# Diabetes Mellitus & Its Prevention

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**Abstract:** Diabetes Mellitus has been known for centuries as a disease related to sweetness. even though several million people all over the world are effected with diabetes, not all are well informed about the nature of the disease. in diabetes, there is excessive glucose in blood and urine due to inadequate production of insulin or insulin resistance. diabetics can lead a normal life, provided they take prescribed durgs and make certain changes in their lifestyle, particularly in their diet and physical activity. uncontrolled diabetes leads to some of the complication so some of the home remedies also play a major role to prevent the diabetes.

**Keywords**: Types, Symptoms, Complications, Diet, Exercise, Home remedies.

Diabetes mellitus is a chronic metabolic syndrome or disorder that prevent the body to utilize the glucose completely or partially. Diabetes is known as a disorder of carbohydrates metabolized characterized by high blood sugar level (hyperglycemia) and high levels of glucose in urine (glycosuria). It is accompanied in many cases by secondary alterations of at and protein metabolism, resulting in an arry of physical disorder. Diabetes mellitus is caused by deficiency of the insulin secreting cells "**βcells"** in the pancreas. Due to improper work of insulin receptors the metabolic alternations will occurs – carbohydrates (glucose), protein (wasting muscle), fat(production of keto bodies or ketoacidosis).

**Insulin**: There are 4types of cells in the pancreatic islets

1. Glucagon secreting A cells or Alpha cells
2. Insulin secreting B cells or Beta cells
3. Somatostatinsecreating D cells or Delta cells
4. Pancreatic – poypeptidecells or PP cells

## Normal requirement

The approximate daily insulin requirement in Non Diabetics whose pancreas has been removed is "25-4"units. The normal pancreas probably secretes move insulin than this, because with removal of the pancreas the insulin requirement is reduced since food is not as well absorbed.

The alpha (α)cells that produce glucagon and raise blood sugar are also removed together with the beta (β) cells. Even 10% of functioning pancreatic tissues is enough to prevent diabetes.

## Mechanism of action:

Insulin acts through receptors on the surface of cells. Decreased insulin response (insulin resistance) may be due to a decrease in the number of these receptors. Insulin aids deposition of carbohydrates, protein and fat into the cells.

**Carbohydrates**: Insulin allows entry of glucose into the cells, stimulates cellular enzyme to deposit glycogen, it also aids glucose utilization.

**Protein**: Insulin is necessary for formation of protein from amino acids in the cells; it inhibits the release of amino acids from the cells. "Deficiency of insulin results in protein breakdown, which in turn leads to wasting of muscles".

**Fat:** fatty acids are stored in the fat cells as triglycerides. They are released from the cells for energy requirement and are metabolized by the liver into ketone bodies (acetoacetic acid, hydroxyl butyric acid and acetone). The ketone bodies are utilized for energy by body tissues. Insulin inhibits release of fatty acids from fat cells, decrease ketone production by the liver and increases peripheral utilization of ketone for energy. Insulin is the only hormone that promotes storage of fatty acids in the cells as against many hormone that tend to release cellular fatty acids.

**In the Absences of Insulin**

i. Blood sugar is raised and liver glycogen is depleted.
ii. Serum lipids increases and ketone bodies accumulation in the blood.
iii. The liver converts amino acids to glucose (gluconeogensis), which increases nitrogen excretion and reduce protein synthesis.

**Types of Diabetes Mellitus**

1. Type 1 DM or Insulin Dependent DM or Juvenile Onset DM
2. Type 2 DM or Noninsulin Dependent DM or Adult Onset DM
3. Gestational Diabetes Mellitus
4. Malnutrition Related Diabetes Mellitus

**Type 1:** Insulin dependent DM or Juvenile Onset Diabetic patients depend on insulin. There is usually sudden onset and occur in the younger age group and there is an inability of pancreas to produce adequate amount of insulin. This may be caused by virus or due to autoimmunity. The child is usually underweight, acidosis is fairly common

## Aethiology:

**Genetics**: The inheritance of human IDDM is polygenic. It has been established that over 50% of the heritability is contributed by the HLA class II gene(chromosome 6).

**Infection**: There is increasing evidence that type I diabetes especially in youngers patients, follows a "***Coxsackie***" or other virus infection. There is sometimes a longinterval between theinfection and the onsetof symptoms. The virus maytriggeranautoimmune reaction in the pancreatic islets and this impairs insulin secretion and ultimately destroy the β cells.

- **Caxsackie $B_4$ virus** – there is a genetic element in individual susceptibility to some of these triggers

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which has been traced to particular HLA genotypes.

**Immunological factors:**
IDDM is slow autoimmune disease associated with other auto immune disorder. Hyperglycemia accompanied by the classical symptoms of diabetes occurs only when 90% of insulin secreting cells are already destroyed.

**Diet:**
Wheat and milk protein have been shown to have the strongest diabetogenic effect and one evidently capable of triggering the string of events which results ultimately in destruction of pancreatic islets insulin secreting cells.
Introduction of cow's milk before the age of 2-3months is associated with the presence of antibodies to bovine serum albumin and an increased of developing IDDM

**Type II (NIDDM):**
Adult onset diabetes is non insulin dependent form, develops slowly and is usually milder and more stable. Insulin may be produced by pancreas but action is impaired. This form occurs mainly in the person who is usually overweight. .Acidosis is infrequent, the majority of patients improve with weight loss and are maintained on diet therapy.

- Type 2 diabetes is due primary to lifestyle factors and genetics.

***Lifestyle:*** NIDDM is commonly associated with obesity, hypertension and hyperlipidemia. In all this insulin resistance being the primary defect known as syndrome X or metabolic syndrome. NIDDM occurs in subjects who are obese insulin- resistant accompanied by impaired β cells function. Therefore it seems likely that NIDDM represents a combination of major or minor genes affecting insulin secretion, insulin action and obesity. A mutation of the glucokinase gene is associated with some cases of uncommon syndrome of maturity onset diabetes in the young. ***Abdominal fat*** people with high waist / hip ratio indicating that fat is largely in the abdominal cavity has a greater risk of diabetes than people with a similar amount of fat distributed peripherally. This probably relates to the insulin insensitivity whichis caused by the high flux of free fatty acids in the portal circulation because intra abdominal fat cells releases fatty acids very rapidly.

**Causes:** Diabetes is the result of lack of effective insulin action.

- Following is a comprehensive list of other causes
  - Genetic defects of β cells function.
    - Maturity onset diabetes of the young (MODY)
    - Mitochondrial DNA mutations.
  - Genetic defects in insulin processing or insulin action.
    - Defect in proinsulin conversion.
    - Insulin gene mutations.
    - Insulin receptor mutations.
  - Exocrine pancreatic defects
    - Chronic pancreatitis; Cystic fibrosis
    - Pancreatectomy ; Hemochromatosis
    - Pancreatic neoplasia; Fibrocalculouspancreatopathy.
  - Endocrinopathies
    - Excess of growth hormone (Acromegaly)
    - Cushing syndrome
    - Hyper thyroidism
    - Pheochromocytoma
    - Glucagonoma
  - Infections
    - Cytomegalo virus infection
    - Coxsackie virus $B_{4.}$
  - Drugs
    - Glucocorticoids
    - Thyroid hormone
    - β – Adrenergic agonists.

## SYMPTOMS:

Initial observations may include the following:

- Increased thirst; leads to loss of water and electrolytes which results in thirst (POLYDIPSIA).
- Increased hunger; Patient feels excess hunger as glucose is lost in urine and tissues are starved of glucose (POLYPHOGIA).
- Glucosuria; occurs when blood glucose level is 180 mg/dl. Glucose increases the osmolarity of the glomerular filtrate and thus prevents the reabsorption of water as the filtrates passes down the renal tubules. In this way the volume of urine is markedly increased in diabetes and POLYURIA and NOCTURIA occurs.
- **Dehydration**: As the blood glucose rises the extracellular fluid becomes hypertonic and water leaves the cells. If the loss of water and electrolytes continue depletion of extra cellular fluid leads to the clinical features of severe dehydration.
- **Fatigue & Loss of Weight:** impaired utilisation of CHO results in a sense of fatigue and two compensatory mechanisms operate to provide alternative metabolic substrate. Both lead to loss of body tissues and wasting may occur inspite of a normal or even increased intake of food. This is added to any loss of weight resulting from loss of fluids. Muscle tissues and fat will be broken down for energy.

**Some other symptoms :**

- Glycosuria
- Hyperglycaemia
- Acidosis (ketosis, ketonuria)
- Fluid electrolytic imbalance.

## METABOLIC EFFECTS OF INSULIN DEFICIENCY

A deficient supply of functioning insulin affects the metabolism of carbohydrate, fats, proteins, electrolytes and water and the consequences of the impairments are complex. When insulin is not being produced or is ineffective, the formation of glycogen is decreased and the utilisation of glucose in the peripheral tissues is reduced. As a consequence the glucose that enters the circulation from various sources is removed slowly and hyperglycemia follows.

| ***CLINICAL EFFECTS*** | ***MECHANISM*** |
|---|---|
| Hyperglycemia | Low uptake of glucose by liver, muscle, adipose tissue.<br><br>Increase in glucose production by liver due to glycogenolysis and glyconeogenesis.<br><br>High release of substrate by Muscle.<br><br>Increase in glycogenolysis, increased amino acid release. |
| Hypertriglyceridemia | Decrease in triglyceride uptake by adipose tissue. |
| Ketonemia | Increase in fatty acid metabolization by adipose tissues.<br><br>Increase in conversion of fatty acids to ketones by liver.<br><br>Low uptake by muscle of ketones produced in liver. |
| Hyperaminoacidemia | Low hepatic uptake of branched chain amino acids |

By gluconeogenesis through which 10% of fat molecules and 58% of protein molecules can yield glucose.When the blood glucose level exceeds the renal threshold (about 160 – 180 mg/dl). The loss of glucose in the urine represents a wastage of energy and entails an increased elimination of Na and $H_2O$. With a deficiency of insulin, lipogenesis increases and lipolysis is greatly increased. These effects being of both immediate and long range consequence. The fatty acids released form adipose tissue or available by absorption from the intestinal tract are oxidised by the liver to form "KETONE BODIES" including acetoacetic acid, β – hydroxybutyric acid and acetone. The liver utilizes only limited quantities of the ketones and releases them to the circulation. Normally the peripheral tissues metabolize the ketones at a rate equal to their production by the liver so that the blood level at any given time is minimal. In diabetes the ketones are produced at a rate that far exceeds the ability of the tissues to utilize them and the concentration in the blood is greatly increased (KETONEMIA). Acetone is excreted by the lungs and gives the characteristic fruity odour to the breath. Acetoacetic acid and β – hydroxybutyric acid are excreted in the urine (KETONURIA).

- The rapid release of fatty acids into the blood circulation often results in a hyperlipemia and the blood serum may have a milky opalescent appearance. The blood level of cholesterol are usually increased either because of increased synthesis or because of decreased destruction by the liver. The development of atherosclerosis in diabetic individuals occurs at an earlier age than in the non-diabetic.

Muscle protein catabolism is accelerated in uncontrolled diabetes. Thus amino acids especially alanine, or released to the liver for gluconeogenesis. Protein catabolism also increased the amount of $N_2$ that must be excreted as a result of deaminisation. The catabolism of protein tissue is accompanied by the release of cellular $K^+$ and its excretion in the urine.

## DIAGNOSIS:

All adults should have their urine examination for sugar twice a year and more often if.

i. Any blood relation has diabetes.
ii. There is sudden increase in weight.
iii. There is unexpected weight loss.
iv. There is frequent urination at night.
v. There are recurrent skin infections.
vi. A wound doesn't heal.
vii. Children are overweight at birth.

## BLOOD EXAMINATION:

**Glucose tolerance test:**
Oral glucose tolerance test is a confirmatory test. Expert committee on diabetes of the WHO recommends for the test that 75g to be used as the glucose load for adults and 1.7g/kg body weight. For children with maximum 75g.

**Random blood sugar:**
After food intake the test is proceeded.

**URINE EXAMINATION:**
Examination of an early morning sample of urine may fail to detect early diabetes mellitus. It is necessary to observe the following.

- Urine is voided just before a meal.
- Breakfast or lunch of carbohydrate rich.
- 2 or 3 hours after the meal, urine is voided and examined for sugar.

Even with the glucose oxidase method. False – positive urine glucose test (pseudoglucosuria) may be noted with ciprofloxacin administration. By using benedicts test (at home) urine examination is done. When heated the sample, the sample turned to orange or red colour indicates the presence of sugar in urine.

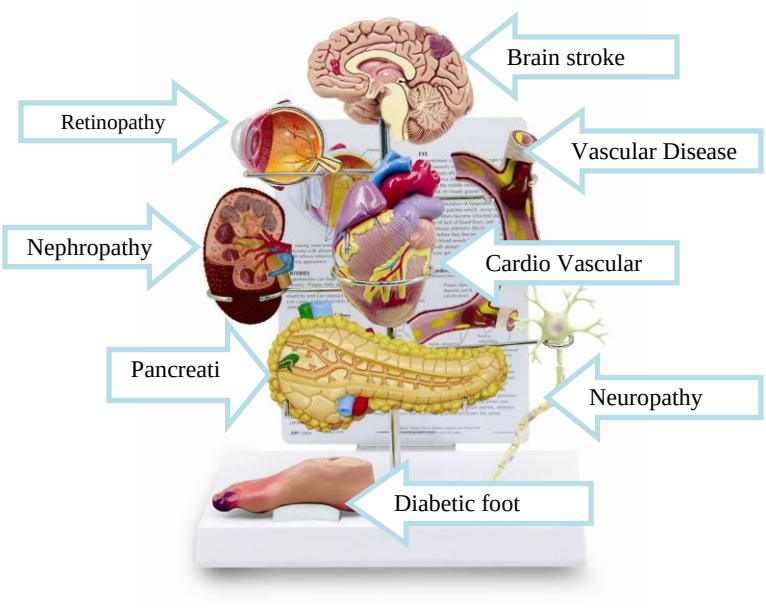
**NORMAL VALUE: (Plasma)**

| | | |
|---|---|---|
| Fasting blood sugar | - | 70-110mg/dl |
| Random blood sugar | - | 120-140mg/dl |
| Post paridal | - | 140-200mg/dl |

Glycosylated hemoglobin : Normal ≥ 6.5%
A new investigation HbAIC (glycosylated hemoglobin) estimation, gives an excellent indication of overall control over preceding period.

- As the concentration of glucose in blood rises, more of it gets attached to haemoglobin and the combined molecule is chemically estimated as Hb $A_1$ C.

## DIABETIC COMPLICATIONS




## MANAGEMENT OF DIABETES:

The main modes of treatment of diabetes:

1. Diet and diet counseling.
2. Drugs
3. Exercise
4. Education (dietary guidelines).

**DIET:** Dietary introductions for a diabetic must be simple because he/she has to follow a diet for the rest of his/her life. There is considerable variation in the chemical composition of food and in modes of cooking. The menu must include foods that the patient likes, that are affordable and easily available.

**PRINCIPLE OF DIET:**

***Calories:*** The total intake of calories is more important for a diabetic than the exact proportions of proteins, fats and carbohydrates in the diet. A diabetic should be kept on a well-balanced diet providing just enough calories to maintain ideal body weight. In a diabetic of normal weight enough calories should be given to maintain weight. In an underweight, calories should be given to increase the weight to normal and maintain it. In an obese, calories should be given to decrease the weight to normal and maintain it.

**THE USUAL DISTRIBUTION OF NUTRIENTS IN THE DIET:**

| | | |
|---|---|---|
| Carbohydrates | - | 55-60% |
| Proteins | - | 20% or 1g/kg bdwt |
| Fats | - | 20-25% |

**CALORIE CONVERSION:**

For example : Intake of calories is 1800k.cal

- CHO = 55-60% :- 55%
  1800×0.55 = 990k.cal
  1 CHOg = 4k.cal. So, 990/4 = 248g CHOs.
- Proteins = 20%
  = 1800×0.20 = 360k.cal.
  1g protein = 4k.cal. So, 360/4 = 90g of proteins.
- Fat = 25%
  = 1800×0.25 = 450k.cal.
  1g fat = 9k.cal. So, 450/9 = 50g of fat.

**Carbohydrates:**

Ingested food goes into the metabolic pool where all nutrients (except those required for growth and repair) are converted to carbohydrates and fats. Thus, even on a diet of meat and fish with a negligible amount of carbohydrates. Carbohydrates are deposited as “Glycogen” in the muscle and liver by the action of insulin. In diabetes, due to deficiency of insulin, this metabolism is disturbed. Carbohydrates restriction impairs insulin sensitivity and reversed by high carbohydrate diet. Hence, carbohydrates is maintained to about 55-60% of total calories. Most carbohydrates should be in the form of polysaccharides such as bread, cereals, beans, etc; Whole apple is better than apple juice because of its high fibre content and low glycemic index.

**GLYCEMIC INDEX:**

High glycemic index forms of carbohydrates are foods that produce high concentration of blood glucose and increased insulin demand and that therefore, could possibly contribute to higher risk of type – Π diabetes. The ability of a food item to raise the blood sugar is measured in terms of glycemic index.

$$GI = \frac{\text{Blood glucose area of test food}}{\text{Blood glucose area of reference food}} \times 100$$

For the measurement of GI, the carbohydrate content of the food to be tested and of the reference food is kept the same. White bread is preferred as reference food because it is palatable and generally accepted. A 100% value is given to the mean blood glucose for 3 hours following ingestion of 50g carbohydrates in white bread.

**DIETARY FIBRE:**

Dietary fibre and complex carbohydrates benefits for diabetes. Such diet lowers:

- Insulin requirements
- Increase peripheral tissue insulin sensitivity
- Decrease serum cholesterol and triglyceride values
- Aid in weight control / weight loss
- Lower blood pressure.

Soluble fiber such as pectin, gums, hemicelluloses (in fruits) increase intestinal transit time, delay gastric emptying, slow glucose absorption and lower serum cholesterol. Insoluble fiber such as cellulose and lignin (vegetables, grains) decrease intestinal transit time, increases fecal bulk, delay glucose absorption and slow starch hydrolysis. Diet high in carbohydrates and fibre improve glucose metabolism without increasing insulin secretion. They lower fasting serum and peripheral insulin concentrations in response to oral glucose administration in both diabetic and non-diabetic individuals.

Diabetic should therefore, eat more “fibre (35-40g)” “Phytic acid”, usually contained in cereals and pulses, may have a more dominant role in decreasing the blood sugar rise, than fibre. The blood glucose response become less with increase in content of phytic acid in the food.

**PROTEINS:** A diet high in protein is good for the health of diabetes, because

i. Supplies the essential aminoacids needed for tissue repair.
ii. Doesn’t rise blood sugar during absorption as much as carbohydrates.
iii. Doesn’t supply as many calories as fat.
iv. Also promotes satiety and helps both types of diabetic patients to adhere to the carbohydrate allowance.

Hence, 20% of proteins are supplied from the total calories. 1g of protein/kg body weight is adequate, more 1.25 or 1.5g/kg body weight may be given if necessary.

**FATS:** Fats should be provided about 20% - 25% of calories. They cannot be oxidized as readily as carbohydrates. The normal end products of oxidation of fats are $Co_2$ and $H_2O$. Ketone bodies are intermediate products of normal fat metabolism. They are produced in the liver and utilized by the tissues to provide energy. The accumulation of these products results in diabetic coma.
The ensuring exercise breakdown of fats results in accumulation of ketone bodies which are then excreted in the urine daily metabolism of 100g carbohydrates prevents accumulation of ketone bodies.

**VITAMINS:** Vitamin supplementation may be helpful to overcome oxidative stress and deficiency. Diet rich in all vitamins particularly in vitamin – C and E antioxidant in fruits and vegetables. Carbohydrates are not completely metabolized when there is a deficiency of vitamin – B. It is postulated that products are partial carbohydrates metabolism, like “Pyruvic acid” accumulate in such situations and damage the nerves, resulting in “PERIPHERAL NEUROPATHY”. The diabetic requires supplements of vitamin – B. It is also advisable to supple vitamin – A, as the liver.

**MINERALS:** Supplementation may be helpful to overcome oxidative stress and deficiency. Minerals especially magnesium and zinc are encouraged. Normal casual intake should be suggested for diabetes and Na may have a role in the development of “insulin resistance” apart from its role in maintaining blood pressure. Moderate dietary Na restriction is beneficial “chromium supplementation decreases”. The requirement for insulin or oral hypoglycaemic agents in patient with type – Π diabetes.

**DIETARY GUIDELINES:** Daily energy intake must be estimated after considering such factors as age, sex, actual weight in relation to desirable weight, activity and occupation.

- The patient should maintain body weight 10% lower than the ideal/desirable body weight. Ideal body weight is calculated using Broka’s index.

**Broka’s index = Height in cms-100 = ideal body weight in kgs.**

- If patient is overweight 20k.cal/kg, if ideal weight is 30k.cal/ kg and underweight 40k.cal/kg are prescribed.
- Total calorie intake is more important for a diabetes than the exact proportions of protein, fat and carbohydrates in the diet.
- Dietary calories should be 50-60% of carbohydrates, 15-20% proteins, 20-25% of fat are prescribed.
- Insulin adjusted depending upon the need. Calorie distribution is adjusted according to type of insulin.
- Patients should avoid fasting and feasting. Regulating of meals is needed for persons taking insulin. Meals should be spaced to consider with the availability of insulin.
- Timely intake of inbetween meal snacks should be stressed to avoid hypoglycaemia. Three main meals and three between meal snacks can be taken.
- Simple sugars should be restricted since they are easily absorbed and have a high glyceamic index. Avoid glyceamic peaks.
- A mixture oils is preferred than single oil. Polyunsaturated fatty acids and monounsaturated fatty acids containing vegetable oils preferred (sunflower oil, groundnut oil, corn oil, gingelly oil) than animal fat and hydrogenated fat which contain more saturated fatty acids. Fish and chicken are preferred than meat and egg. Avoid atherogenic diet.
- High protein intake helps to increase insulin production and promotes satiety .pulses are rich in protein fibre.
- Complex carbohydrates and fibre should be included in the diet. 25.40 gms of dietary fibre can be included for each 1000k.cal consumed.
- The water soluble fibre has the greatest hypoglycaemic and hypocholestrolemic effect. The diet should include legumes, whole grains, and fenugreek seeds.
- The diet should meet the requirement of antioxidants , micronutrients and phytochemicals. The intake of permitted vegetables and fruits should be increased.
- Antihyperglyceamic agent acarbose delays and reduces rise in postprandial blood glucose levels. Acarbose is an α – glucosidase inhibitor. Whole wheat is preferred to rice because it contains acarbose which allows carbohydrates to be absorbed slowly.
- Sodium intake is to be no more than 6gms daily. Na is restricted to 3gms in hypertensive diabetic patients.
- Hypoglycaemic foods like fenugreek can be included in the diet.

**FOOD EXCHANGE:**

Slice of Bread 30g - 75 K.Cal
Thin Chapathi(Wheat) 15g - 40 K.Cal
Jowar/BajarChapathi 30g - 100 K.Cal (Average of all Cereals & Mellitus).

2 Slices of Bread = 2 Chapathi of Bajar/Jowar = 4 Thin Wheat Chapathi.

- Rice can exchange ration of 2 wheat chapathi or one slice of bread for 4 tbs of rice - 100K.Cal
- Dhal - 1 Cup provides – 100 K.Cal& a vegetarian diet 2 Cups of Dhal & 1 Cup of Dhal with Meat, Egg, Fish.
- Egg – 50 K.Cal/(Protein Rich),Meat(Lean),Fish, Chicken, Liver weighs 100g before cooking but calories remain same 100 K.Cal.
- For Vegetarians skimmed milk powder is suggested 1tbs of skimmed milk powder + 3tbs of wheat flour makes a delicious chapathi with protein rich.
- ¾ Cup Cow's , ½ Buffalo , 1 ¼ Buffalo skimmed milk powder provides 100 K.Cal.
- Vegetables (Except Potato and Sweet potato) other root vegetables like Carrots ,Raddish , Onion & Turnips too provide few Calories and can be taken as desired.
- Potato & Sweet Potato average weight 100g & provides 100 K.Cal approximately. 1 Medium size potato occasionally allowed in exchange for any 100 K.Cal(420 KJ).Food items mentioned Eg: 1 Slice of bread , 2 Chapathi , 1 Cup Skimmed milk.

**FAT FOR COOKING:**

- 1 tbp / meal for thin diabetes.
- 2 tbp/ meals for normal weight diabetes.

**FRUITS:** Fruits supply Carbohydrates and Vitamin -C , Fruit allowed 2 or 3 times a day.

- Orange , Sweet Lime , Apple – ½ , Guava Small – 1.
- ½ Small Papaya , ½ Melon , ¼ Small Watermelon.
- 24 Grapes , 10 Strawberries or Gooseberries.

**NUTS**: These are allowed as exchange Foods = 100 K.Cal.

- 3 Walnuts.
- 12- 15 Almonds.
- 16- 20 Groundnuts.
  Provides 100 K.Cal
- 30 Pistachios.
- 8 Cashewnuts.

**ALCOHOL**: Alcohol stimulates the smooth Endoplasmic reticulum of the liver cells , and may enhance the effect of Oral Anti – Diabetic Drugs & Suddenly reduce blood sugar(Hypoglycemia). Alcohol probably a risk factor in the development of diabetic retinopathy . Alcohol is absorbed from the stomach and reaches the blood through stream. It is metabolised and the capacity to release glucose from its reserve stores is blockerd. Alcohol should be consumed in moderation i.e Not more than 2 Equivalents (One Equivalent= 1 ½ oz distilled beverage , 12 oz beer and 4 oz wine).

- Soya milk is as nutritious as the animal milk , it is better suited for diabetic and heart patients.

**SAMPLE DIET PLAN :**

| | |
|---|---|
| Early Morning | Milk (Skimmed) - 1 Cup or<br><br>Tea without Sugar. |
| Breakfast | Idly – 3/Dosa – 2/Wheat Upma – 1Cup/Kichidi-1Cup/Chapathi-2(Thin)\Oats.<br><br>Mixed Vegetable Curry/Sambar or Fresh Chutney(Leafy Green). |
| Mid Morning | Fruit - 60gms |
| Lunch | Rice – 2 Cup.<br>Vegetable Curry – 1 Cup.<br>Leafy Green Vegetable – 1 Cup.<br>Curd – 1 Cup. |
| Mid Afternoon | Vegetable Salad – 1 Cup/wheat Bread – 4 Slices. |
| Snacks | Ragi Java/Oat meal/Sprouted Legumes/WheatFlakes/Biscuits (Nutrichoies, other Mariegold) |
| Dinner | Chapathi - 2/Pulka - 2/Rice – 75g<br>Vegetable Curry – 1 Cup.<br>(OR)<br>Egg Curry/Pea/Beans – 1 Cup.<br>Curd/Buttermilk – 1 Cup. |
| Bedtime | Milk(Skimmed)/Fruit Small-30gms |

**TIPS:**

- Add 3 Garlic in diet in any form .
- Add fenugreek powder to curries or in chapathi.
- Only 2 tbs of Oil included.
- No Fasting and Every 2 hour feed is important.
- Avoid of Ghee , Coconut , Vanaspathi.

***Some of the foods listed for diabetic persons***

| **FOODS PERMITTED** | **FOODS AVOIDED** |
|---|---|
| Green Leafy Vegetables | Coconuts , Papads , |
| Vegetables | Ghee , Pickles , |
| Fruits – Apple , Guava – 1 medium size | Vanaspathi , Preserved Foods , |
| Papaya - ½ | Creams , Fried Foods , |
| Melon - ½ | Sweetened Jucies |
| Watermelon - ¼ | Sugar , Jaggery , |
| Sweet Lime | Honey , |
| Oranges , | Dried Fruits , |
| Grapes - 24 | Alcohol , |
| Gooseberries - 10 | Beverages |
| Strawberries - 10 | **MODERATELY PERMITTED** |
| Skimmed milk & Milk Products | Non – Veg , Meat , Fish , Egg |

| | |
|---|---|
| Vegetable Salads, Soups. | Roots & Tubers , |
| Nuts - Walnuts - 3 | Artificial Sweeteners , |
| Almonds - 12 – 15 | Pulses |

**Role of other factors:** Like diet othersomefactorsplay a major in the management of diabetes as they are exercise, durg and education.

**Exercise:** Person with diabetes should therefore exercise regularly. This can include brisk walking, jogging, cycling, swimming, and playing badminton or tennis. Depending on one'sintrest, any of these can be selected. It should become a part of regular life. It is recommended that diabetic should doexercise of moderate intensityfor a minimum period of 150 minutes a week i.e.

**Education:** Diabetic should be educated on the nature of the disease they have and the possibility of development of acute and long term complications of the diseases, if blood glucose is not kept under control. Adequate basic information on diabetes enables the diabetics to comprehend and improve their psychological acceptance of the disease.

**HOME REMEDIES:**

- **Cinnamon** may lower blood glucose, triglycerides and LDL cholesterol in people with type – Π diabetes.
- CinnamonTea: 1g Or 1stickIn 1 Cup Boiling Water. Cinnamon Powder: Used In Salads, Orange Juice, Oatmeal, Coffee Before Brewing.
- Eat garlic regularly as it regulates sugar levels.
- **FENUGREEK SEEDS** : which has the noval free amino acids, 4 – hydroxyl isoleucine which stimulates insulin secretion, there by limiting the extent to which blood glucose is elevated, promoting insulin secretion and inhibiting the rise of blood glucose.
- Take a tablespoon of **AMLA JUICE** on daily basis. So it can help to pancreas to secrete insulin hormone.
- **BITTER MELON**: Charantin is identified as a primary agent for blood sugar regulation. Charantin demonstrate hypoglycemic or other action of potential benefit in diabetes.
- Eat tender curry leaves (fresh) twice a day to reduce sugar.
- Kidney beans help in detoxifying pancreas.
- SOYA BEAN: it is rich in vitamin – A, calcium, iron, fibre considered to be beneficial and protein fibre is good for diabetes.
- CAYENNE: Works as health tonic and improve blood circulation.
- Mix ½ tsspoon of ground bay leaf and ½ tspoon of turmeric in 1 tablespoon aloe vera gel. Take this mixture twice a day before lunch and dinner.
- Bitter melon is wonderful herb for diabetes.
- 45 minutes walk everyday helps normalise body weight and correct insulin resistance.

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