- Low dietary fiber intake is reported across all income groups especially in women (15-30g/d)

Saboo, et al. (2022). Metab Syndr. 2022;16(5):102480. doi:10.1016/j.dsx.2022.102480
Singh and Singh, (2015). Asian J Pharm Clin Res, Vol 8, Issue 3, 2015, 58-61
What India eats, ICMR-NIN, Available at: https://www.millets.res.in/pdf/what_india_eats.pdf

Position of the Indian Dietetic Association: Dietary fiber & Health December 2018

- ✓ **Increasing dietary fiber intake lowers postprandial glucose and improves glycemic control.**
- ✓ **Fiber enhances insulin sensitivity through SCFAs from intestinal fermentation.**

Dietary fiber is beneficial to health.

- Ü **Adequate intake reduces risks of chronic diseases like cardiovascular disorders, type 2 diabetes, obesity, and supports digestive health.**

Puri et al., Position of the Indian Dietetic Association: Dietary fiber and Health, Available at : http://idaindia.com/wp-content/uploads/2018/12/IDA-position-paper-fibre-24.12.18.pdf

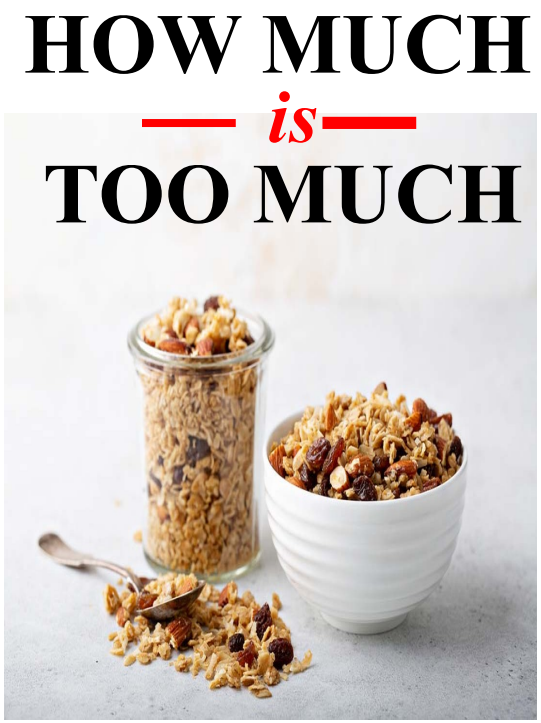
Position of the Indian Dietetic Association: Dietary fiber & Health December 2018

- **Increasing dietary fiber intake is associated with improved lipid profile.**
- **Total dietary fiber intake is :**
  - ✓ Inversely associated with T-Chol., LDL cholesterol, and triglycerides,
  - ✓ Positively associated with HDL cholesterol
- **Significant reduction in serum cholesterol among diabetes patients with a high fiber diet is seen. These effects are found to be sustained for a long-time period**
- **Water-soluble fibers (specifically, beta-glucan, psyllium, pectin, and guar gum) were found to be most effective in reducing serum LDL-C concentrations**

Puri et al., Position of the Indian Dietetic Association: Dietary fiber and Health, Available at : http://idaindia.com/wp-content/uploads/2018/12/IDA-position-paper-fibre-24.12.18.pdf

Potential Negative Effects of consuming Dietary Fiber

- Healthy adults consuming recommended dietary fiber levels rarely experience negative effects
- Excessive fiber intake may reduce mineral bioavailability (iron, calcium, magnesium, zinc)
- High fiber intake can cause gastrointestinal discomfort, including gas and flatulence
- GI discomfort typically occurs at very high intake levels (75-80 g/day), which are uncommon



Puri et al., Position of the Indian Dietetic Association: Dietary fiber and Health, Available at : http://idaindia.com/wp-content/uploads/2018/12/IDA-position-paper-fibre-24.12.18.pdf

Key points to consider when stepping up fiber intake and minimizing side effects

CHOOSE WHOLE, UNREFINED FOODS:

Opt for fresh fruits, vegetables, whole grains, legumes, nuts, and seeds. Replace refined flours with whole-grain options.

GRADUALLY ADD FLATULENCE-FORMING FOODS:

Slowly introduce beans and other fiber-rich foods to prevent bloating and discomfort.

START WITH A HIGH-FIBER BREAKFAST:

Choose high-fiber cereals and add fresh fruit or juice with pulp.

INCLUDE A DAILY SALAD:

Begin meals with a salad or unstrained soup using leafy greens like spinach and romaine lettuce.

DISTRIBUTE FIBER INTAKE :

Spread fiber consumption evenly throughout the day to avoid discomfort.

INCREASE FLUID INTAKE:

Drink plenty of water to prevent constipation and help fiber work effectively.

Saboo, et al. (2022). Metab Syndr. 2022;16(5):102480. doi:10.1016/j.dsx.2022.102480

CASE STUDY - 1

Demographics: 50-year-old male, type 2 diabetes for 5 years.

Baseline Status:

Fiber intake: ~12 g/day (refined, low-fiber diet).

Symptoms: Constipation, bloating.

HbA1c: 8.2%;

Fasting glucose: 160 mg/dL; LDL elevated.

Current Treatment: On metformin, lifestyle intervention inadequate.

Intervention Plan

1. **Gradually increased fiber intake:** Starting at **20–25 g/day**, to **30–35 g/day** over 8 weeks.
2. **Sources:**

Soluble fiber: Oats, psyllium, legumes, fruits (apples, citrus).

Insoluble fiber: Cooked vegetables, whole grains.

3. **Hydration:** 2.5–3 L/day to prevent constipation.
4. **Education:** Adaptation period, gradual introduction of gas-producing foods (e.g., beans, broccoli), food chronology – starting meal with fiber.
5. **Monitor:** Glucose levels, lipid profile, and gastrointestinal symptoms regularly.

Short Term and Long Term Outcome

Short-Term (4–6 weeks):

- Improved bowel regularity; reduced bloating.
- Slight drop in fasting glucose (~150 mg/dL).

Long-Term (12 weeks):

- **HbA1c:** Reduction from 8.2% to ~7.5%.
- **LDL:** 10% reduction.
- **Weight loss:** ~2–3 kg due to improved satiety and portion control.

CASE STUDY - 2

Age: 48 years

BMI: 29 (Overweight)

Lifestyle: Sedentary, high intake of refined carbohydrates

Diagnosis: Prediabetes (HbA1c: 6.1%, Fasting Blood Glucose: 110 mg/dL)

Intervention Plan

1. **Daily Fiber Target**:
   - Set a goal of **35 g/day of dietary fiber** (above the typical intake of ~15 g/day in the patient's baseline diet). Inclusion of both soluble and insoluble fiber
2. **Carbohydrate-to-Fiber Ratio**:
   - Reduced refined carbohydrate intake.
   - Maintained a **carbohydrate-to-fiber ratio of ≤10:1**, aiming for slower glucose absorption and stable blood sugar levels.
3. **Supplementation**:
   - Added **5 g psyllium husk** before meals to enhance satiety and post-meal glycemic control.
4. **Lifestyle Changes**:
   - **Physical Activity**: 30-minute brisk walks, 5 days/week.
   - **Hydration**: Minimum of 2 liters/day to aid fiber digestion.


Thank you!