**SUBJECT CODE :DIETETICS-II**

**SUBJECT CODE: 16SCCND8**

**UNIT - 1**

**Diabetes Mellitus**

**Introduction**

Diabetes mellitus, commonly known as diabetes, is one of the most serious diseases affecting humanity. Its incidence has increased alarmingly and it affects 18 million Indians as reported in the Journal of the Diabetic Association of India in 1999.Studies indicate that there may be just as many undetected diabetics and twice as many may be onthe verge of getting it. Undetected and hence untreated diabetes is one of the main causes of further complications such as loss of limbs due to impairment of nerves and loss of vision due to retinal detachment.Diabetes is a chronic, degenerative disease that affects the way body uses food. In normal digestion, body converts sugars, starches and other substances into glucose, which is carried by the blood to every cell in the body. The glucose is used with the help of insulin (a hormone made in the pancreas) to produce energy for every action–pumping blood to writing to physical movements of our body.

Diabetics are unable to produce insulin, make too little or are unable to use it. Diabetes is not a disease**,** which can be cured. It can only be kept under controlby the patient with the help of the nutritionist assisted by the physician. If not kept under control, a number of complications occur. These include**:**

(*a*) loss of sensation in peripheral nerves, resulting in injury, infection and amputation of lower

extremities.

(*b*) Eye disorders leading to blindness

(*c*) Thickening of arteries and

(*d*) Kidney dysfunction.

Proper care of diabetes is essential to prevent or at least reduce incidence of complications. It is vital that the patient learn all about the disorder and its management, for health care in diabetes is basically self-care. A proper nutrition plan is the foundation of successful diabetes management. Control of diabetes rests on three factors: diet, exercise and insulin.

Symptoms and Diagnosis

As diabetes develops, the person complains of excessive thirst (polydipsia), increases frequency and amount of urine and feels very hungry. Young patients lose weight, while older patients may be overweight. The presence of sugar in the urine and above normal blood sugar level are clinical symptoms of diabetes. A fasting blood sugar level of 120 mg/dl or higher on two different days indicates that the person suffers from diabetes.

**Classification of Types of Diabetes Mellitus**

There are three types of diabetes mellitus:

**Type I** is Insulin Dependent Diabetes Mellitus (**IDDM**) – About 10 to 20 per cent of known cases of diabetes are of Type I. There is no insulin or insufficient insulin to regulate blood glucose, because the beta cells are destroyed or are very few. The reason for the destruction of the beta cells can be an auto immune reaction, viral infection, genetic aberration and/or stress. It may occur at any age but a large number of patients are young. Most of the diabetic cases occurring before 20 years of age are of Type I. The disorder starts abruptly with typical symptoms mentioned above.

**Type II** is Non-Insulin-Dependent–Diabetes Mellitus (**NIDDM)**: 80 to 90 per cent known cases are of type II. In these, insulin receptor response is decreased while insulin production may be normal, increased or decreased. Sudden shock, trauma or tragic event in the family, heredity and excess body weight are contributory factors. Most patients are obese. Most cases occur during the mid-thirties or mid-forties. The onset is gradual and the ailment is detected during a routine medical check-up. If the diet is suitably modified and regular exercise is taken, these persons do not need insulin except during stressful days. Other types of **Diabetes Mellitus**: A **third** type of diabetes occurs in association with certain conditions. These include chronic pancreatitis or as a corollary to intake of some medications such as glucocorticoids, antihypertensives, etc. In this type the plasma glucose levels are higher than normal,but lower than those indicative of diabetes.

**Gestational diabetes** occurs in some women during pregnancy. Diet modification as indicated for type II diabetes helps to correct the glucose intolerance during pregnancy. The blood glucose returns to normal after delivery; but many of these women develop diabetes mellitus in later years**.**

**Nutritional Care:** is the cornerstone of **diabetic therapy**.

**Energy: It** needs are same as for other individuals. The aim is to attain and then maintain a healthy weight for the body size and type. If an obese patient loses weight, it leads to improved glucose tolerance. Ideally 55 – 70 per cent calories should be mainly from complex carbohydrates. The aim is to control blood glucose and lipid levels.

**Fibre:** It is observed that substituting highly refined carbohydrates in the diet with foods, containing complex carbohydrates and fibre, benefits both type I and type II **diabetics**. Such diets improve glucose tolerance control, often decreases insulin requirements and tends to lower serum cholesterol and triglyceride values. It also helps to control weight and lower blood pressure. Intake of fruits is beneficial for diabetics. The soluble fibres (pectin, gums, hemicelluloses) present in fruits increase transit time, slow glucose absorption and lower serum cholesterol. Fibre content of common foods Fenugreek seeds, recommended as addition to diabetic diet in ancient medical system, are valuable due to their high content of mucilaginous and total fibre. It also contains an alkaloid (trigonelline), which is known to lower blood sugar level.

**Lipids:** In diabetic diet, the total fat should be 20 to 30 per cent of the total energy. Of these saturated fats contribute about a fourth (7-10%), monounsaturated half (10-13%) and polyunsaturated about a fourth (8-10%) of the total energy. Cholesterol content of the diet should be less than 300 mg per day. In a 2000 calorie diet, the calories from fat would thus be 400 to 600, which amounts to about 45 to 65 grammes of fat in the diet, a third of it is taken in hidden form. Hidden fat occurs in foods such as milk, ***dahi,*** nuts, oilseeds, eggs and meat. Hidden fats content of diet varies, but is estimated to provide about a third or more of the total fat in the diet. Thus the visible fat intake in the diet as butter, ghee and oil used in food preparation can be 30 to 40 grammes.

to control the saturated fat intake, the amounts of animal foods such as ghee, butter, cheese, eggs and meats must be monitored to provide less than 15 grammes of the total fat intake.

**Proteins:** The recommended amount of protein is 0.8g/kg of ideal body weight. Adolescent children, pregnant or nursing mothers need increased intake up to 15 to 20 per cent of total energy.

**Sweeteners:** Use of artificial sweeteners in reasonable amounts is acceptable to control total calorie intake.

**Sodium:** A moderate sodium intake of 1 gram/1,000 calories is recommended, because many diabetics are hypertensive or have hypertension. Foods containing sodium such as pickles, papads, and baked foods containing baking powder should be avoided.

**Vitamins and Minerals:** Requirements are similar to those of other individuals. There is no need

for supplements.

**Alcohol:** Alcohol is not a food and its use places an additional burden on the system. Its use is not advisable especially when oral hypoglycemic agents are to be taken as part of the therapy.

**How do we translate the above guidelines into a diabetic diet prescription?**

Suppose the diabetic person is 50 years old, who is involved in light activity.

His healthy weight is 55 kg.

Total energy needed : 55 × 30 = 1,650 calories

Proteins : 0.8/kg or 0.8 × 55 = 44.0 g, rounded to 45 g.

45 × 4 = 180 calories from proteins (11%).

Fats: 28% or 16.50 × 28 = 462 calories/9 = 51g fat

CHO : 1650 – (180 + 462) = 1008/4 = 252g (61%)

**Diet Plan:** The diabetic has to follow the diet plan through the rest of her/his life. Hence the meal plan should be based on her/his normal schedule, meal pattern, food acceptance, food preparation methods and facilities available. It should also take into account the cultural – religious factors. Meal plans should be realistic, attractive and flexible, within the limits of the diet prescriptions. Meals should be as similar to the family meals as possible.

**Meal Distribution:** It is important to distribute the carbohydrate foods in the meals through out the day. Avoid taking too high an amount of carbohydrates at any one meal. The type I diabetics need three meals and two or three snacks each day. As these persons use insulin, the carbohydrate intake should coincide with the action time of the insulin used. Type II diabetics or NIDDM patients, who do not need insulin, can take the three large meals at 7-8 am, 12-1 noon and 7-8 pm; in addition a snack at 4-5 pm and a fruit after supper may be eaten around 10 pm before retiring.

**Exchange Lists:** The patient must study the food exchange lists available for planning diabetic diets Plan the menu by dividing the food exchanges into various meals according to the patient’s need and choice. The menu can be distributed according to the needs of the patient and whether the patient is type I or type II diabetic.

It is important to include minimum number of servings of basic food groups. Ensure that you include whole grain cereal preparations (chapatis, bhakari/roti, whole wheat preparations, etc.), three *Vegetarian Non-Vegetarian* to four servings of vegetables two of fruits (one being vitamin C rich) and four to five servings of

protein foods.

**Control of Type I Diabetes**

In chemical control, the blood glucose is kept normal and urine sugar free by taking properly measured diet and insulin. It is believed that it will prevent or postpone further complications of diabetes

mellitus.

**Insulin:** Insulin is a protein. It has to be injected to ensure its being used as a regulator in the body. If taken orally, it would be digested like any food protein and will not be able to regulate the use of blood glucose. The amount of insulin needed depends on the patient’s requirements; it can be reduced by exercise, while any infection or other stress may result in increased need. A number of types of insulins are available with different duration and speed of activity. The type that helps a patient to function effectively is chosen. Most diabetics, who need insulin, take one dose daily, while a few may need two doses per day.

**Exercise:** Exercise is an important part of any treatment plan. It should be selected to fit in with the person’s capacity and requirements. It has many beneficial effects: It helps to maintain weight, heart function, control of blood lipids and reduce adverse changes due to stress. Persons with IDDM need to reduce their insulin dosage before and during exercise or take a carbohydrate containing snack to prevent hypoglycemia due to exercise.

**Control of Type II Diabetes**

Besides diet control, insulin and oral hypoglycemic agents may have to be taken by diabetic patients to metabolize excess glucose.

**Oral Hypoglycemic Agents (OHA):** When NIDDM is not controlled with diet and exercise, oral agents are sometimes used. These agents require the presence of endogenous insulin. Hence these are not suitable for use in IDDM. OHA initially stimulate beta cells to increase insulin production (which may be temporary) and thus control glucose levels. These may increase the number of insulin receptor sites, thus improving glucose use.

**Illness:** Illness should be reported to the health care provider. Insulin or OHA should be continued if these are being used. Food should be taken as usual, with change to soft or liquid diet as needed. Sufficient amount of fluids should be taken.

**Monitoring Control:**

(*a*) Check blood glucose to keep day-today control

(*b*) Check glycosylated hemoglobin to check long term index of control.

(*c*) Check urine glucose. Main value of this test is to confirm elevated blood glucose and monitor

ketonuria. It is not a reliable test to detect hypoglycemia or the degree of hyperglycemia. Some substances give false or negative results; these are megadoses of ascorbic acid, salicylates and levadopa.

**Acute Complications**

**Hypoglycemia–** blood glucose less than 50 mg/dl.

When a diabetic participates in games or increased activity without taking food, hypoglycemia may occur. When a diabetic takes an overdose of insulin or OHA, and does not eat at the scheduled time, there is a decreased supply of glucose, which results in fall of blood glucose level. When the blood glucose level falls below 50mg/dl, hypoglycemia occurs. Hypoglycemia may also occur, when a diabetic has diarrhoea or vomits, as this results in a decrease in blood sugar level. Hypoglycemia is accompanied by a feeling of weakness, giddiness and fainting, if not attended to promptly. If the person is conscious, he/she should be fed sugar, hard candy, fruit juice, sugar containing carbonated beverage or syrup, which give quick relief from symptoms. If the person is unconscious, intravenous glucose should be injected **immediately.** A diabetic should carry sugar. hard candy or glucose tablets, for use when needed**. A diabetic** **should carry a medical identity card** indicating that she/he is a diabetic and should be given intravenous glucose if she/he is unconscious due to hypoglycemia. Such immediate treatment can avert extended hypoglycemia, which causes damage to the central nervous system and the brain.

**Acidosis and Coma:** Type I diabetics are in danger of suffering from acidosis. It is caused by severe lack of insulin and stress. There is an increase in lipolysis (breakdown of fats for energy) and production of fatty acids. Liver oxidises fatty acids to meet energy needs. In the diabetic state, liver oxidises fatty acids and produces acetone, acetoacetate and beta-hydroxybutyrate. These tend to spill over into the urine causing **ketonuria.** Prevention is very essential and involves ensuring that carbohydrate is distributed in the daily meal to fit in with type of insulin, its dosage and time of injection. Thus by treating early symptoms promptly, **coma** can be prevented. In older patients (NIDDM), the cause must be identified and treated quickly. It is very important to prevent dehydration.

**Long-term Complications**

Poorly controlled diabetes increases risks of long-term diabetic complications. These health problems relate mainly to tissue changes affecting blood vessels in vital organs.

**Neuropathy:** These changes in the nerves involve injury and disease in the peripheral nervous system, especially in the legs and feet. It results in sensory loss and causes numbness in feet. Inadequaten blood supply leaves the foot susceptible to injury, infection, gangrene and ultimately amputation. Hence the need to pursue the diet, exercise and if need be insulin, very methodically and avoid or delay complications.

**Retinopathy:** The changes in the eyes include thickening of capillaries with small hemorrhages from broken arteries in the retina, with yellow waxy discharge or retinal detachment. This complication can eventually cause blindness. Retinopathy is not to be confused with blurry vision that occurs sometimes as one of the first signs of diabetes. Blurry vision is due to the increased glucose concentration in the eye fluids, which brings about brief changes in the light-refracting surface of the eye.

**Atherosclerosis:** Another complication is the development of fibrous plaques on the inside lining of major blood vessels, which thickens gradually, narrowing the interior part of the blood vessel and restricts blood flow. This complication occurs in diabetics about four times as often as in the general population. This risk factor accounts for the need to reduce dietary fats and cholesterol in diabetic diet.

**Nephropathy:** The thickening of capillaries in the glomerulus leads to **nephropathy**, later to renal failure, which is the leading cause of death among IDDM patients.