UNIT 21 DIETARY MANAGEMENT OF OBESITY, HEART DISEASE AND DIABETES MELLITUS

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21.1 INTRODUCTION

You know that malnutrition can manifest itself in the form of either undernutrition or overnutrition. In the earlier units of this block, you have already acquainted yourself with many nutritional disorders related to undernutrition. In this unit, you would be introduced to some of the nutritional disorders due to overnutrition. Can you recall the definition of overnutrition given in earlier blocks? Overnutrition refers to the intake of nutrients in amounts more than that required by the body.

Nutritional disorders like obesity, heart disease, and diabetes mellitus (high blood sugar levels) are the result of overnutrition. The prevalence of these nutrition-related disorders is quite high in rich and affluent countries like America, China, Russia, Japan. Recent investigations have shown that the prevalence of these disorders has increased in developing countries like India also.

In this unit, you will find an interesting discussion on clinical symptoms, risk factors and dietary management of some of the overnutrition related diseases like obesity, diabetes mellitus and heart disease. Various technical terms often used in context of these diseases are also explained here.

Objectives

After going through this unit, you will be able to

- identify the nature and clinical features of obesity, diabetes mellitus and heart disease
- describe the risk factors of above mentioned disorders and
- discuss the dietary management of these disorders

21.2 OBESITY

Obesity refers to being fat or having excess fat tissue (i.e. more than that required for optimal functioning). Most of us do not consider it as a serious disorder. Some of us consider it bad from the point of view of body appearance only, while others may think only in terms of reduced work capacity or inability for active participation in sports or other such activities. However, this is not all. Data gathered by Life Insurance Corporation shows that an obese individual has shorter life expectancy than the individual having normal weight. Obese individuals are more at risk of developing heart diseases or diabetes mellitus. These diseases are the principal cause of death in obese individuals.
The hazards of surgery, pregnancy and child birth are more in obese individuals. Obesity can lead to various respiratory problems (breathing problems) also due to more stress on the respiratory system.

After learning about such consequences aren’t you interested in knowing about the causes and treatment of this nutritional disorder? Surely, you would be. Before doing so, let us find how to diagnose obesity or in other words when would we call a person obese/not obese. According to the definition of obesity mentioned earlier, it is due to accumulation of excess fat in the body. Therefore in order to diagnose obesity, you need to determine total body fat content. However, this is not an easy task. In simple terms, obesity can also be equated to body weight. You can call a person obese, if he or she weighs 20 per cent above the ideal body weight (if a person’s ideal body weight is 45 kg and he weighs 55 kg i.e. higher than 20 per cent of his ideal body weight, he is obese). Very often people use another term “overweight” as a synonym for obesity. However, there is a clear cut distinction between the two terms and these should not be used interchangeably. The term overweight is applied only to persons who weigh 10 per cent to 20 per cent more than the ideal body weight.

You would have noticed the use of the term “ideal body weight” in the definitions for both obese and overweight individuals. Let us try to understand what we mean by the term “ideal body weight” here. Ideal body weight refers to average or desirable weight according to height and body frame of a healthy individual. For adults over the age of 25 years, height-weight tables compiled by Life Insurance Corporation of India provide a rough guide for estimating ideal body weight according to height and body frame (Tables 21.1 and 21.2).

The tables are based on the principle that the ideal weight for one’s height and body frame at the age of 25 should be maintained throughout adult life.

### Table 21.1 : Weight for Height for Females

<table>
<thead>
<tr>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>Overweight limit (+ 20%) (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>148</td>
<td>46.5</td>
<td>56.0</td>
</tr>
<tr>
<td>152</td>
<td>48.5</td>
<td>58.0</td>
</tr>
<tr>
<td>156</td>
<td>50.5</td>
<td>60.5</td>
</tr>
<tr>
<td>160</td>
<td>52.5</td>
<td>63.0</td>
</tr>
<tr>
<td>164</td>
<td>55.0</td>
<td>66.0</td>
</tr>
<tr>
<td>168</td>
<td>58.0</td>
<td>69.5</td>
</tr>
<tr>
<td>172</td>
<td>60.5</td>
<td>72.5</td>
</tr>
<tr>
<td>176</td>
<td>64.0</td>
<td>77.0</td>
</tr>
<tr>
<td>180</td>
<td>67.0</td>
<td>80.5</td>
</tr>
<tr>
<td>184</td>
<td>70.5</td>
<td>84.5</td>
</tr>
<tr>
<td>188</td>
<td>74.0</td>
<td>89.0</td>
</tr>
</tbody>
</table>


### Table 21.2 : Weight for Height for Males

<table>
<thead>
<tr>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>Overweight limit (+ 20%) (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>148</td>
<td>47.5</td>
<td>57.0</td>
</tr>
<tr>
<td>152</td>
<td>49.0</td>
<td>59.0</td>
</tr>
<tr>
<td>156</td>
<td>51.5</td>
<td>62.0</td>
</tr>
<tr>
<td>160</td>
<td>53.5</td>
<td>64.0</td>
</tr>
<tr>
<td>164</td>
<td>56.0</td>
<td>67.0</td>
</tr>
<tr>
<td>168</td>
<td>59.0</td>
<td>71.0</td>
</tr>
<tr>
<td>172</td>
<td>62.0</td>
<td>74.5</td>
</tr>
<tr>
<td>176</td>
<td>65.5</td>
<td>78.5</td>
</tr>
<tr>
<td>180</td>
<td>68.5</td>
<td>82.0</td>
</tr>
<tr>
<td>184</td>
<td>72.0</td>
<td>86.5</td>
</tr>
<tr>
<td>188</td>
<td>75.5</td>
<td>90.5</td>
</tr>
<tr>
<td>190</td>
<td>77.5</td>
<td>93.0</td>
</tr>
</tbody>
</table>

Tables 21.1 and 21.2 provide information regarding the ideal body weight for a particular height for females and males respectively. They also tell you about the overweight limit (i.e. 20% of the ideal body weight). If a person's weight lies between the ideal body weight and the overweight limit, he or she is overweight. On the other hand, if weight of a person is above the overweight limit, he or she is definitely obese. For example if a female (148 cm) weighs 54 kg, she is overweight. However, if she weighs 60 kg, she is obese.

**Risk factors:** Obesity is invariably a product of energy imbalance in the body. Energy imbalance here refers to imbalance between energy intake and energy output. If you consume more food (i.e. take in more energy) and do lesser work (i.e. spend lesser energy) it would result in energy imbalance in the body (Figure 21.1). There are several factors which favour the development of such an imbalance in the body. These factors are termed as risk factors. Let us talk about some of the risk factors.

**Over-eating:** Eating too much is a habit with many people. If one is in the habit of eating more food in general or consuming energy-rich foods like butter, cakes, pastries, jam, jellies, wafers and other rich snacks and desserts, one is likely to gain weight. Some people prefer to eat less during the meal time, but keep on munching snacks in between meals. Remember that total intake of calories goes up in this way and it increases the possibility of weight gain.

**Sedentary life-style:** Besides food intake another factor which influences the energy balance of the body is activity pattern. In urban areas, especially the affluent or rich class people tend to have a sedentary life-style. Most of the time they are involved in some kind of mental work and do very little of running or walking around. Housewives are equipped with electric gadgets like vacuum cleaner, mixer, washing machine, etc. to make work simpler for them. Such people tend to spend or use very little of calories they have consumed as part of food. The result is energy imbalance and consequent weight gain.

**Psychological factors:** Some people tend to eat more if they are tense or bored or lonely. Such conditions make food as the focus of their attention and a means or outlet for release of tension and boredom. Such people also have a tendency to gain weight and become obese.

**Genetic influence:** Obese parents do tend to have obese children. This fact has been brought into focus by many research investigations. In one of the research studies it was found that if both parents are of normal weight, the probability is that 7 per cent of the children will be obese. On the other hand, if one of the parents is obese, the possibility is that 40 per cent of children will be obese. If both the parents are obese, the chances that children will be obese goes up to 80 per cent.
Dietary Management of Obesity: Dietary management of a disease means the dietary measures or steps to be taken for the treatment of a disorder/disease. Dietary management of any disorder/disease has three steps:

1) Defining the principles of dietary management
2) Working out nutritional needs (modifications in RDIs) according to the effect of disease on the body and major principles of treatment
3) Dietary management i.e. modifying day's diet based on changes in RDIs.

We shall discuss the dietary management of obesity and other disorders in this unit, according to the above mentioned steps:

Let us now discuss dietary management of obesity.

1) PRINCIPLES OF TREATMENT OF OBESITY: The main principles are—

- slow and gradual reduction of body weight till it is closer to ideal body weight
- maintenance of weight loss achieved
- prevention of complications like heart disease or diabetes mellitus.

2) THE MODIFIED NUTRITIONAL NEEDS: Let us study what modifications are needed in the amount of energy, protein, carbohydrate, fat, vitamins and minerals for obese individuals.

Energy: As you have read earlier in this unit, obesity is the result of energy imbalance in the body. So modifications in energy (calorie) needs are important. Do remember that this modification in energy is not the same in every individual. One has to cut down 500 to 1000 Kcal from a day’s diet depending on the individual requirements. In general, a restriction of 500 Kcal per day results in a loss of about 450 g (1 pound) a week and 1000 Kcal leads to a loss of about 900 g (or 2 pounds) a week. In many studies, it has been found that a daily intake of 1400-1600 Kcal results in satisfactory weight reduction. However, it is not the same for every individual. The extent of energy reduction can go up to 1000 to 1200 Kcal depending upon individual requirements. Do remember that one should not try calorie (energy) adjustment on one's own. One should consult a dietician or a physician for this purpose.

Protein: Care should be taken to include enough protein-rich foods in the diet. Around 1 g protein/kg body weight can be given.

Fat: Total fat intake in the form of visible fats needs to be restricted. Saturated fats and cholesterol-rich foods should be avoided (as obese individuals are more at risk of developing heart disease).

Vitamins and minerals: Diet should provide vitamin and minerals in adequate amounts according to recommended dietary intakes.

3) DIETARY MODIFICATIONS: Following points are to be taken into consideration for dietary management of obesity:

i) Restrict total food intake: For the purpose of restriction of total food intake, make a note of foods one (obese individual) eats daily as parts of meals. Don't forget to count the foods one eats in between meals like biscuits, namkin, a piece of sweet, toffees or chocolates. Calculate the total energy intake (use food composition tables given in Annexure 2, Practical Manual— I for this purpose). Compare total intake with RDIs. Find out the extent of energy restriction required for weight reduction. (Take the help of an experienced dietician/physician for this purpose). You will find the following guidelines useful for the purpose of restriction of total food intake.

- Do remember that energy restriction is not an easy task and one cannot achieve miracles by reducing one's intake by 1000 to 1200 Kcal in a day. It has to be slow and gradual. Start reducing 200-300 Kcal per day and slowly more restriction can be achieved.
Do not start energy restriction with main meals. First cut down on the extra tit bits one tends to eat in between. Give smaller meals at regular intervals. Don’t let the person miss a meal. Otherwise one will tend to eat a lot more in the next meal. Do not eat while watching television or reading.

ii) Cut down intake of fat and fat-rich foods: Restrict the intake of visible fat. Give visible fats in the form of cooking oils. Avoid giving ghee, butter or hydrogenated fats—they have more of saturated fats and cholesterol and tend to increase the possibility of heart diseases or diabetes in obese individuals. Avoid giving fat-rich foods like meats, cakes, pastries, fried snacks, nuts and oilseeds.

iii) Give more of protein rich foods: Milk (toned milk or whole milk from which cream has been removed), pulses, lean meats, chicken, fish.

iv) Give more of leafy vegetables and yellow and orange fruits: They provide the basic protective and regulatory nutrients.

v) Give more fibre-rich foods: Whole cereals, whole pulses, fibrous fruits and vegetables. Fibrous foods have more satiety value and hence tend to satisfy hunger and at the same time provide less energy (calories).

Besides dietary modifications, physical exercise and psychological support are also important components of treatment of obesity.

Check Your Progress Exercise 1

1) Match the following:

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Death risk statistics</td>
<td>a) 10-20% more than the ideal body weight</td>
</tr>
<tr>
<td>ii) Overweight</td>
<td>b) Life Insurance Corporation</td>
</tr>
<tr>
<td>iii) Obesity</td>
<td>c) Modification in RDIs</td>
</tr>
<tr>
<td>iv) Dietary management of disease</td>
<td>d) 20% above the ideal body weight</td>
</tr>
<tr>
<td></td>
<td>e) Ideal body weight</td>
</tr>
</tbody>
</table>

2) Answer the following in brief:

a) What do you understand by ‘energy imbalance’?

b) List the factors which favour development of energy imbalance in the body.

c) What measures would you adopt to prevent such an imbalance?
21.3 DIABETES MELLITUS

You must be familiar with the word ‘sugar’ used in context of a disease in which blood sugar levels are high and traces of sugar are observed in urine. It is interesting to note here that the word ‘sugar’ is colloquially used for the disease called ‘diabetes mellitus’. Let us in this section study about clinical symptoms, risk factors and dietary management of this disease.

Diabetes mellitus is defined as a metabolic disorder characterized by an elevation of blood sugar (glucose) level.

The main factor behind this condition is lack of a hormone called insulin. The disease can develop under the following circumstances:

- if insulin is present in the body but it is not functional
- if insulin is present but in lesser amounts than that is required by the body
- if there is total lack of insulin in the body.

For better understanding, let us give more attention to insulin and its role in body metabolism.

Insulin is secreted by the beta cells (Islets of Langerhans) of the pancreas (Figure 21.2). Insulin plays a major role in oxidation of glucose in the body (carbohydrate metabolism). In the case of deficiency of insulin in the body, glucose cannot be oxidized properly in the body cells. This results in increase in levels of glucose in the blood (hyperglycemia). If accumulation of glucose in the blood is beyond the levels the kidney can retain, it can lead to passage of glucose in the urine also (glucosuria). Deficiency of insulin also affects fat and protein metabolism. In such a condition, fat formation in the body decreases and breakdown increases. This leads to accumulation of byproducts of fat metabolism (called ketone bodies) in the blood. This condition is known as Ketosis. As energy is not available from carbohydrates, tissue protein are also broken down to supply energy to the body. As a consequence, weight loss occurs.

As you have read, in diabetes there can either be insufficiency or total lack of insulin in the body. The disease can be divided into two types depending on the insulin status of the body.
• Insulin dependent diabetes mellitus (IDDM)—In this type of diabetes mellitus (in order to function normally) body is dependent on insulin doses from an exogenous source (outside source). It occurs more frequently in young children and adolescents.

• Non-Insulin dependent diabetes mellitus (NIDDM)—In this type of diabetes mellitus there is lack or insufficiency of insulin in the body which can be brought under control by either diet alone or a combination of diet and certain drugs. The body is not dependent on insulin from an outside source. This is frequently observed in adults (especially those who are overweight).

How will you diagnose diabetes in an individual? If you find that an individual has increased thirst, increased urination, increased hunger or weight loss all of a sudden, it can be due to diabetes. Other symptoms which indicate presence of diabetes are blurred vision, weakness or loss of strength, pain in legs.

However, in order to confirm the presence of diabetes in an individual, one has to depend on blood and urine tests. Here a sample of blood or urine is tested in the laboratory.

Urine test: In this test urine is tested for presence of glucose, 2 to 3 hours after a full meal. You should note that no glucose is present in the urine of a normal individual.

Blood test: Do you know what the normal fasting blood glucose level is? It is 80-120 mg per 100 ml. Fasting level here refers to the level of glucose taken after a fast of 12 hours. It is generally taken early morning (without breakfast or bed tea).

Obviously, in a diabetic individual these levels will be higher than 120 mg per 100 ml. Minor variations in these levels can be noticed due to reasons other than diabetes. So fasting blood sugar level of 140 mg/lOO ml or above is considered an indication of diabetes.

A test called glucose tolerance test (GTT) is usually also used to confirm the presence of diabetes in an individual.

In this test a dose of around 75 g of glucose is given to an individual (adult) after a fast of around 10-12 hours. In the case of children, dose is worked out on the basis of body weight. Blood glucose levels are recorded at an interval of \( \frac{1}{2} \) hour from 0 to 2 hours (\( \frac{1}{2} \) hour—1 hour—\( \frac{1}{2} \) hours—2 hours). In some cases, fasting blood glucose levels are taken at 0 hour and 2 hours only.

RISK FACTORS: Some of the risk factors of diabetes are given below.

Age: Although diabetes can begin at any age, middle aged people are prone to it.

Malnutrition: Undernutrition and overnutrition both play a role in development of the diseases. Thus, both underweight and obese (overweight) individuals are more at risk.

Heredity: People whose parents, grand parents or siblings are suffering from the disease are at higher risk.

Gestation: Some women develop diabetes during pregnancy (gestation). In most of the cases it gets cured after delivery. Such women who had diabetes during pregnancy are at risk of developing the disease later.

Stress: Some of the studies have indicated that some factors like emotional stress, anxiety etc. can lead to development of the disease in the body.

DIETARY MANAGEMENT: Besides dietary management, oral drugs and insulin doses are also used for treatment of diabetes. The three measures commonly adopted for control of the disease are:

a) dietary management alone
b) dietary management and oral drugs
c) dietary management and insulin doses.

As you can note here, dietary management is central to the success of treatment of diabetes in any of the above mentioned measures. Any of these measures is prescribed by a physician depending on the type of diabetes and insulin status of the body. Dietary management alone or dietary management with drugs is prescribed in
Nutrition-Related Disorders

case of non-insulin dependent diabetes mellitus. However, for treatment of insulin
dependent diabetes mellitus, one has to use dietary management and insulin doses.

Dietary management of insulin dependent diabetes is a bit complicated. In this case
the meals have to be adjusted according to the type of insulin dose being taken. So,
you need the help of an experienced dietitian or physician.

In this unit, we shall discuss dietary management of non-insulin dependent diabetes.
Before starting the discussion on dietary management of diabetes mellitus, you
should note here that diabetes mellitus is a progressive disease, which is there for life.
You cannot cure it. But, you can keep it under control. If diabetes is properly
controlled, the individual lives a near normal life without complications. If he does
not keep a control over it, he is likely to develop certain complications like
blindness, kidney failure and even death. Remember that in most of the non-insulin
dependent diabetics, the disease can be kept under control, by controlling the diet
alone.

Let us now focus our attention on some aspects of dietary management of diabetes.

1) MAIN PRINCIPLES OF TREATMENT: The principles for treatment of
diabetes mellitus are to—
   a) maintain ideal body weight and general well-being
   b) keep the person relatively free of symptoms
   c) prevent further complications.

2) MODIFICATIONS IN NUTRITIONAL NEEDS: The following modifications
are needed in RDIs for various nutrients.

Energy: Control of energy intake in order to maintain ideal body weight is essential.
If the individual is underweight, an increase in total energy intake is recommended.
However, if an individual is overweight energy restriction is essential. Remember
that, whatever be the circumstances, the main aim of treatment is to maintain ideal
body weight.

You can use the following chart for deciding the total energy intake for a diabetic
individual (adult).

<table>
<thead>
<tr>
<th>Body condition</th>
<th>Kcal per kg body weight (Desirable weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>For weight loss</td>
<td>20</td>
</tr>
<tr>
<td>For a bed patient</td>
<td>25</td>
</tr>
<tr>
<td>For light work</td>
<td>30</td>
</tr>
<tr>
<td>For medium work</td>
<td>35</td>
</tr>
<tr>
<td>For heavy work</td>
<td>40</td>
</tr>
</tbody>
</table>


Let us understand how to make use of this chart. You can refer to Tables 21.1 and
21.2 for finding the desirable or ideal body weight of an adult individual. For
example, if a sedentary man (one who does light work) is 156 cm tall (according to
table 21.2) his ideal body weight is 51.5 kgs. He requires 30 kcal/kg body weight (see
chart). His total energy requirement would be 30 x 51.5 = 1545 kcal. Similarly, you
can make use of this chart for calculating energy requirements of other diabetic
individuals also.

Protein: The recommended dietary allowance of protein of 1 g/kg body weight is
considered desirable for diabetic individuals also.

Carbohydrate: It is often a common mistake to give a carbohydrate-restricted diet
to diabetic patients. You should note here that around 80-100 g carbohydrate should
essentially be there in the diet to prevent too much breakdown of fat and
accumulation of its byproducts (ketosis). In fact, 50-55 per cent of a day's calories
should come from carbohydrates. However, most of the carbohydrate taken shou'
be in the form of complex carbohydrate (having more of fibre). Refined or simple carbohydrates need to be avoided. Many research studies have shown beneficial effects of fibre on the control of diabetes. Fibre reduces fasting blood sugar level and insulin requirements. On the other hand simple carbohydrates tend to increase fasting blood glucose levels. They are readily absorbed and immediately raise blood sugar. Thus, it is advisable to consume fibre-rich foods like whole pulses, whole cereals, leafy vegetables.

Fat: The diabetic individual should not be allowed to take more than 15 to 20 g fat per day. This is because he/she is more at risk of developing heart disease. Foods high in saturated fat and cholesterol should be limited. Effort should be made to give fats having unsaturated fatty acids. Can you recall some of the rich sources of saturated fatty acids, cholesterol and unsaturated fatty acids (Refer to Unit 3, Block 1)? For your benefit we have listed them again in Table 21.3.

Table 21.3: Rich sources of Fat (saturated fatty acids, cholesterol and unsaturated fatty acids)

<table>
<thead>
<tr>
<th>Cholesterol</th>
<th>Saturated fatty acids</th>
<th>Unsaturated fatty acids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg yolk</td>
<td>Egg yolk</td>
<td>Cooking oils</td>
</tr>
<tr>
<td>Organ meats</td>
<td>Mutton, beef hydrogenated fats</td>
<td>like groundnut oil</td>
</tr>
<tr>
<td>Hydrogenated fats</td>
<td>Ghee</td>
<td>Safflower oil</td>
</tr>
<tr>
<td>Ghee</td>
<td>Cream</td>
<td>Soya oil</td>
</tr>
<tr>
<td>Cream</td>
<td>Whole milk</td>
<td>Cottonseed oil</td>
</tr>
<tr>
<td>Whole milk</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Vitamins and minerals: The diet should provide vitamins and minerals in adequate amounts according to recommended dietary intakes.

3) DIETARY MODIFICATIONS: Before suggesting any modification in the diet, you should talk to the individual about his meal pattern, work schedule and likes and dislikes. You should not give a very tight diet-schedule to an individual which the person may find it difficult to adhere to. In fact, you should suggest only few dietary modifications in his/her earlier meal pattern (as few as possible to keep diabetes under control).

1) Regulation of the meals consumed is essential. Diabetic individuals should be encouraged to have meals at regular intervals. It is advisable for him/her not to skip meals or keep a fast.

2) All the main meals consumed should provide fairly even amount of calories.

3) Care should be taken to include foods from all three basic food groups. However, suitable modifications are needed within each group to ensure control. Let us see what these modifications are:

Energy-Giving Group

Cereals—Use of whole grain cereals like whole wheat flour is recommended. Use of refined cereal products like maida, suji etc. should be restricted or avoided.

Roots and tubers—Use of roots and tubers like yam, colocasia, potato, sweet potato should be in moderation as they contain more of refined or simple carbohydrates.

Sugar—Sweeteners like table sugar, jaggery, honey, glucose and others like jams, jellies, marmalade, and concentrated sweets (like toffees, chocolates, burfi, gulab jamuns and other such sweets) should be avoided.

Fat—As has already been mentioned, not more than 15 to 20 g of visible fat should be allowed. Unsaturated fats like groundnut oil, soya oil, safflower oil, corn oil etc. should
be used in moderation. Saturated fats and cholesterol-rich foods should be avoided (refer to Table 20.3).

**Body-Building Group**

*Milk*—Milk should be taken liberally. Use of milk products like paneer, curd, khoya etc. should be encouraged.

However, use of full fat milk or buffalo’s milk should be restricted (as it has more of fats). One can give milk to diabetic individuals after removing the fat layer or cream (which covers the surface after boiling).

**Pulses**—Use of pulses (especially the whole pulses) should be encouraged. This is because whole pulses are not only rich in protein but also fibre.

In order to ensure adequate intake of protein and fibre in the diet, one could mix the flour of bengal gram (whole) in atta (whole wheat flour) used for making chapatis for a diabetic individual in the proportion of 1:2 (1 part of bengal gram (whole) flour and 2 parts of atta (whole wheat flour)).

*Egg*—Eggs (especially egg yolk) should be consumed in moderation. If one is fond of taking eggs, one can take egg white and discard the yolk portion (as it is a rich source of cholesterol).

**Fleshfoods**—Organ meats like liver, kidney etc. are rich sources of cholesterol, hence they should be avoided. You should select lean cuts of meat for diabetic individual or preferably use chicken or fish. Care should be taken to select the right method of cooking (i.e. roasting or baking instead of frying).

**Protective/regulatory Group**

*Vegetables:* Increase the intake of vegetables especially fibrous vegetables (like leafy vegetables, lotus stem, brinjal, beans etc.).

*Fruits:* Fruits, as they are sweet, need to be taken with caution. One should take very sweet fruits like mango, grapes, sapota, watermelon, sugarcane juice, all canned foods, banana and apple etc. with caution. If one wants one can just have a piece of it occasionally. Others like guava, apples, oranges, mausmbi etc. can be taken in moderation (just one or two a day).

**Check Your Progress Exercise 2**

1) Fill in the blanks:
   a) The normal fasting blood glucose level is .................
   b) .................glucose is present in the urine of a normal individual.
   c) Diabetes mellitus can develop, even if insulin is present in the body but is not .................
   d) Insulin is secreted from .................cells of the pancreas.
   e) The body is not dependent on insulin from .................source in .................diabetes mellitus.

2) Comment on the use of the following foodstuffs in the diet of a diabetic individual.
   a) Refined cereals ............................................................
   b) Groundnut oil ..............................................................
   c) Full fat milk ...............................................................
21.4 HEART DISEASE

You may be familiar with the term 'heart disease'. You probably might be using it in context of heart attack or high/low blood pressure. You can add a lot to your knowledge in context of heart diseases by reading through this section. Major heart diseases can be divided into two categories—Coronary heart disease and hypertension (high blood pressure). Both these terms may sound quite unfamiliar to you. Read on to find the meaning of these terms.

21.4.1 Coronary heart disease

*Coronary heart disease or CHD is the result of an inadequate supply of blood to the myocardium (or heart muscle) due to obstruction in the flow of blood through coronary arteries.* This definition is a little difficult to understand, as it has many unfamiliar terms. Explained in the following paragraphs is the meaning of terms like 'Coronary artery' and 'myocardium' and the process by which the disease sets in. You will find this discussion interesting as you will be introduced to many other technical terms used in connection with coronary heart disease. You have to read these paragraphs carefully to get a clear picture.

There are two kinds of blood vessels—*arteries* which carry oxygenated blood from heart to body tissues and *veins* which carry deoxygenated blood from body tissues to heart. The following (Figure 21.3 (a) shows an artery).

The blood flows through the lumen of the artery. What do you think would happen if the lumen of the artery is narrowed due to deposition of fatty layer on the arterial wall (Figure 21.3 b). Obviously, it will obstruct the flow of blood through the arteries. The process of deposition of fatty layers and the narrowing of lumen may result in the formation of a blood clot (the fatty layer mainly consists of compounds of cholesterol and other forms of fat). Eventually, the blood clot blocks the passage of blood (Figure 21.3 c) through the artery involved. *This characteristic thickening of the arterial wall due to deposition of fatty layer and obstruction in blood flow is known as atherosclerosis.* What will be the result of such blockage? The tissue or cells which were getting their supply of oxygen and nutrient through the blocked artery, will not receive their share. They will die in the process. This problem is not so serious if a small artery is involved. However, if major arteries or coronary arteries are involved, the situation becomes serious. *Coronary arteries are the arteries which supply oxygen and nutrients to the heart muscle or myocardium.* The group of heart diseases resulting from obstruction/blockage of blood flow through coronary arteries is termed as coronary heart disease (CHD).

The following flow chart explains the process by which coronary heart disease sets in.

```
Deposition of fatty layers on the arterial wall (coronary artery) and narrowing of lumen.

Further narrowing of lumen and obstruction in flow of blood

Formation of blood clot

Blockage of the artery

Death of the part of the tissue of myocardium or heart muscle.
```
The disease may manifest itself clinically in three forms:

**Angina pectoris**: This is due to narrowing of 60-70 per cent of lumen of coronary artery. It results in significant reduction in flow of blood. The patient experiences tight pressing, severe pain across the chest after exertion or hard work.

**Myocardial infarction** (or heart attack): occurs when a clot is formed in the coronary artery resulting in complete blockage of blood to that part of myocardium which is being supplied by that particular artery. It reduces the functional capacity of heart.

**Congestive heart failure**: Finally, the heart muscle becomes too weak due to repeated heart attacks or myocardial infarctions and is unable to maintain its function of normal blood circulation. It results in fluid imbalance or accumulation of fluid in lungs or other parts of body. This condition results in added problems in breathing and more stress on the heart. It can even lead to death.

**RISK FACTORS**: Coronary heart disease is a multifactoral disease. Various factors responsible for the disease can be clubbed in three categories:

- personal characteristics
- learned behaviour
- background conditions

Let us discuss risk factors placed in each one of these categories.
Personal characteristics—These include factors like sex, age, family history (which one acquires at birth). These are not in control of a person. Let us see how these factors have an influence on CHD or coronary heart disease.

Age — The incidence of CHD rises with ageing particularly after middle age.

Sex — Men are more prone to CHD than women.

Family history—Those persons who have the family history of CHD (i.e. their parents or grand parents are suffering from it) are more prone to CHD.

Learned Behaviour—This category includes behaviour patterns, eating habits and style of living which one tends to acquire after birth over the course of time. These factors have a definite influence on CHD or coronary heart disease.

Sedentary lifestyle—Sedentary individuals (who are engaged in light physical activity and remain sitting most of the time in a day) are more prone to CHD.

Stress—Anxiety and emotional stress increase the chances of CHD.

Smoking—Many research investigations have proved the definite influence of smoking on CHD. Heavy smokers are more prone to CHD than non-smokers.

Diet—A number of dietary factors have been found to be associated with coronary heart disease. It has been established in several research studies, that consumption of diets rich in saturated fat and cholesterol increases the chances of CHD.

Obesity—Obese individuals are more prone to CHD, than those having normal weight.

Background Conditions—These include other disease conditions like diabetes mellitus, hypertension, hypercholesterolaemia (higher levels of cholesterol in the blood) etc. by which one might have been suffering from. The persons suffering from these diseases are at increased risk of developing CHD.

DIETARY MANAGEMENT OF CORONARY HEART DISEASE: Dietary management of coronary heart disease has several phases. During the acute phase of illness (myocardial infarction or congestive heart failure) the patient is generally hospitalised. The diet is given to the patient under the supervision of trained dietitians. The discussion of hospital diets given to the patient is outside the purview of this unit.

Here, in this discussion, we will study about the dietary management of coronary heart disease from the point of the following individuals:

a) those individuals who are at risk of developing CHD (prevention of development of disease)

b) those who already have some manifestations like atherosclerosis or angina pectoris

c) those who have recovered from the acute phase of illness (i.e. myocardial infarction or congestive heart failure)

1) MAIN PRINCIPLES OF TREATMENT: The main principles for prevention of CHD are:

• to keep fat and cholesterol levels in the blood in normal limits

• to prevent clinical manifestations like angina pectoris, myocardial infarction or congestive heart failure.

2) MODIFICATIONS IN NUTRIENT NEEDS: The following modifications in requirement of various nutrients need to be made—

Energy—Energy restriction is needed in case of obese individuals. Energy intake should be just enough to maintain ideal body weight. If the person is of normal weight, energy intake should be according to recommended dietary intakes for energy. If the person is obese or overweight suitable modifications are to be made under the supervision of a dietitian or physician (See dietary management of obesity under Section 20.2).
**Nutrition-Related Disorders**

**Protein**—The recommended dietary intake of 1 g protein/kg body weight is suitable for these patients.

**Fat**—As fat and fat-rich foods have a direct connection with heart disease, one has to carefully monitor the intake of fat by the patient. Normally not more than 10 to 15 g (2 to 3 tsp) of visible fat in the form of cooking oils should be allowed. In addition, restriction of other fat-rich foods (especially foods containing saturated fatty acids and cholesterol) is essential.

**Vitamins and Minerals**—Vitamins and minerals should be present in adequate amounts according to recommended dietary intakes. Particular care has to be taken with regard to fat-soluble vitamins (because of fat-restricted diets).

3) **DIETARY MODIFICATIONS** - The main crux of dietary management is to provide a fat-controlled and energy-restricted diet to the patient. The following points summarize the major changes to be made in the diet.

**Energy restriction** - You need to make the following modifications:

- Cut down the intake of total food.
- Avoid consumption of fat-rich foods.
- Give cereals in moderation. Cut down intake of refined cereals, encourage use of whole grain cereals.
- Give more of pulses especially the whole pulses. Other body-building foods like milk and milk products and flesh foods have to be given by taking their fat content into consideration.
- Increase the intake of fruits and vegetables (especially fibrous ones).
- Cut down the intake of sugar and other sweeteners.

**Fat restriction** - As you can see, fat control is the major aspect in the changes suggested above. Let us now find out how to achieve reduction in fat intake. You have already studied about some of these points under dietary management of diabetes mellitus (Section 20.3).

i) Reduce the intake of fats and oils.
ii) Replace saturated fats like ghee, hydrogenated fats, butter with unsaturated fats like groundnut oil, soya oil, safflower oil.
iii) Oils like mustard oil and coconut oil have more saturated fatty acids than unsaturated fatty acids. Their use should be limited.
iv) Use low fat milk or toned milk instead of whole milk. Whole milk can be given after removing the fat or cream (which comes on top after boiling).
v) Give eggs in moderation. If possible not more than one egg should be given to the patient (or otherwise, it should be given after removing the yolk portion of it).
vi) Avoid giving fat-rich portions of flesh foods. Select lean cuts of meat. Trim visible fat from it before cooking.
vii) Use roasting, baking, boiling and steaming as methods of cooking instead of frying (both shallow and deep frying).
viii) Don't give nuts like groundnuts, cashews, walnuts etc. They are rich in fat.
ix) Avoid giving other fat-rich desserts and fried snacks like cakes, pastries, samosas etc.

**Sodium restriction**—As you have read that hypertension or high blood pressure is one of the risk factors for CHD. Sodium intake influences blood pressure. Thus, high intake of sodium indirectly becomes a risk factor for CHD also. Those individuals who have hypertension or their family members are suffering from hypertension, should keep a check on intake of sodium (common salt). How one can restrict intake of salt in the diet, is discussed in the next subsection.
21.4.2 Hypertension

'Hypertension' is the technical term used for a condition of the body in which blood pressure is higher than normal. How do we define 'blood pressure'? Blood pressure refers to the pressure exerted by the blood flowing through the arteries on the arterial wall. It is measured by using an instrument called sphygmomanometer. The normal blood pressure is 120 mm Hg/80 mm Hg. (Here “mm Hg” stands for “millimetres of mercury, a unit of pressure”). The upper figure is called systolic pressure (recorded during contraction of heart muscle) and the lower figure is called diastolic pressure (recorded during relaxation of heart muscle). In hypertension there can be increase in either systolic/diastolic pressure alone or diastolic and systolic pressure both. Increase in diastolic pressure is considered more dangerous.

Hypertension is classified in three categories—mild, moderate and severe—depending on the diastolic pressure.

Mild Hypertension—If diastolic pressure is 90 to 104 mm Hg, it is termed as mild hypertension.

Moderate Hypertension—If diastolic pressure is 105 to 119 mm Hg, the condition is known as moderate hypertension.

Severe hypertension—If diastolic pressure is 120 to 130 mm Hg and above, the condition is known as severe hypertension.

It has been found that incidence of hypertension is on the increase in the past few decades in our country. Most of the time the cause of hypertension is unknown. However, some of the factors like sedentary life style, obesity, diet (rich in saturated fat, cholesterol or salt), smoking, emotional stress etc. can be considered as risk factors for it. No symptom may be observed in the case of mild hypertension. It does, however, have serious implications if not treated and controlled. Sometimes, the patient may complain of headache or giddiness. If one experiences repeated headaches, or feels tired and giddy very often, one should get the blood pressure checked by a doctor. It is advisable to get the blood pressure checked once a year, even if one experiences no symptoms.

Dietary Management—In treatment of all cases of hypertension—mild, moderate or severe—diet plays a central role. In fact mild hypertension is controlled by dietary modifications only. However, in moderate and severe hypertension suitable medication is also given in addition to a modified diet. In this discussion, we will talk about aspects of dietary management related to mild hypertension.

For treatment of patients of moderate or severe hypertension you need the help of a trained dietitian and a physician.
The diet for hypertension patients like any other heart disease involves a check on intake of fat and total energy. The fat controlled and energy restricted diet as prescribed for CHD patients is applicable here also. It means you need to make similar modifications in the diet to reduce intake of fat and hence the total energy intake as given in sub-section 21.4.1. In addition, you need to carefully monitor intake of sodium by these patients. *It has been proved in many research studies that intake of sodium directly influences blood pressure.* It has also been found that restriction of sodium intake accompanied by fat restriction can effectively control mild or moderate hypertension.

What are the major sources of sodium in our diet?

The main source of sodium in our diet is common table salt or sodium chloride. Can you recall some of the other sources of sodium (refer to Unit 5, Block 2)?

The other sources include:

- baking powder and baking soda
- some preservatives and other substances added to food (like monosodium glutamate)
- Rich food sources like milk, egg white, meat, poultry, fish, green leafy vegetables, beet root, radish, carrot, cauliflower, lotus stem (dry), pulses, spices like cumin seeds, omum etc.

In mild hypertension, just restriction of intake of common salt can be helpful. However, for moderate and severe hypertension patients, no salt is recommended to be used for cooking. In addition for some patients restriction of intake of foodstuffs rich in sodium is also imposed.

Let us now study how to reduce intake of common salt for patients of mild hypertension. Common daily intake of salt in our country is around 3-4 g to a maximum of 10-12 g. This needs to be cut to 2 to 2.5 g day. Some tips for cutting down total salt intake are given below—

- Use salt lightly in cooking.
- Do not add salt to the cooked food.
- Do not give salt-preserved foods like ketchups, sauces, pickles, chutneys, canned foods, processed meats, salted or smoked fish.
- Do not give highly salted foods like salted butter, fast foods, wafers, namkeens, salted nuts, cheese, cheese spreads.
- Check for labels of medicines and foodstuffs. Do not give medicine whose label mentions sodium as one of the ingredients. Similarly, avoid giving foodstuffs whose label indicate the word ‘salt’ or ‘sodium’

Check Your Progress Exercise 3

1) Match the following:

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Myocardium</td>
<td>i) Fat deposition in the lumen of an artery</td>
</tr>
<tr>
<td>b) Atherosclerosis</td>
<td>ii) Myocardial infarction</td>
</tr>
<tr>
<td>c) Hypertension</td>
<td>iii) Significant narrowing of lumen of coronary artery</td>
</tr>
<tr>
<td>d) Angina pectoris</td>
<td>iv) Heart muscle</td>
</tr>
<tr>
<td></td>
<td>v) Diastolic/systolic</td>
</tr>
<tr>
<td></td>
<td>vi) Coronary artery</td>
</tr>
</tbody>
</table>
2) Mr. X is suffering from hypertension. He has been advised by his doctor to restrict intake of salt. What dietary measures would you suggest to him for doing so.

3) Mr. Y is suffering from CHD and is advised to restrict egg intake. However, he is very fond of eggs. What advise would you give to Mr. Y?

4) Comment on the use of following groups of foodstuffs in the diet of CHD patients?
   a) Cooking oil — Hydrogenated fats
   b) Mutton curry — Roasted chicken

21.5 LET US SUM UP

In this unit you have read about three overnutrition related disorders—obesity, diabetes mellitus and heart disease (coronary heart disease and hypertension).

Given below is the brief description of what has been discussed in the unit about each of these diseases.

- Obesity is the result of energy imbalance in the body. An excessive intake of food and relatively less energy output leads to accumulation of fat in the body. Factors like over-eating, sedentary life style, psychological factors result in energy imbalance and hence obesity. The essential components of dietary management are restriction of total intake of food, fat, fat-rich foods and other energy giving foods.

- Diabetes mellitus is a metabolic disorder in which blood sugar level rises above the normal limit. The normal fasting blood glucose level is 80-120 mg/100 ml. If accumulation of glucose in the blood is beyond the limits the kidney can retain, there is passage of glucose in the urine also. The disease is due to lack or insufficiency of a hormone called insulin (secreted from beta cells of pancreas).
The disease is classified into two types—insulin dependent diabetes and non-insulin dependent diabetes. The main dietary principles are energy intake just for maintenance of ideal body weight, adequate intake of carbohydrates (however, restriction of sugar and other simple carbohydrates), restriction of fat and fatty-rich foods and adequate intake of body-building and protective/regulatory foods.

Coronary heart disease or CHD is the heart disease due to inadequate supply of blood to the heart muscle. It is a multifactorial disease having a number of risk factors (which ultimately lead to onset of the disease). It may manifest itself in three forms—angina pectoris, myocardial infarction and congestive heart failure. Fat controlled, energy restricted diets are mainly used to prevent the development of such a disorder.

Hypertension, is another heart disease in which blood pressure of the body is higher than normal. Normal blood pressure is 120/80 mmHg. Upper figure is called systolic pressure and lower figure is called diastolic pressure. Hypertension is classified into mild, moderate and severe hypertension depending upon the range of increase in diastolic pressure. Fat controlled, energy restricted and salt restricted diets are prescribed for patients.

21.6 GLOSSARY

Atherosclerosis: A form of heart disease in which blood vessels are blocked by fatty deposits on the inner walls of the vessel.

Coronary: Arteries that supply nutrients and oxygen to the heart muscle.

Deoxygenated blood: Referring to blood in which haemoglobin is in combination with carbon dioxide.

Diastolic: Referring to the period of relaxation of heart muscle.

Dietitian: A specialist (nutritionist) who translates physician's diet prescription into food and food items.

Fasting blood glucose levels: Referring to blood glucose levels taken after the fast of 10-12 hours. Normally it is taken early morning after an overnight fast.

Hypercholesterolaemia: Referring to higher levels of cholesterol in blood.

Ideal body weight: Average or desirable weight according to height and body frame of an healthy individual.

Insulin: A hormone secreted from beta cells of pancreas.

Ketosis: A condition of the body in which byproducts of fat metabolism or ketone bodies accumulate in the blood.

Myocardial infarction: Death of part of heart tissue caused by blockage of coronary arteries supplying blood to it.

Oxygenated blood: Referring to blood in which haemoglobin is in combination with oxygen.

Physician: A physician diagnoses the disease and prescribes suitable medicines and diet.

21.7 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1) i) b; ii) a; iii) d; iv) c

2) A) Energy imbalance refers to imbalance between energy intake and energy output. In other words, when more foods are consumed (energy intake) and...
less energy is spent for moving around doing work, the result is energy imbalance.

B) Factors like over-eating, sedentary lifestyle, psychological factors like tension, anxiety and genetic factors are some of the risk factors which favour energy imbalance in the body.

C) In order to prevent energy imbalance a) one should consume enough food (not less or more) to provide sufficient energy according to recommended dietary intakes. b) Regular exercise especially for sedentary individuals is also important.

Check Your Progress Exercise 2

1) a) 80-120 mg/100 ml. b) No c) functional d) beta e) outside: non-insulin dependent.

2) a) Refined cereals are not good as they contain more of simple carbohydrates (sugar). They get immediately absorbed in the blood and raise blood sugar levels.

b) Groundnut oil is a good cooking medium for diabetic patients as it has no cholesterol and saturated fatty acids. However, it should be used in moderation as it contains the same calories as ghee, butter or hydrogenated fats.

c) Full fat milk is rich in fat, so it should be given to diabetic patients only after removing the excess fat (or cream layer which covers the top after boiling).

d) Mango is too sweet. It is also rich in energy. It's use should be avoided.

e) Cream is rich in cholesterol and saturated fatty acids. It's use should be avoided.

f) Bengal gram (whole) is a good choice for diabetic patients. It is rich in fiber as well as protein. It can also be mixed in the wheat flour for making chapatis.

Check Your Progress Exercise 3

1) a) iv; b) i; c) v; d) iii.

2) You can ask Mr. X to
   - add less salt while cooking food
   - not to add salt on cooked food
   - avoid taking highly salted foods like wafers, namkeens, cheese, cheese spread, salted butter, fast foods etc.
   - avoid taking salt preserved foods like ketchups, sauces, chutneys, pickles, canned foods, processed meats etc.
   - check the labels of packed foods and medicines for inclusion of sodium or salt.

3) Mr. Y should be asked to take eggs in moderation just one or two a day. He should take only egg white and discard egg yolk.

4) a) Cooking oil is a better medium of cooking for CHD patients. Hydrogenated fats are rich in saturated fatty acids and cholesterol.

b) Roasted chicken is the better choice as chicken as lesser amount of saturated fat. Usually roasting involves use of less fat for cooking. On the other hand, mutton is rich in fat. Usually curry preparation requires lot of fat as medium for cooking.