DIET IN DIABETES MELLITUS

Unit

OBJECTIVES

- Know the prevalence of Diabetes in India.
- Learn about the types of Diabetes.
- Understand the signs, symptoms and metabolic changes in Diabetes.
- Understand the diagnosis and complications of Diabetes..
- Know about the treatment of diabetes.
- Understand the significance of lifestyle modifications in managing Diabetes.



Diabetes mellitus is a chronic disease in which the body's ability to produce or respond to the hormone insulin is impaired, resulting in abnormal metabolism of carbohydrates and elevated levels of glucose in the blood. Diabetes is no longer a dreaded disease; a well managed diabetic has a good life expectancy. Diabetes mellitus is a metabolic disorder that prevents the body to utilize glucose completely or partially. It is characterized by raised glucose concentration in the blood and alterations in carbohydrate, fat and protein metabolism. This can be due to failure in the formation of insulin or liberation or action.

9.1. Prevalence of Diabetes

Diabetes mellitus is a serious metabolic disease, affecting people of all geographic, ethnic or racial origin and its prevalence is increasing globally. Burden from this costly disease is high on the low and middle income countries (LMIC) where the impacts of modernization and urbanization have caused marked adverse changes in lifestyle parameters.

In 2013, of the estimated 382 million people with diabetes globally, more than 80 per cent lived in LMIC. It was estimated that India had 65.1 million adults with diabetes in 2013, and had the 2nd position among the top 10 countries with the largest number of diabetes. This number is predicted to increase to 109

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million by 2035 for an estimated population of 1.5 billion. unless steps are taken to prevent new cases of diabetes. One in every eight individuals in India is a diabetic. The average age for the onset of diabetes is around 40 years while it is around 55 years in other countries.

Key facts about Diabetes

- The number of people with diabetes has risen from 108 million in 1980 to 422 million in 2014.
- The global prevalence of diabetes among adults over 18 years of age has risen from 4.7% in 1980 to 8.5% in 2014 .
- Diabetes prevalence has been rising more rapidly in middle- and low-income countries.
- Diabetes is a major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation.
- In 2015, an estimated 1.6 million deaths were directly caused by diabetes. Another 2.2 million deaths were attributable to high blood glucose in 2012.
- Almost half of all deaths attributable to high blood glucose occur before the age of 70 years. WHO projects that diabetes will be the seventh leading cause of death in 2030.
- Healthy diet, regular physical activity, maintaining a normal body weight and avoiding tobacco use are ways to prevent or delay the onset of type 2 diabetes.
- Diabetes can be treated and its consequences avoided or delayed with diet, physical activity, medication and regular screening and treatment for complications.

9.2. Types of Diabetes

1. Insulin Dependent Diabetes Mellitus (IDDM or Type 1 Diabetes Mellitus)

- ✤ The onset is abrupt.
- Occurs at childhood or as young adult. However may occur at late age also.
- This is identified as auto immune disorder.
- They depend on exogenous insulin for survival and to maintain life.
- Type I patients are ketosis prone.

2. Non Insulin Dependent Diabetes Mellitus (NIDDM or Type II)

It is a heterogenous disorder characterized by liver, muscle and adipose tissue sensitivity to insulin and impaired beta cell function and associated with defects in both insulin secretion and insulin action.

- They are not ketosis prone, except during periods of severe stress, such as those caused by infections, trauma and surgery.
- They don't depend on exogenous insulin.
- Onset is gradual.
- Occurs only after the age of 30 years. However now even seen in young children due to stress and modern lifestyle.
- Many have a family history of Diabetes.
- Most are obese.
- ✤ Glucose levels improve on weight loss.
- Many type II diabetics need supplement of exogenous insulin.
- May present with micro vascular and macro vascular chronic complications.

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3. Gestational Diabetes Mellitus (GDM)

This appears during pregnancy and disappears after pregnancy is terminated. Women with GDM have an increased future risk for progression to Type II or rarely Type I. The incidence of gestational diabetes is 15-17 percent in Indian pregnant women. In addition to ketoacidosis, pregnant woman with diabetes are more prone to preeclampsia, toxaemia and urinary tract infections. Uncontrolled diabetes during the first three months of pregnancy increases the risk of abortions and congenital malformations in the fetus. Elevated blood sugar should therefore be adequately controlled by dietary means and treatment with insulin.

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Why the birth weight of the baby born to diabetic mothers are more?

- Mother's blood brings extra glucose to the fetus.
- Fetus make more insulin to handle the extra glucose.
- Extra glucose gets stored as fat and fetus becomes larger than normal.

4. Secondary Diabetes Mellitus

This may occur as a result of some other disorders such as Haemochromatosis, chronic pancreatitis, Down's syndrome, etc.

5. Malnutrition Related Diabetes Mellitus (MRDM)

Malnutrition-related diabetes mellitus (MRDM) is a rare type of diabetes associated with long term malnutrition. This type of diabetes is characterized by insulinopenia, insulin resistance, hyperglycemia and failure of the beta-cells in the pancreas. It is also known as tropical diabetes or tropical pancreatic diabetes mellitus. These patients are thin, young, severely hyperglycemic, but in contrast to IDDM do not have ketonuria and requires high doses of insulin for control.

6. Insulin Resistance

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It is state in which a normal amount of insulin produces a subnormal amount of insulin response. These patients can present with diabetes or some of these patients can compensate for this defect with elevated serum levels and may have only impaired glucose tolerance. It can be due to:

- Genetic disorders
- Immune disorders
- Endocrine and metabolic conditions



Maturity Onset Diabetes of the Young (MODY) is a relatively rare type of Type 2 Diabetes that is characterized

by an early age of onset (age 9-25) and autosomal dominant inheritance. Unlike type 2 Diabetes, often associated with insulin resistance, MODY is caused by a primary defect in pancreatic beta cell function resulting in decreased insulin secretion. Patients with MODY are not usually obese.

9.3. Causes

Primary or Idiopathic diabetes

Heredity: There is a familial tendency to develop Diabetes.

- If both parents are diabetic, all their children will be diabetic.
- If one parent is s diabetic, and the other is a diabetic carrier, half of their children will be potential diabetics.
- If one parent is diabetic and the other a non diabetic and also a non carrier, none of their children will be diabetic, but they all will be carriers.

However, environmental and other factors play a role in unmasking an underlying diabetes genotype and whether a person with a genetic predisposition actually develops the disease or not.

Age: The disease may occur at any age but about 80 % of the cases occur after the age of 45.

Sex: In the younger age groups, diabetes is more commonly seen in males than in females. In middle age, women are more affected and the chances increase with pregnancy and increasing parity.

Obesity: There is a strong association between diabetes and obesity. In obesity, there is hyperinsulinaemia and insulin resistance or impaired insulin uptake by receptors in target tissues. Obese people are also less physically active than normal weight individuals which increase the risk of diabetes.

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Why weight is a risk factor for Diabetes?

- Overweight people have fewer available insulin receptors.
- More fat requires more insulin, promoting insulin resistance.
- Fat cells release free fatty acids which interfere with glucose metabolism.

Dietary factors/Nutritional factors: A high intake of sugar has also been related to obesity and may predispose to diabetes. A low intake of fibre due to consumption of refined foods is associated with high prevalence of Diabetes.

Infections: Type I diabetes usually occurs after viral infection, which brings about an auto immune reaction that may destroy the beta cells of the pancreas and impairs insulin secretion.

Stress: It elucidates adrenaline and thereby precipitates diabetes.

Secondary Diabetes

Diabetes can also occur secondary to the following disorders:

- Diseases which destroy the pancreas and lead to impaired secretion and release of insulin. E.g., pancreatitis, haemochromatosis, carcinoma of pancreas and pancreatectomy.
- Abnormal concentration of certain hormones in the circulation which are insulin antagonist. These include:
 - Growth hormone
 - Adrenocortical hormone (Cushing syndrome, Addison's disease, Hypopituitarism)
 - Adrenaline
 - Thyroid hormone



Meet any two diabetics and find out the reason for them developing diabetes.

- 1. Diabetic 1 -
- 2. Diabetic 2 -



Women of reproductive age who have developed

polycystic ovarian syndrome (PCOS) are at an increased risk of type 2 diabetes. PCOS is a hormonal disorder characterized by enlarged ovaries containing fluid filled cysts. Women with PCOS have irregular menstrual cycles and high circulating levels of male hormones like testosterone. Insulin resistance and impaired glucose tolerance are manifestations of PCOS.



Sita is overweight, but none in her family has diabetes. Should she be really concerned with her weight?

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Diabetes insipidus is a condition where the body loses too much fluid through

urination, causing a significant risk of dangerous dehydration as well as a range of other illnesses and conditions. It is a rare disorder affecting the regulation of body fluid levels. People with diabetes insipidus produce excessive amounts of urine, resulting in frequent urination and thirst. However, the underlying cause of these two symptoms differs from types 1 and 2 diabetes.

9.4. Signs and Symptoms

- Polyuria or increased urination due to large volume of urine.
- Polydipsia or increased thirst due to excessive water loss and the need for its replacement in the tissues.
- Polyphagia or increased hunger due to a failure to utilize food for nourishment of the body.
- General weakness.
- Decreased resistance to infection.
- Decreased ability of wound healing due to a high blood sugar and poor fluid balance.
- Dehydration as a result of excessive water and electrolyte loss from the body, causing dry furred tongue and cracked lips.
- Ketosis or ketoacidosis i.e., accumulation of ketone bodies in the blood as a result of increased lipolysis. Breathing may be deep and rapid and the breath has acetone smell. Ketosis, if not controlled, may lead to coma and finally death.

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- Rapid weight loss.
- Sleepiness
- Fatigue

Degenerative changes in advanced cases include peripheral neuritis, retinitis, atherosclerosis with associated diseases of coronary arteries and vascular changes in kidneys causing nephropathy. Associated symptoms are failing or blurred vision, pain, numbness of the limbs and proteinuria.

9.5. Metabolic changes in Diabetes

Carbohydrate metabolism: Insulin lack produces and causes fundamental changes in carbohydrate metabolism which leads to hyperglycaemia. The primary is inability to regulate glucose in blood stream and the following changes in carbohydrate metabolism:

- Reduced entry and oxidation of glucose in muscle and tissues.
- Decreased formation of glycogen in liver.
- Decreased synthesis of fat as fats are mobilized as energy source instead of carbohydrates.
- Release of glucose into blood from increased breakdown of glycogen in liver.

Fat metabolism: Fat metabolism is also altered during diabetes mellitus. Due to the fact that the tissues are unable to oxidize sufficient quantities of glucose to meet energy needs, the body has to use fats as a source of energy. This results in mobilisation of large quantities of fat from adipose tissue and circulating as free fatty acids. This causes a considerable increase of fatty acid and triglycerides in the blood stream.

In the absence of normal carbohydrate metabolism, the liver oxidizes fatty acids on a larger scale producing large amounts of acetyl CoA which leads to the formation of large amounts of ketone bodies like acetoacetate, betahydroxy butyric acid and acetone. A metabolic acidosis develops known as ketosis which leads to coma in severe diabetes.

Protein metabolism: Since diabetic patients cannot meet the energy requirements from the oxidation of glucose and fats, there is breakdown of tissue proteins. There is increased protein catabolism leading to negative nitrogen metabolism.

9.6. Diagnosis of Diabetes

Several laboratory tests are available to both health care providers and people in order to confirm a diagnosis of Diabetes.

Fasting Plasma Glucose (FPG) Test: The Fasting Plasma Glucose Test involves asking the person to abstain from eating or drinking anything for eight hours prior to having a blood sample drawn. If the person's glucose level while they are fasting is greater than or equal to 126 mg/dl they are most likely to have diabetes. If the person has a fasting glucose level that is more than 100, but less than 126 mg/dl - they are considered to have Pre-Diabetes. They do not yet have Diabetes, but they are at greater risk of developing it in the near future.

Oral Glucose Tolerance Test: An Oral Glucose Tolerance Test involves first drawing the person's fasting blood sugar level, and then drawing another blood sugar level two hours after they have consumed a drink containing seventy-five grams of sugar. If the person's blood sugar level after they have consumed the sugar drink is greater than or equal to 200 mg/dl they have Diabetes. If their blood sugar level is between 140 and 199 mg/dl, they are considered to have Pre-Diabetes.

Finger Stick Blood Glucose Test or Random Plasma Glucose (RPG) Test: This test can be performed in community-based screening programs, or anywhere, and provides rapid results. The test is not as accurate as blood testing in a laboratory; however, it provides rapid results, and it is very easy to perform. The results are accurate within ten-percent of laboratory values. Testing involves a minor finger-stick of the person's finger in order to obtain a tiny blood sample, which is then placed onto a strip. The strip is placed into a small machine that interprets the person's blood sugar level. At very high or low blood sugar levels, the finger-stick test may prove inaccurate, and is considered a preliminary screening. The majority of persons with diabetes use the finger-stick test to monitor their blood sugar levels.

The following image shows small diabetes blood sugar meter - reading 4.8 - a finger pricker, syringe, and blood glucose test strips.



Monitoring Urine Glucose and Ketone levels

Glycosuria is usually measured by

- Clinitest (modification of Benedict's test)
- Clinistix, Testape, Diastix (Paper strip method)

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Diagnosis	A1C (percent)	Fasting plasma glucose (FPG)ª	Oral glucose tolerance test (OGTT) ^b	Random plasma glucose test (RPG)ª
Normal	below 5.7	99 or below	139 or below	
Prediabetes	5.7 to 6.4	100 to 125	140 to 199	
Diabetes	6.5 or above	126 or above	200 or above	200 or above

- (a) Glucose values are in milligrams per deci liter, or mg/dL.
- (b) At 2 hours after drinking 75 grams of glucose.

Source: Adapted from American Diabetes Association. Classification and diagnosis of diabetes. Diabetes Care.2016;39(1):S14–S20, tables 2.1, 2.3.

Both methods are dependent upon a normal glomerular filtration rate (120ml/min) and renal threshold for glucose reabsorption by the tubules (180mg/dl).

Glycosylated Hemoglobin or 'Hemoglobin A1c' Test:

The Hemoglobin A1c test measures how high the person's blood sugar levels have been over the last 120 days. The test involves drawing a blood sample, and is the best way to measure blood sugar control in persons with diabetes. If the test results show 7% or less, the person has good blood glucose control. If the person has 8% or higher test results, their blood sugar has been too high for too long.

Activity : 3

Write the normal blood sugar levels for an adult ----- mg/dl.

9.7. Management

Although it is not possible to cure diabetes completely, diabetics can lead almost a normal life if they follow certain dos and don'ts scrupulously. Cooperation of the patient is very important in the management of Diabetes.

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The main modes of treatment in Diabetes are:

- 1. Diet
- 2. Insulin
- 3. Drugs
- 4. Exercise
- 5. Education

9.7.1. Dietary management

A well designed meal plan is an important cornerstone in the management of diabetes mellitus.

Goals of nutritional therapy

- Achieve physiologic blood glucose levels.
- Maintain desirable plasma lipid levels.
- Reduce complications of diabetes mellitus.
- Attain and maintain desirable body weight.
- Meet energy needs in a timely manner.
- Individualize to preferences and food available.

The nutrition plan

Calories

Calorie requirement depends on the weight of a person. The calorie content of all diabetics should be set at a level which will permit them to maintain their desired body weight and in children and adolescents allow for a normal rate of growth and development.

Category	Calorie requirement	
Overweight	20Kcal/kg/day	
Ideal weight	20Kcal/kg/day	
Underweight	20Kcal/kg/day	
Elderly person above 50 years	10 % less calories for each additional decade	
Children 1 st year	1000 calories	
For girls 1-12 years	1000+ 100 calories per year of age upto 12 years	
For boys 1-12 years	1000+ 125 calories per year of age upto 12 years	

Table 9.1 Calorie requirement based onWeight/Age

Carbohydrates

Carbohydrates should provide 50-60 percent of total energy. Among this, 60-70 percent should be complex carbohydrates and 30-40 percent should be simple carbohydrates. It is the type of carbohydrate that determines the glycaemic response than the actual quantity. Simple carbohydrates tend to raise the blood glucose more than complex carbohydrates. Glucose, maltose and sucrose produce large increase in blood glucose but fructose does not. Fructose can be used as a sweetener for a diabetic. Acarbose, an enzyme inhibitor present only in wheat reduces blood glucose response.

Activity : 4

Why is wheat preferred for a Diabetic than Rice? Give reasons.

Glycaemic Index

Glycaemic Index of the food is determined by measuring the area under blood glucose curve obtained by the consumption of the test food expressed as a percentage of the area obtained by giving the same quantity of carbohydrates in the form of glucose.

Fibre

High fibre diet intake improves glycaemic control and reduces insulin requirements. Patients using more fibre have exhibited reductions in fasting blood sugar levels and glycosuria and increased sensitivity to insulin. It is the soluble fibres that are most effective in producing favourable effect in carbohydrate

Item	Glycaemic index	Item	Glycaemic index
Bread	70	Rice	72
Wheat	70	Idli	80
Sundal	80	Milk	33
Ice cream	36	Curds	36
Groundnuts	13	Tomato soup	38
Apple	39	Banana	69
Orange	40	Beans	79
Glucose	100	Honey	87
Green gram	29	Channa	29

Table 9.2 GLYCAEMIC INDEX OF SOME COMMON FOODS

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and lipid metabolism when compared to insoluble fibres. Soluble fibre prolongs the rate of and gastric emptying and intestinal transit time. It forms a gel with water and thickens the unstirred layer. Carbohydrates are thus packed and insulated from the action of the digestive enzymes in the intestines thus reducing the rate of absorption. Insoluble fibre reduces gastric emptying and intestinal transit time. High fibre diet enhances the response of gastric inhibitory polypeptide (GIP) which is a stimulus for insulin secretion.



List any five foods that are high in fibre and can be consumed by a diabetic.

1.

- 2.
- 3.
- 4.
- 4.
- 5.

Always consume plenty of water at least 2 litres, if you are eating a fibre rich diet. Fibre without adequate fluids can lead to constipation. Increasing fibre intake slowly can also help to ease bloating or other unwanted gastrointestinal distress.

Protein

Protein should provide 12-20 % of energy intake. An additional 30 grams may be necessary during pregnancy and lactation. High protein intake helps to increase insulin production and promotes satiety. Protein requirements are increased in malnutrition, surgery or wound healing. Protein from vegetable source is preferable to that from animal sources.

Fat

The amount and type of fat plays an important role in the diet of a diabetic. Diabetics have a greater incidence of hyperlipidemia and atherosclerosis than do nondiabetics. The present recommendation of total fat is 20-30 % of total calories. Fat intake should be monitored carefully.

Saturated, monounsaturated and polyunsaturated fats are given in the ratio of 1:1:1.

Food Exchange lists

Food exchange lists are groups of measured foods of the same calorific value and similar protein, fat and carbohydrate and can be substituted for one another in a meal plan. The food exchange lists helps the patient to:

- 1. restrict the food intake according to the insulin prescription so that both hyperglycaemia and hypoglycaemia can be prevented.
- 2. have variety in the diet so that he can adhere to it always.
- 3. learn easily the principles of diet.

Dietary Guidelines

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- Daily energy intake must be estimated after considering such fact as age, sex, activity and occupation.
- The total intake of calories is more important for a diabetic than the exact proportions of protein, fat and carbohydrate.
- A diabetic should maintain standard body weight or slightly lower.
- Simple sugars should be restricted since they are easily absorbed and have a high glycaemic index.
- Food exchange lists should be followed to prevent hypo and hyperglycaemia. The exchange lists should be followed to avoid monotony, dietary constancy and flexibility.
- Patients should avoid fasting and feasting.

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DIABETES SUPER FOODS THAT WILL HELP CONTROL AND MINIMIZE BLOOD SUGAR SPINACH. LARY FINGER CARBAGE CAULIFLOWER LETTUCE LEAF GREEN ONHONS TURNIP DEPENDAL **ONDORS** BLET ROOT GREEN CHILLIES CAPSICUM SKINNY CUCUMBER CUCUMBER. TOMATOES WHITE RADDISH CARBOT RED RADDISH LIMON BITTER GOURD REDGED GOURD LIGHT SOUP OR STEW BOG WHITE BOTTLE GOURD SODA WATER. INDIAN BLACKBERRY GARLIC **CINNAMON** FENUGREEK.

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Foods to be avoided

- Simple sugars (glucose, honey, syrup)
- Sweets

- Dried fruits
- ✤ Cake
- ✤ Candy

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- Fried foods
- Alcohol
- Jaggery
- Sweetened juices

Foods to be eaten in moderation

- Fats
- Cereals
- Pulses
- Meat
- Eggs
- Milk and milk products
- Roots
- Fruits
- Nuts

Foods permitted

- Green leafy vegetables
- Other vegetables
- Clear soups
- Salads
- Plain coffee or tea
- Skimmed and butter milk
- Spices



List any five vegetables and fruits that can be consumed by a diabetic.

Vegetables	Fruits
1	1
2	2
3	3
4	4
5	5

Get your fibre fix

- Go for grains. Look for 100% whole wheat or whole grains and check fibre grams on food labels.
- Feast on low sugar fruits. Eat a piece of fruit instead of drinking juice.
- Put away your peeler. Eat fruits and vegetables along with the skin if it is possible. Just be sure to wash them well first.
- Boost breakfast. Mix a high fibre cereal (more than 5 grams of fibre per serving) and top with fruit.
- Skip the chips.

9.7.2. Insulin

The philosophy of diet therapy for the juvenile diabetic is that while in a healthy person, the insulin secretion matches the food intake, in a diabetic the food intake has to match the injected insulin. Dietary measures should be used to control blood glucose and to minimize the risk of hypoglycaemia and to reduce the long-term complications.



How insulin works

Insulin is a hormone that comes from a gland situated behind and below the stomach (pancreas).

- 1. The pancreas secretes insulin into the bloodstream.
- 2. The insulin circulates, enabling sugar to enter your cells.
- 3. Insulin lowers the amount of sugar in your bloodstream.

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the islet the **B**-cell common bile duct endocrine tissue. exocrine tissue pancreatic intestine duct. ox-cell #3-cell #3-cell ПЛ An Insulin pump administers \mathbf{V} insulin through a catheter in KNOW? the abdomen to help control a person's blood sugar levels.



the pancreas

9.7.3. Oral Hypoglycaemic drugs

Action of oral anti diabetic drugs in controlling the blood sugar levels may be due to:

- Stimulation of insulin production from beta cells of Langerhans.
- Effect in making circulating insulin more effective.
- Action on intestinal mucosa decreasing the rate of absorption of glucose.
- Acting directly on peripheral muscle tissue increasing utilization of glucose.

Some of the common oral hypoglycaemic drugs are Biguanides and Sulphonylureas.

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9.7.4. Exercise

Regular physical activity affects overall glycemic control through improved insulin sensitivity, lowered insulin requirements, and improved glucose tolerance. Collectively, these health benefits may contribute to a reduction in the risk for long-term diabetes complications, slow the progression of existing complications and enhance quality of life. In addition, exercise is known to reduce stress and strain and enhance the quality of life.

Benifits of Exercise for Diabetics



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Yoga and diabetes mellitus

Practice of Pranayama produces a significant fall in the fasting blood sugar and post prandial blood sugar. Blood pressure is maintained at normal levels with significant reduction in the dosage requirement of antihypertensive. A significant decrease in LDL and VLDL with increase in HDL cholesterol is noted after the practice of yoga in diabetic individuals.



Women who watch twenty hours or more of television each week are more likely

to experience obesity, diabetes and other health risks. Researchers found that every two hours spent on watching television was associated with a 14 percent increase in diabetes risk.

9.7.5. Education

The Diabetics should be educated on the nature of the disease they have and the possibility of development of acute and long term complications of the disease if the blood sugar is not kept under control. Adequate basic information on diabetes enables the diabetic to comprehend and improve their psychological acceptance of the disease. In addition, the importance of following the Doctor's and Dietitian's instructions regarding diet, drugs and exercise should be explained.

Diabetics should be aware of the importance of monitoring urine and blood sugar and serum lipids at regular intervals to ensure overall wellbeing. Diabetics should understand the principles of dietary modifications and comply. Diabetics should be aware of complications and preventing methods.

ПП syndrome Metabolic \mathbf{V} a cluster of several is KNOW? medical conditions or comorbidities namely central (visceral) obesity, hypertension, insulin resistance and abnormal lipid metabolism which together increase the risk of type 2 Diabetes mellitus and cardiovascular diseases. A person is designated as having the metabolic syndrome if he or she has three of the following abnormalities:

- Abdominal obesity
- Prediabetes
- High blood pressure
- Low serum HDL cholesterol
- Elevated serum triglycerides

9.8. Complications of Diabetes

9.8.1. Acute complications

Hypoglycaemia: This is a condition of low glucose in the blood stream which can be caused by:

- An overdose of insulin
- Omission of food
- Loss of food by vomiting or diarrhoea
- Increase in exercise without accompanying modification of insulin dosages

Patient experiencing hypoglycaemia becomes uneasy, nervous, restless, weak and hungry. They appear pale and the skin becomes moist with excessive perspiration. There may be trembling, dizziness and double vision. Nausea or vomiting and convulsions can occur. If untreated, it may lead to coma and death.

Immediately, the patient should be administered a readily available carbohydrate source like glucose, candy, syrup, honey or fruit juices. Therefore diabetics should always be advised to carry sugar candy to control the condition causing symptoms when they are still mild.

Diabetic acidosis and Coma: Diabetic ketoacidosis is a case of severe insulin deficiency characterized by hyperglycaemia, elevated glucagon levels, acidosis and elevated blood ketones. This is caused due to the following reasons:

- The patient ingests extra /additional food which is more than that is controlled by the insulin dose.
- The patient omitted taking the insulin dose.
- The patient forgot to take the correct insulin dose.
- Injury
- Trauma
- Surgery

The symptoms are weakness, headache, pain, nausea, vomiting, flushed, dry and hot skin and dry mouth with increased thirst. One key symptom is acetone odour in the breath accompanied with painful and rapid breathing and dizziness. Clinical symptoms of shock are exhibited with unconsciousness followed by death unless prompt measures are taken.

9.8.2. Chronic complications

Retinopathy: Diabetic retinopathy also known as diabetic eye disease is caused due to damage occurring to the retina of the eye as a result of diabetes. It can eventually lead to blindness. Early detection, timely treatment and appropriate follow-up care of diabetic eye disease can protect against vision loss.

Nephropathy: Diabetic nephropathy is the damage caused to the kidneys or development

of kidney disease due to diabetes. It involves functional or structural damage to the nephrons and associated organ systems. This results in malfunctioning of the kidneys eventually leading to kidney failure.

Neuropathy: Patients with diabetes are especially vulnerable to the development of nerve damage and diminished transmission of nerve impulses which affect muscle function and sensory perception in vein-less parts of the body.

Diabetic Cardiomyopathy: It is a disease that damages the structure and function of the heart due to diabetes. This disease can lead to heart failure and arrhythmias.



Eight symptoms of Diabetes not to be ignored to prevent complications

- 1. Tingling sensation in feet
- 2. Occurrence of sores and blisters
- 3. Poor wound healing
- 4. Skin problems
- 5. Swelling in the feet
- 6. Digestive problems
- 7. Blurry vision
- 8. Chest pain

Stress is a well known offender in causing blood glucose levels to rise, particularly in patients with type 2 diabetes. Yoga, progressive relaxation, massage therapy, exercise and meditation are just a few ways to distress. Talk therapy, either one-to-one with a counselor or in a support group, can also be extremely helpful.

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9.8.3. Tips to avoid Diabetes complications

- Choose carbohydrates carefully.
- Loose weight if you need to.
- Get enough sleep.
- Be active.
- Monitor blood sugar regularly.
- Manage stress.
- Say no to salt.
- ✤ Avoid smoking and alcohol.
- Maintain the blood pressure and blood cholesterol levels.

9.9. Artificial Sweeteners

High content of sugar consumption is undesirable for diabetics. Non caloric and high

intense sweeteners are available as sugar substitutes. An ideal sweetener is as sweet or sweeter than sucrose, has a pleasant taste with no after taste, is colourless, odourless, readily soluble, stable, functional and economically feasible. It is non toxic, does not promote dental cavities and is either metabolized normally or excreted from the body without contributing to any metabolic abnormalities. Some of the sweeteners available in the market are Aspartame, Saccharin and sucrulose. Use of sweeteners by a diabetic patient is not encouraged as it does not help the patient to wean away from sweet foods.



Do you think artificial sweeteners can be consumed by a diabetic in any amount? What are their side effects?



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9.10. Home remedies

The following foods are suggested to reduce the blood sugar levels and complications of diabetes:

- Fenugreek
- Jamun fruit
- Green leafy vegetables
- Sprouts
- Varagu
- Thinai
- Curry leaves
- Cinnamon

SUMMARY

- Diabetes mellitus is a chronic metabolic disorder that prevents the body to utilize glucose completely or partially.
- It is characterized by raised glucose concentration in the blood and alterations in carbohydrate, fat and protein metabolism.
- One in every eight individuals in India is a diabetic.
- The average age for the onset of diabetes is around 40 years while it is around 55 years in other countries.
- The types of Diabetes are Type 1 or Insulin dependent Diabetes mellitus, Type 2 or Non insulin dependent Diabetes mellitus. Gestational diabetes, Malnutrition related Diabetes mellitus and Secondary Diabetes.
- The main cause of type 1 diabetes is infection.
- The main causes of type 2 Diabetes are heredity, age, stress and obesity.
- The main symptoms of diabetes are polyuria, polyphagia, polydipsia, fatigue and delayed wound healing.

14th November is World Diabetes Day

Effective blood glucose control measures with healthy diet, physical activity and drugs not only allow the diabetics to lead a normal healthy life but also prevent the complications associated with diabetes.

YOU SHOULD CONTROL DIABETES OTHERWISE IT WILL CONTROL YOU

- There are alterations in carbohydrate, protein and fat metabolism for a diabetic. The following are the diagnostic test for Diabetes- Fasting blood glucose, Random plasma glucose and Oral Glucose Tolerance Test.
- The main modes of treatment in Diabetes are Diet, Insulin, Drugs, Exercise and Education.
- The acute complications of Diabetes include hypoglycaemia and Diabetic acidosis and coma.
- The chronic complications are retinopathy, nephropathy, neuropathy and cardiomyopathy.
- Non caloric and high intense sweeteners are available as sugar substitutes for a diabetic.
- Effective blood glucose control measures with healthy diet, physical activity and drugs not only allow the diabetics to lead a normal healthy life but also prevent the complications associated with diabetes.

DIET IN DIABETES MELLITUS

A-Z GLOSSARY

Terms	Meanings
Acidosis	A buildup of acid in the blood stream
Ketosis	A metabolic state characterized by raised levels of ketone bodies in the body tissues.
Hyperglycaemia	Increased blood sugar level
Hypoglycemia	Decreased blood sugar level
Glycosuria	Sugar in the urine
Somatostatin	Hormone produced by many tissues in the body and regulates the endocrine system
Polyuria	Increased urination
Polydipsia	Increased thirst
Polyphagia	Increased hunger
Haemochromatosis	It is an inherited condition wherein the iron levels in the body slowly builds up.
Chronic pancreatitis	It is long standing inflammation of the pancreas that alters the organ's normal structure and functions.
Down's syndrome	A genetic chromosome 21 disorder causing developmental and intellectual delays.
Carcinoma of pancreas	Cancer in the pancreas
Pancreatectomy	Surgical removal of all or part of the pancreas
Cushing's syndrome	A condition that occurs due to exposure to high cortisol levels for a long time.
Addison's disease	A disorder in which the adrenal glands don't produce enough hormones.
Hypopituiturism	Diminished hormone secretion by the pituitary gland
Insulinopenia	Deficient secretion of the insulin by the pancreas resulting in hyperglycaemia.
Oral Hypoglycaemic drugs	Drugs used to lower the level of blood glucose.
Retinopathy	Damage occurring to the retina of the eye as a result of diabetes.
Nephropathy	Damage caused to the kidneys or development of kidney disease due to diabetes.
Neuropathy	Damage to the nerves due to diabetes.
Diabetic Cardiomyopathy	It is a disease that damages the structure and function of the heart due to diabetes.
Glycaemic Index	It is an ability of a food item to raise the blood glucose levels.
Food exchange lists	Food exchange lists are groups of measured foods of the same calorific value and similar protein, fat and carbohydrate and can be substituted for one another in a meal plan.

DIET IN DIABETES MELLITUS = 159

UNIT 9_new.indd 159

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Evaluation

I. Choose the correct answer (1 mark)

- 1. Excess thirst in diabetes is called as
 - (a) polyuria (b) polyphagia
 - (c) polydipsia (d) ketonemia.
- 2. This is avoided for a diabetic patient.
 - (a) vegetable salad (b) fruit salad
 - (c) wheat (d) honey.
- 3. The normal blood sugar level is -----mg/ dl.
 - (a) 80-120 (b) 60-100
 - (c) 40-80 (d) 140-180.

(a) 15 (b) 20 (c)25 (d)30.

- 5. This is an acute complication of diabetes.
 - (a) retinopathy(b) neuropathy(c) nephropathy(d) hypoglycaemia.

II. Write short answer (2 marks)

- 1. What is Diabetes mellitus?
- 2. What is meant by gestational diabetes?
- 3. Why is exercise important for a diabetic?
- 4. How will you avoid diabetes complications?
- 5. What are the causes of secondary diabetes?
- 6. Write on the prevalence of diabetes in India.

DIET IN DIABETES MELLITUS

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7. Explain diabetic ketoacidosis.

III. Answer in brief (3 marks)

- 1. List the symptoms of diabetes.
- 2. Explain the causes for diabetes.
- 3. Explain glycaemic index.
- 4. Discuss artificial sweeteners.
- 5. How will you diagnose diabetes?
- 6. Explain how types of insulin affect modification of diet.
- 7. What are the dietary guidelines to be followed for a diabetic?
- 8. Write on the home remedies for diabetic.

IV. Answer in detail (5 marks)

- 1. Write on the acute complications of diabetes.
- 2. Differentiate between type 1 and type 2 diabetes.
- 3. Explain the metabolic changes in diabetes.
- 4. Write on principles of planning diet for a diabetic.
- 5. Write on the chronic complications of diabetes.

