UNIT 6 NUTRITIONAL MANAGEMENT OF FOOD ALLERGIES AND FOOD INTOLERANCE

Structure

6.1 INTRODUCTION

In this unit we will be discussing the adverse reactions associated with food. You may have read or heard of cases, wherein an individual after consuming specific foods have reported immediate and often dramatic physical reactions such as vomiting, diarrhoea, cramps, wheezing, swelling of the airways, a severe drop in blood pressure etc. On the other hand, you may have also come across individuals, who cannot tolerate particular foods say milk, wheat products etc. For example, people with lactose intolerance cannot digest the sugar lactose, in milk. They develop gas, bloating, and abdominal pain when they consume milk products. These are, in fact, different conditions, which link food to adverse reactions. Food allergies and food intolerance can cause much more than annoying gastrointestinal symptoms. And in some cases they cause no obvious symptoms until a chronic disease shows up later in life. Therefore it is important to detect and treat food allergies and food intolerance as early as possible. In this unit we will learn about different types of adverse food reactions – their cause, effects and the dietary management.

Objectives

After studying this unit you will be able to:

- classify adverse food reactions,
- differentiate between food allergies and food intolerance,
- discuss the etiology, clinical manifestation, metabolic aberrations and complications, linked with adverse food reactions,
- explain the diagnosis of adverse food reactions, and
- describe the dietary management of patients with food allergies and food intolerance.

6.1 ADVERSE FOOD REACTIONS

What do we mean by adverse food reactions? We shall try to understand this concept with the help of a few case studies.

Case 1: An eight year old boy presented with hyperactivity, and disruptive behaviour at school. He was very moody and suffered from chronic rhinitis and frequent colds. This child had always been difficult and irritable. As an infant on a cow's milk formula, he suffered colic, sleeplessness, and screaming fits.

Case 2: A 27-year old IT Consultant who lives in Bangalore and who suffers with loose stools, gas, irritable bowel syndrome, inability to gain weight, acne on back, poor endurance, and hypoglycemia/needing to eat every 2-3 hours. Allergy testing demonstrated a severe allergy to gluten. Removal of gluten from his diet resulted in complete resolution of his irritable bowel within 2 days.

Case 3: A 15-year-old schoolgirl was admitted to hospital as an emergency whilst on holiday. Her parents believed her to be ***allergic to nuts.*** At the age of 5 years, she vomited for about 1 minute after eating a bar of chocolate containing nuts. Three years later, she developed marked angioedema (swelling of the blood vessels) of her face, lips and tongue, followed by tightness of her throat and vomiting: this occurred 2-3 minutes after her friends forced her to have peanuts. Less severe attacks had followed after inadvertent ingestion of hazelnuts and almonds. As a consequence, she avoided peanuts and other nuts wherever possible.

Case 4: Monu, aged 2 ½ years, was referred to hospital with eczema. It started behind his knees at the age of 7 months when solids were first introduced into his diet and steadily worsened. Monu has a strong family history of atopic disease; his mother and maternal grandmother both suffered from asthma. Monu was put on a diet free of cows milk, wheat, oats, peas, beans, nuts, food preservatives and food colourings. Over the following 3 months, there was partial improvement in the severity of his eczema.

Case 5: August 6th, 1982 a woman in Alaska reported that three days before, she and her husband had become ill about one and a half hour after consuming a meal of marinated raw salmon. Illness consisted of generalized hives (red, itchy skin patches), a brassy taste, flushing, abdominal cramps, nausea, and vomiting without diarrhoea. Symptoms persisted for four hours.

You may have read or heard of similar case studies linking consumption of food(s) with adverse reactions such as vomiting, diarrhoea, cramps, wheezing, swelling of the airways, a severe drop in blood pressure, developing gas, bloating, and abdominal pain etc. These are, in fact, different conditions, which link food to adverse reactions. ***Adverse reaction is a general term indicating a clinically abnormal response or reaction to exposure to food regardless of mechanism.*** Foods can cause a wide variety of reactions. Some can be life threatening, however most reactions are less severe. These reactions can fall into several different categories. They can be toxic or non-toxic, they can involve the immune system (as could be in case study, 3 and 4) or stems from problems with digestion or metabolism (as in case study 2) or by pharmacologic agents in foods (as in the case study 5). These adverse reactions by mechanism are illustrated in Figure 6.1.

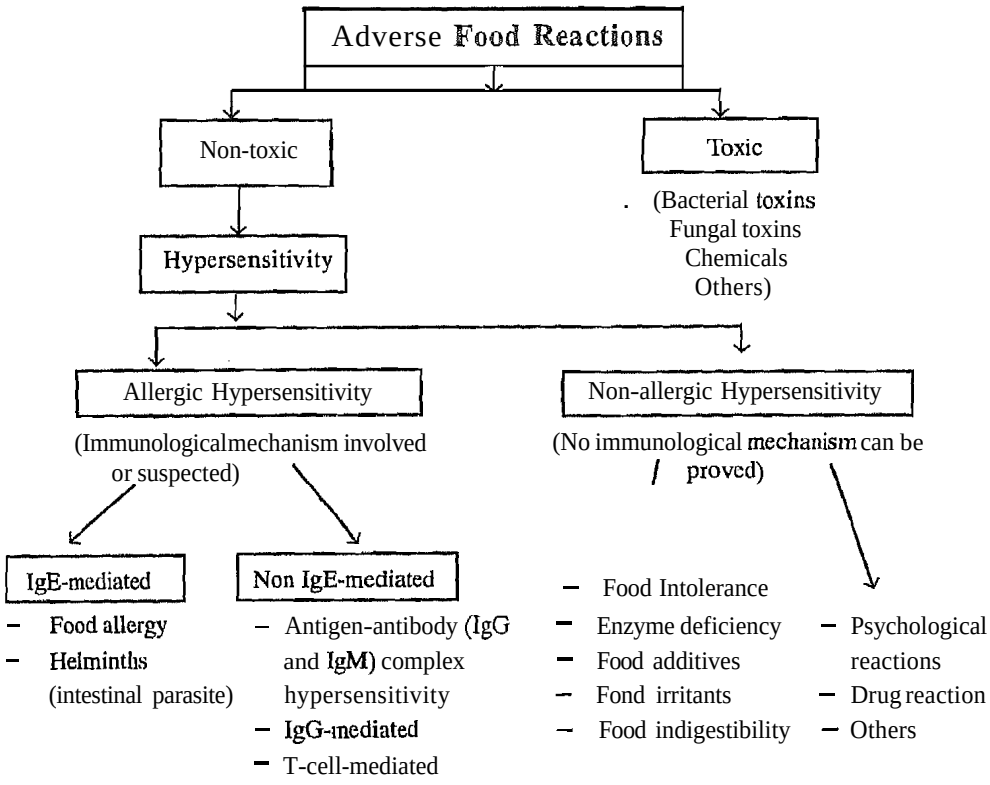

Figure *6.1: Adverse food reactions by* **mechanism**

The toxic reactions from food toxicity or poisoning, about which you may recall studying in the Food Microbiology and Safety Course (MFN-003), can affect anyone. Toxins released from contaminated food or microorganism (bacterial or fungal) or parasites in food cause food-related illnesses. Tliese toxic adverse reactions are not the focus of this unit. Non-toxic adverse food reaclion that involves a response due to intake of specific foods classified as "hypersensitivity" or what is commonly known as food *allergy* and/or reactions caused by problems with digestion or metabolism, referred to as *food intolerance* are the focus of this unit. Food allergies and intolerances also are different from food poisoning, which generally results from spoiled or tainted food and affects more than one person eating the food.

Let us now review these non-toxic adverse reactions in details. We shall begin with allergic hypersensitivity.

6.2.1 Food Allergy (Hypersensitivity)

Case studies 1, 3 and 4 presented above are typical examples of food allergy. What is. a food allergy? A food allergy or hypersensitivity is an abnormal response to a food by our immune system. As illustrated in Figure 6.1, this non-toxic allergic hypersensitivity is immune mediated, i.e. immunological mechanism is involved or suspected. To understand this mechanism, we need to refresh our understanding of the immune system. In the Applied Physiology Course (MFN-001), we studied about the antibody-mediated immune system in sub-section 3.6.1. Antibodies, we learnt, are immunoglobulin produced by plasma cells in response to an antigen or allergen. Antigen, you may already be aware, is usually a foreign substance (i.e. protein, bacteria, virus, polysaccharide etc.) that stimulates antibody production. Allergens, on the other hand, are substances foreign to the body that on interaction with the immune system causes an allergic reaction. Five classes of antibodies have been identified. Immunoglobin A (IgA), Immunoglobin D (IgD), Immunoglobin E (IgE), Immunoglobin G (IgG) and Immunoglobin M (IgM).

Immunoglobin E (IgE) helps to eliminate parasites (helminthes) and is responsible for classic allergic reactions commonly referred to as food hypersensitivity or food allergy (refer to Figure 6.1), a reaction that occurs when the immune system reacts to the normally harmless food protein that the body has erroneously identified as harmful. We classify this immune reaction, therefore, as the *IgE-mediated reaction.* In

fact, the immune reactions are classified into four types: Type I, Type II, III, which are antibody dependent (refer to Table 6.2) and Type IV which is T-cell dependent. You may recall studying about the cell-mediated immunity which does not involve antibodies, but rather involves the production of T-lymphocytes (T-cells) in response to an antigen (refer to the Applied Physiology Course (MFN-001), Unit 3, sub-section 3.6.2) .

Table **6.1: Types of** allergic reactions

Type I: Immediate hypersensitivity, anaphylactic IgE-mediated	This is the quick-onset food allergy. The reaction occurs when an allergen reacts with sensitized IgE-antibody on mast cells. This leads to degranulation of the mast cells releasing mediators such as histamine,cytokines etc. which causes adverse reactions. In certain circumstances, IgG has also been involved in this type of reaction.
Type II: Cytotoxic hypersensitivity	In this reaction IgG antibody reacts with the cell membrane or an antigen associated with the cell membrane and fixes complement, which leads lo complement-mediated ccll death. It is not usually thought to play a role in food allergy.
Type III: Arthus reaction, antigen-antibody (IgG and IgM) complex hypersensitivity	In this type of reaction antigen and antibody (IgG and IgM) form complex to induce complement fixation and consequent local inflammatory response, several hours after exposure to antigen. This reaction may have a role in several food-related inflammatory diseases (such as colitis, enteritis with bleeding, malabsorptive disorders etc.).
Type IV: Cell-mediated immunity or delayed hypersensitivity	This reaction is mediated by T-cells. T-cells interact directly with antigens. This type of reaction may have a role in celiac disease, protein-losing enteropathies, inflammatory bowel disorder such as ulcerative colitis.

Having reviewed Table 6.1, it is important to note that it is the immediate hypersensitivity (Type I), involving IgE, which is responsible for classic allergic reactions. How does this immunopathologic IgE-mediated process leading to allergic reactions works? Let us find out.

Basically, there are three steps involved with the IgE-mediated allergic response. These include:

Step 1: Sensitization

Step 2: Early phase reaction

Step **3:** Late phase reaction

Let us understand this process.

The body's immune system normally reacts to the presence of toxins, bacteria or viruses by producing a chemical reaction to fight these invaders. However, sometimes the immune system reacts to ordinarily benign substances such as food or pollen, to which it has become sensitive. ***Sensitization,*** therefore is the first step in the IgE-mediated allergic response. If our immune system is inclined to form IgE to certain foods, our body must be exposed to the food before we can have an allergic reaction. In other words, people with food allergies have an unusually sensitive immune system. A true food allergy occurs when the body's immune system reacts to a protein from a particular food that has been swallowed. This protein is called an allergen. The allergen causes the persons own antibodies to attack the foreign substance. Thus initial exposure to allergen leads to production of allergen-specific IgE.

Production of allergen-specific IgE starts a chain reaction of chemical changes, which cause adverse reactions in the body. Reaction may occur immediately, in a few minutes,

or several hours after the food is eaten (i.e. within minutes of subsequent exposure of the IgE antibody to the allergen). This is the second phase of the allergic reaction called the ***earlyphase reaction. As*** the food is digested, it triggers certain cells in our body to produce a food-specific IgE in large amounts. The food-specific IgE is then released and gets attached to the surfaces of mast cells as shown in Figure 6.2. The next time we eat that food, it interacts with food-specific IgE on the surface of the mast cells and triggers the cells to release chemicals such as histamine, which is a key mediator of the early allergic response, producing smooth muscle constriction, mucus secretion, vascular permeability and sensory nerve stimulation. To illustrate, if you are allergic to a particular food, you may first feel itching in the mouth as you start to eat the food. After the food is digested in the stomach, you may have gastro intestinal diturbances such as vomiting, diarrhoea, or pain. When the food allergens enter and travel through the bloodstream, they may cause your blood pressure to drop, As the allergens reach the skin, they can cause hives or eczema. When the allergens reach the lungs, they may cause airway obstruction, asthma etc.

Allergen also stimulates immune cells (e.g., mast cells,T-cells) to produce inflammatory mediators (e.g., leukotrienes, cytokines). The newly formed mediators act at post-capillary endothelial cells, promoting outflow of plasma leading to localized oederna, adhesion of circulating leukocytes, infiltration of tissues by eosinophils, neutrophils, and basophils. Over the course of several hours, the infiltrating inflammatory cells become activated and release mediatorsstimulating and enhancing further inflammatory reactions. This is the ***late phase reaction.***

Systemic anaphylaxis (life threatening allergic reaction) is the most acute and sometimes fatal response.

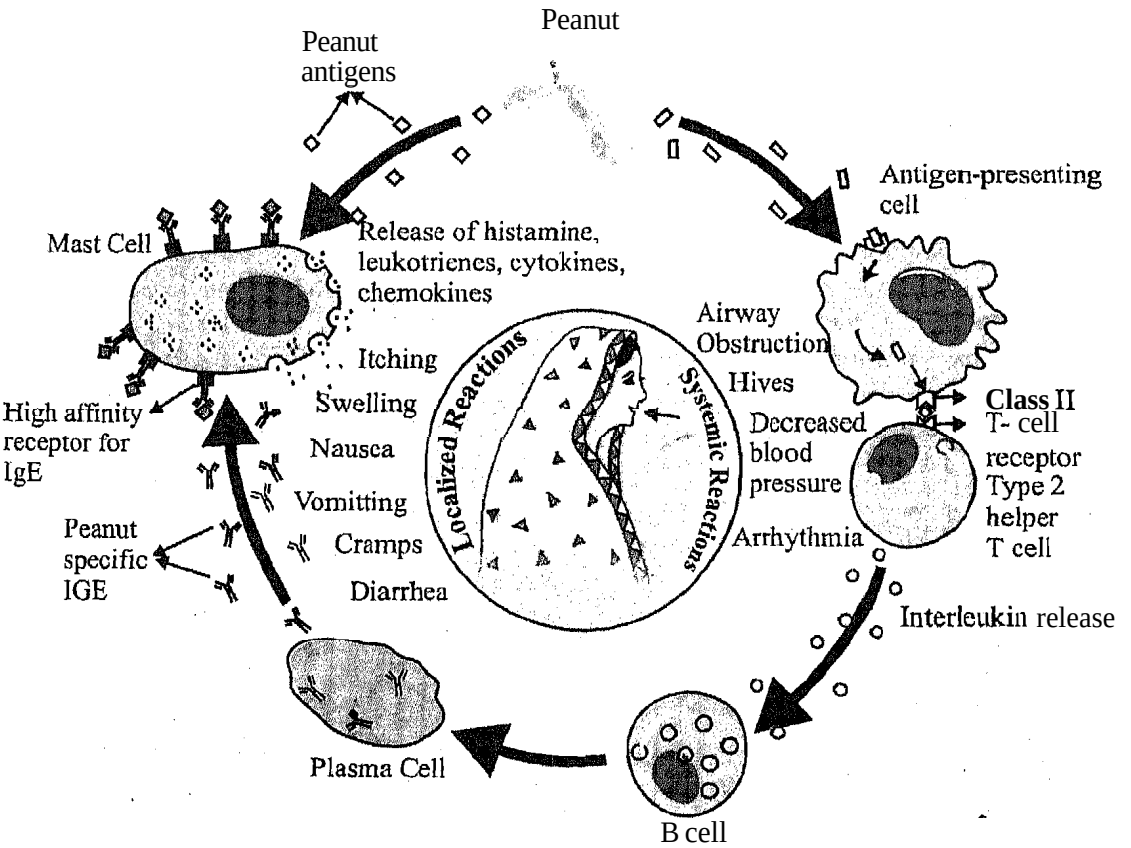

Figure 6.2: The allergy reaction process

Source : Adapted from kraues food, nutrition and diet therapy. 11th edition.

From our discussion above, it emerges that a wide range of symptoms express during an allergic reaction ranging from mild abdominal discomfort to life-threatening anaphylaxis,

Most frequently occurring symptoms are those linked to the skin, respiratory, cardiovascular and gastrointestinal system. Asummary of these symptoms is included in Table 6.2. Systemic ***anaphylaxis*** (severe allergic hypersensitivity) is the most dangerous allergic reaction and can include abdominal pain, nausea, vomiting, cyanosis, a drop in the blood pressure, chest pain, diarrohoea, shock and death.

Table *6.2:* Symptoms of food allergy

Gastrointestinal Manifestations	Skin/Cutaneous Manifestations	Respiratory Manifestations	Systemic Manifestations	Neurological Behaviour
Abdominal pain, nausea, vomiting, diarrhoea, gastrointestinal bleeding, colitis, distention, protein-losing enteropathy	Itching, flushing, urticaria (hives), angioedema (swelling of the blood vessels) eczema, erythema (skin inflammation), redness	Running nose, cough, airway obstruction, airway tightening, wheezing, laryngeal oedema, asthma, rhinitis	Failure to thrive; anaphylaxis, hypotension, dysrythmias	Headache, irritability, restlessness

The IgE-mediated adverse reaction, commonly referred to as food hypersensitivity or food allergy, though occurs within minutes and rarely takes more than a few hours. It is usually quite severe and, in cases of anaphylactic shock, can be fatal. Considering the pathophysiology of food allergy, it is therefore imperative that we try to understand the risk factors that are specific to development of food allergy. These factors are discussed next.

What are the risk factors for the development of food allergy?

Having gone through the discussion above, can you identify at least one important factor leading to food allergy? Yes, a genuine food allergy occurs when a specific immune reaction occurs in the body in response to consuming a particular food. In other words, exposure to a food (antigen) or some element in the food (allergen, usually a protein) (refer to Figure **6.3)** is a prerequisite for the development of food allergy. Excessive exposure to a particular food — for example, in Japan where rice is a staple, rice is a common food allergen; in Scandinavia the common allergen is codfish; while in India, it is chickpeas. Eggs, cow's milk, peanuts, wheat, soya and fish cause most of the allergic reactions in children. Peanuts, walnuts or almonds, fish, and shellfish (such as shrimps, crabfish, lobsters, crab) cause most of the allergic reactions in adults.

Besides food allergens, other risk factors include heredity, gastrointestinal permeability, and environmental factors as highlighted in Figure **6.3.** Heredity is thought to play a major role in the development of atopic disease. ***Atopy refers to an individual being prone to develop allergies because of a genetic state of hyper responsiveness to allergens. In*** most cases, allergies occur when an individual who has a genetic sensitivity to certain allergens is exposed to the substance. Family history of allergies increases our risk of developing allergies, including food allergies.

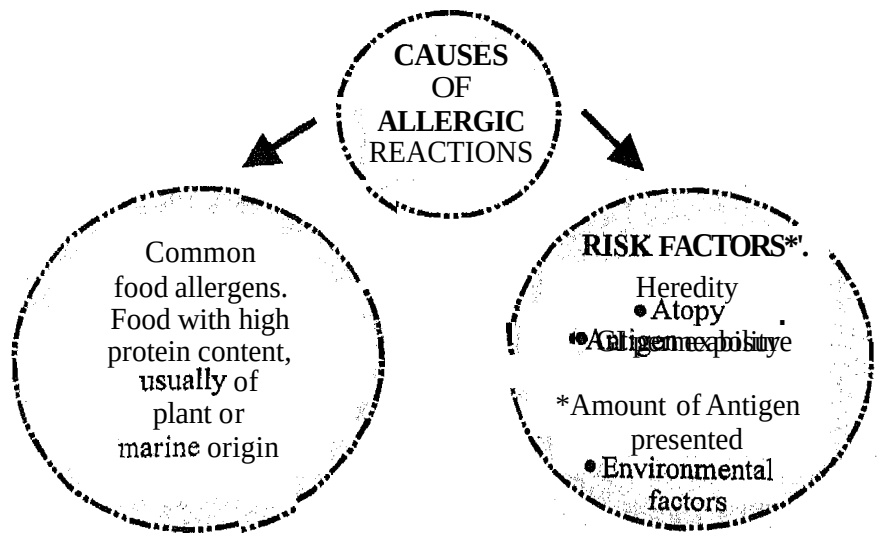

Figure 63: Causes of food allergies

Gastrointestinal permeability may allow antigen penetration and presentation to the lymphocytes. Gastrointestinal permeability is greatest in early infancy and declines with intestinal maturation. Other conditions such as gastrointestinal disease, malnutrition, prematurity and immunodeficiency states may also be associated with increased permeability and risk of developing food allergies. Environmental factors include early exposure to microbes, tobacco smoke, exercise and cold.

It is important to note that allergies are most likely to affect babies and young children because of their underdeveloped immune system.

With a brief review of the risk factors, we end our study of the immune-mediated adverse reactions here. Next, we shall move on to the non immune-mediated adverse reactions, commonly referred to as food intolerance. But, first let us answer the questions given in check your progress exercise 1 and recall what we have learnt so far.

Check Your Progress Exercise 1

1. What do you understand by adverse food reactions? Explain giving examples.

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2. Food allergy is immune mediated. Elaborate on the statement.

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3. Which organs are usually affected by food allergies? Give the common symptoms.

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4. What are the'common food allergies seen in adults and children?

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Now, let us begin our study about food intolerance.

6.2.2 Food Intolerance

What is food intolerance? How does it differ from food allergy? Food intolerance like food allergy is an adverse reaction to food. Food intolerance is different from food allergy in that it does not involve the body's immune system. Food intolerance is a digestive system response rather than an immune system response. It occurs when a food component irritates a person's digestive system or when a person is unable to properly digest or breakdown, the food. It is a non-allergic hypersensitivity, which can occur for variety of reasons as highlighted earlier in Figure 6.1. It may be triggered by a physical reaction to a food or food additive or caused by a metabolic reaction to an enzyme deficiency such as the inability to digest milk properly (lactose intolerance), by pharmacologic agents in foods, by food poisoning such as ingesting contaminated or spoiled fish, or a food idiosyncrasy such as sulphite-induced asthma. The situation is therefore rather different from a food allergy where a specific person's body for whatever reason reacts against a certain food. Here, the most likely causes are food intolerance or excessive consumption of a certain type of food.

Many factors may contribute to food intolerance. In some cases, as with lactose intolerance, the person lacks the chemicals, called enzymes, necessary to properly digest certain proteins found in food. Also common are intolerances to some chemical ingredients added to food to provide colour, enhance taste and protect against the

growth of bacteria. These ingredients include various dyes and monosodium glutamate (MSG), a flavour enhancer. Let us get to know about these factors in details.

(a) Enzyme deficiency or *defects*: A food sensitivity or intolerance can occur when the body has difficulty in digesting a particular food and therefore reacts against it. Let us understand this mechanism in details. In normal digestion, the foods we eat are broken down (through chewing and the action of the acids etc. in our stomach and our intestines) into their component parts. The useful ones (the nutrients) are absorbed into the bloodstream through the digestive tract (or 'gut wall'), the redundant ones are flushed out through the bowel. However, if the foods are not properly broken down through some digestive malfunction the body either will not be able to absorb them properly or, since they have not been properly 'processed', may react against them. In the case of lactose intolerance, for example, the body fails to manufacture the enzyme lactase that is needed to digest the lactose sugar in milk. Without lactase, the digestion cannot process the lactose sugar in the milk. The digestion cannot cope with the raw lactose sugar so reacts against it in the form of cramps, vomiting, diarrhoea, abdominal pain etc. One other example is phenylketonuria (PKU), which is an inborn error of metabolism. In the Nutritional Biochemistry Course (MFN-002), you may recall studying, that in normal people the enzyme *phenylalanine hydroxylase* converts phenylalanine (an amino acid) to tyrosine (another amino acid), which is then utilized by the body. In PKU since phenylalanine cannot be hydroxylated to tyrosine, its metabolites accumulate and cause damage to the central nervous system and result in unusual irritability, eczema etc. Galactosemia due to deficiency of the enzyme galactose-1-*phospahte uridyl* ti-ansferase which converts galactose-1-phosphate to glucose-1-phosphate leads to accumulation of galactose causing various symptoms such as vomiting, fever, jaundice etc.

(b) Naturally occurring food chemicals *(pharmacologic* effect): Pharmacologically active substances include vasoactive amines such as histamine, tyramine, tryptamine, phenylethylamine, and serotonin. These substances are present naturally in many foods, and produced during fermentation, cooking, ageing and storage in other foods. These are substances, which cause a reaction like an allergic reaction. For example, histamine can reach high levels in cheese, some wines, and certain kinds of fish such as tuna and mackerel. These substances may also be consumed in Ioods such as fermented foods (i.e. sauerkraut, pork sausages, canned tuna), brewer's yeast, canned fish, avocados and bananas. In susceptible people, these foods can trigger urticaria, facial flushing, decreased blood pressure and headaches.

Further, certain foods, such as irritants, can trigger histamine release from intestinal immune cells, particularly if taken in large quantities. The most familiar of these substances is caffeine, found in tea, coffee, chocolate and cola drinks. A large intake of caffeine can cause tremor, migraine and palpitations. Other irritant substances include lecithin in legume, paprika, chilli, pepper, paprika, acidic foods, and alcohol.

(c) Reaction to food additives: Food additives such as preservatives, flavour enhancers and colouring agents have been linked to adverse food reactions. Additives implicated include tartrazine (the yellow-orange colour dye used in foods, soft drinks, medicine), benzoic acid or sodium benzoate (added in soft drinks some cheeses, processed potato products) causing hives, rash and asthma. Sulphite are a group of sulphite-based compounds that may occur naturally or may be added to food a flavour enhancer and preservative. Sulphites (including sodium sulphite, potassium sulphite, sodium metabisulphite, sodium bisulphite etc.) are added to many foods and beverages to prevent browning, control microbial growth, modify texture etc. have been well documented to cause adverse reactions such as acute asthma and anaphylaxis, loss of consciousness.

Monosodium glutarnate (MSG) is thought to be safe for most people, but in some cases, adverse reaction to this flavouring agent includes headache, nausea, flushing, abdominal pain and asthma.

(d) *Reaction* to *microbial contamination:* The illness described in case 5 above appears to be scombroid fish poisoning, which results from the ingestion of histamine-

like substances formed when bacteria degrade the flesh of certain marine fish. You may recall studying in the Food Microbiology Course (MFN-003) in Unit 6 about scromboid fish poisoning. Ingestion of improperly handled and stored seafood (yellow-fin tuna, bonita and mackerel) you learnt causes scombroid poisoning. These types of fish contain bacteria in the intestine, which break down the protein (histidine) in the tissue (to histamine) if fish is not immediately gutted and cooled after being caught (i.e. improper storage). Histamine, at high concentrations, is risk a factor for food intoxication whereas moderate levels may lead to food intolerance. A host of symptoms, including skin flushing, facial swelling, dizziness, throbbing headache, oral burning, metallic, sharp or peppery taste in mouth, abdominal cramps, nausea, vomiting, diarrhoea, palpitations, and **a** sense of unease. Another example of microbial contamination is paralytic shellfish poisoning. The causative agent is *saxitoxin*. It is a powerfulneurotoxin produced by *Gonyaulax catenella*. Initial symptoms of poisoning, which can be seen within 30 minutes of consuming shellfish, mussels, clams) include headache, a floating feeling, dizziness, tingling, burning, numbness in the extremities, which spreads quickly throughout the body producing general lack of muscular co-ordination.

(e) *Food indigestibility:* Certain food components, when ingested in large amounts cannot be digested properly and end up in the large intestine where bacteria feed on them. This can lead to bloating, flatulence arid diarrhoea. Examples of such foods include fructose, xylitol, sorbitol, cellulose, hemicellulose, lignin, gums etc.

(f) *Psychologicul reactions:* Some people may have a food intolerance that has a psychological trigger. For example an unpleasant event in one's life, often during childhood, tied lo eating a particular food. Eating that food years later, even as an adult, is associated with a rush of unpleasant sensations and reactions. Symptoms may be precipitated by any food.

Having gone through the discussion above, now can you tell the difference between a food allergy and intolerance? Yes, food allergies can be triggered by even a small amount of the food and occurs every time the food is consumed. People with food allergies are generally advised to avoid the offending foods completely. On the other hand, food intolerances often are dose related. People with food intolerance may not have symptoms unless they eat a large portion of the food or eat the food frequently. For example, a person with lactose intolerance may be able to drink milk in coffee, but becomes sick if he or she drinks several glasses of milk.

Now that we can differentiate between food allergies and food intolerance, let us review the adverse reactions caused by food intolerance. Food intolerance reactions can be quite similar to those of food allergy (as described above), as well as, they may include: the *skin* (rashes, swelling), *airways* (asthma, stuffy or runny nose, frequent colds and infections), *gastrointestinal tract* (irritable bowel symptoms, colic, bloating, diarrhoea, vomiting, frequent mouth ulcers, reflux, bedwetting), *central nervous system* (migraines, headaches, anxiety, depression, lethargy, impairment of memory and concentration, panic attacks, irritability, restlessness, inattention, sleep disturbance, restless legs, mood swings etc.). Symptoms of food intolerance can come and go and change throughout life. Since, the symptoms of food intolerance can be mistaken for those of a food allergy; it is here that the role of the physician and a dietitian is crucial. Being able to determine what the client/patient is experiencing is (a food allergy or a food intolerance) is important for treatment. In the next section, we shall study about the diagnosis, prevention and treatment of these adverse reactions.

6.3 ADVERSE FOOD REACTIONS – THE DIAGNOSIS PROCESS

Diagnosis requires an initial screening, perhaps by a physician (a full physical examination) to rule out other diseases. Diagnostic test in food allergy also includes the biochemical, immunological testing {CAP-FEIA, radioallcrgosorbent test (RAST) etc.) and skin tests. We shall not go into the details of these tests since they are not

within the purview of this course. However, it is important to understand that these tests can be helpful only to diagnose the IgE-mediated allergic reactions. Biochemical testing can rule out non-allergenic causes of symptoms. One reliable proof for a food reaction is disappearing of symptoms on elimination and reoccurring on challenge. For food intolerance, particularly the diagnosis is via elimination and challenge with food substances/chemicals. Delayed reactions and non IgE-mediated reactions can, only be diagnosed by an elimination diet. Diagnosis requires identification of the suspected food, proof that the food causes an adverse response, and verification of immunological involvement. Following questions about food reactions may be useful for this diagnosis:

- Whether the individual/patient can pinpoint a particular food
- The amount of food eaten
- The time it took from eating to the reaction developing
- Whether the same food has caused a reaction at some other time too
- Whether other foods have caused the same reaction
- How often the reactions occur
- Whether reactions are seasonal
- What is the usual food intake pattern?
- Whether a symptom and food intake diary is maintained, if not keep a symptom and food intake diary and record all events in chronological order.

The first diagnostic tool therefore is the clinical history. Information related to description of symptoms, the time of food ingested relative to the onset of symptoms, a description of the most recent reaction, a list of suspected foods, and an estimate of the quantity of food required to cause a reaction will be useful. The food and symptom diary is, therefore, a useful tool if there is a perceived general food reaction with chronic symptoms but no specific suspect food(s). A sample of the food and symptom diary is given in Figure 6.4. Asking the patients to maintain such a food and symptom diary, preferably for a week or 10 days, can be quite revealing.

Date:	MORNING Breakfast 6 am - 12 pm	AFTERNOON Lunch 12 pm - 3 pm	EVENING Tea 3pm-6pm	NIGHT Dinner and bed time 6 pm - 6 am
Food				
Medications nutritional Supplements				
Activities				
Symptoms				

Figure 6.4: Food and symptom diary

Besides clinical history, the diagnosis of the adverse food reaction based on the response to a carefully designed elimination diet is also useful. ***Food elimination,*** therefore, is

another tool in the diagnosis process. In the diagnostic food elimination, the elimination diets are prescribed ***for short term, under supervision and only for a*** good reason. Elimination diets are therapeutic trials. The elimination diet, as the name suggests, is a diet that eliminates a single or several foods depending on the medical and dietary history. This diet eliminates foods and food additives considered to be common allergens, such as wheat, dairy products, eggs, corn, soy, citrus fruits, nuts, peanuts, tomatoes, food colouring agents and preservatives, coffee, chocolate etc. In immediate type food reaction the culprit is often known and only the offending food is eliminated. If the reactions are delayed, multiple foods may need to be eliminated. The type of elimination diet selected depends on the diet history, symptoms and severity of the reactions. The elimination diet may be ***basic, targeted*** or ***severe elimination diets.*** The use of a basic elimination diet may be helpful in assessing the role of food allergy. In the ***targeted elimination diet*** foods based on patients history and/or the results of specific IgE tests to the foods in question is eliminated as highlighted in Figure 6.5. The use of ***severe elimination diet*** is warranted when removal of suspected food(s) does not eliminate symptoms, multiple food sensitivities are suspected, and food is uulikely to be causing symptoms. The implementation of severe elimination diet is illustrated in Figure 6.6. Thus using the elimination diets, foods most commonly implicated and foods most commonly eaten are usually excluded. In food intolerance, food chemicals, as well as, additives are avoided using the elimination diet.

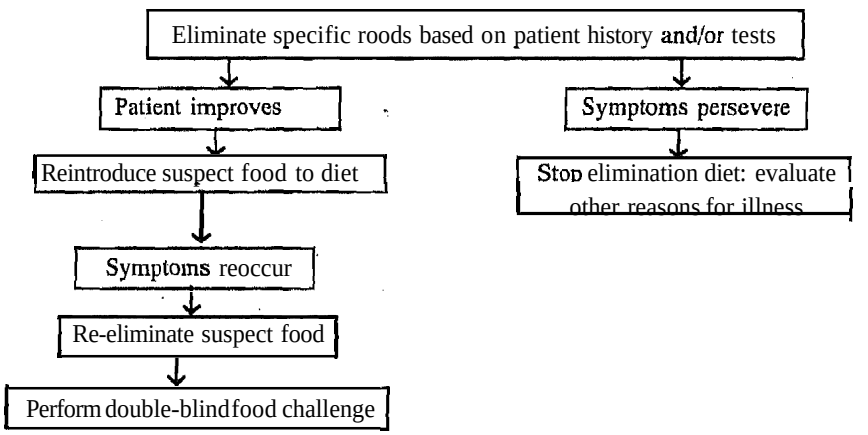

Figure 6.5: Using the targeted **elimination diet**

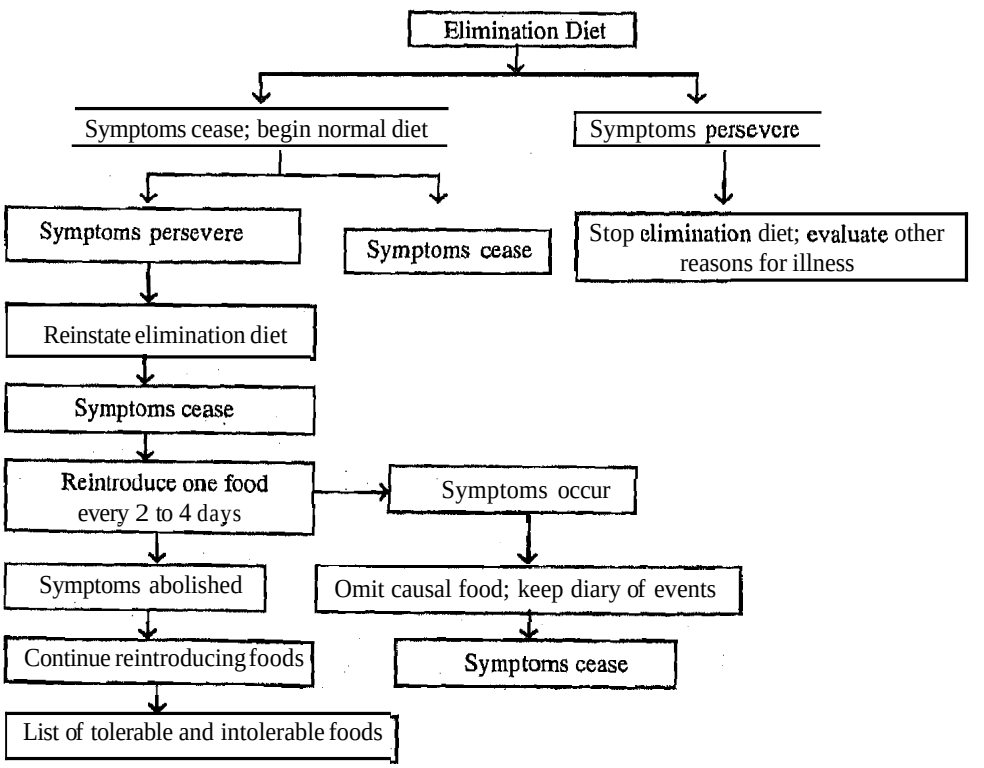

Figure **6.6: Implementation of the** severe **elimination diet**

The diagnostic elimination diet is followed for a set period usually approximately for 4-6 weeks. As you may have noticed in Figure 6.5 and 6.6 above that if no response is seen within this period, a diet of different foods can be tried. If response is seen, the diet should be abandoned and alternate explanations for symptoms explored. If a marked improvement is seen, foods are re-introduced individually or in the case of food intolerance according to food chemical content. Food re-introduction is therefore yet another tool in diagnosis. Let us get to know this element better.

Food challenge or re-introduction is another crucial element in diagnosis. Challenge involves *eating a test dose of suspected food or food chenzical and noting down the response and the severity of the response.* If an initial dose does not elicit a response, increasing doses are then used as challenges, sometimes over several days. If the response is negative, the next food is challenged after a stipulated time. If the response is positive, the food should be avoided. Positive challenge results require the avoidance of the food allergen. In food intolerance, the dose of chemical tolerated also need to be established. Positive challenge should be repeated at intervals to establish, especially in children, whether they have outgrown the sensitivity.

The food challenge can be conducted in three ways. a) Open food challenge (OFC), which allows the food to be given openly, b) single-blindfood challenge (SBPCFC), in which the food is hidden from the patient with at least one placebo; and c) double-blind, placebo-controlled food challenge ((DBPCFC), in which the food is hidden from the patient and presented with at least one to three placebo. The ultimate 'gold standard' for the positive diagnosis is the DBPCFC, where the patient is challenged with the offending food in a disguised manner after an elimination period. Interestingly neither the patient nor the physician/dietitian knows whether they are consuming or introducing the allergen or not.

Once the adverse food condition is diagnosed, it is easy to treat and manage the problem. Answer the questions given in check your progress exercise 2 before you move on the treatment and management of adverse food reactions, which are discussed next.

Check Your Progress Exercise 2

1. Differentiate between food allergy and food intolerance, giving examples.

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2. List the common causes of food intolerance.

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3. What is elimination diet? Enumerate its significance in diagnosis of adverse food reaction.

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4. What is food challenge? Discuss its relevance.

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6.4 TREATMENT AND MANAGEMENT OF ADVERSE FOOD REACTIONS

Management of adverse food reactions involves diagnosing the problem followed by nutritional and medical care. We have already reviewed the diagnosis earlier in this unit. Here we shall focus on the nutritional management since medical management is not within the scope of our study. Look at Figure 6.7 which illustrates the management of food allergies.

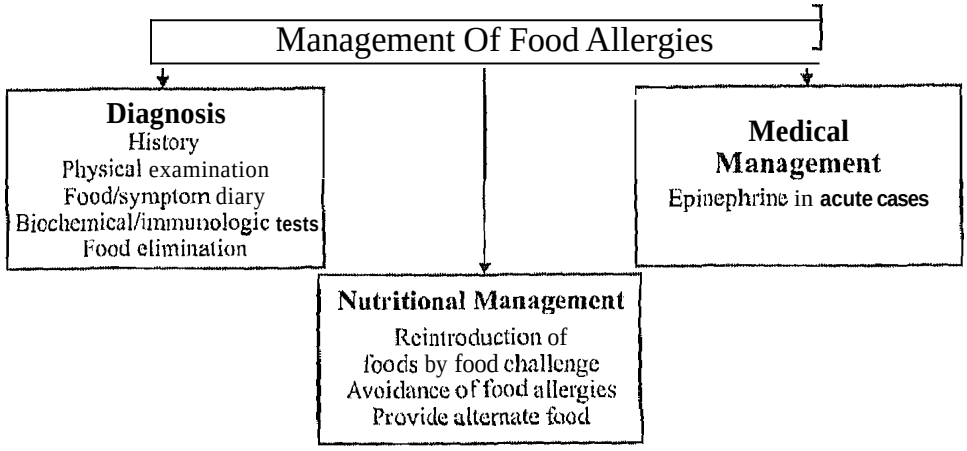

Figure 6.7: Management of food allergies

The four general principles of allergy management include:

1. Avoid factors that cause symptoms.
2. Use appropriate medications.
3. Evaluate for immunotherapy.
4. Educate and follow-up.

The primary treatment for managing food allergies is eliminating the offending food or foods. In fact, non-pharmacological treatment of food allergy requires complete elimination and strict avoidance of the allergen from the diet as highlighted in Figure 6.7. A diet should be planned carefully so that the nutrient and calorie needs are met. If a major food group such as dairy products causes an allergy, a supplement or non-dairy food/formula may be added to the diet. In food intolerance, however, the aim should be to eat a diet with a tolerable dose of food chemicals including a wide variety of foods, Although many food intolerances may allow some ingestion of the offending food, food hypersensitivities or allergies do not. In fact, some types of food intolerance can be treated. The management of few food intolerance conditions such as phenylketonuria lactose intolerance has been covered in Unit 13 and 19, respectively later in this course. Hence, we shall not dwell on their management here. We suggest you look up the relevant sections in the units mentioned above to learn about the management of adverse food reactions caused by these conditions.

Here, we would like to continue with our discussion on management of food allergies. Once all food challenges have been completed, a maintenance diet should be planned. A maintenance diet is based on avoidance of offending foods and substitution aiming at a nutritionally balanced diet. To help identify and avoid offending foods, allergy-specific list that describes foods to avoid may be useful. Table 6.3 presents allergy-specific list of foods for your reference. Besides avoidance of offending food, certain nutritional supplements may serve useful in management of adverse food reactions and maintenance of a good nutritional status during the course of treatment. A brief review on these supplements follows.

improve digestion, by helping the intestinal tract control the absorption of food allergens and/or by changing immune system responses to foods. It is well known that probiotics, like lactobacillus, assist in the digestion of lactose. One group of researchers has reported using probiotics to successfully treat infants with food allergies in two trials: a double-blind trial using Lactobacillus GG bacteria in infant formula, and a preliminary trial giving the same bacteria to nursing mothers. Probiotics may also be important in non-allergic food intolerance caused by imbalances in the normal intestinal flora.

Many of the effects of allergic reactions, we learnt earlier, are caused by the release of histamine, Some natural substances, such as vitamin C and flavonoids, including quercetin, have demonstrated antihistamine effects in laboratory, animal, and other preliminary studies. However, no research has investigated whether these substances can specifically reduce allergic reactions in humans.

You may have heard the proverb 'Prevention is better than cure'. Let us then learn about the preventive measures next.

6.5 PREVENTION OF ADVERSE FOOD REACTIONS

Considering the increasing incidence, cost and morbidity associated with allergic reactions, it is perhaps useful to design preventive strategies geared towards minimizing the allergic responses. In fact, prevention strategies for allergic diseases are the key to minimizing the allergic response. In this section, therefore, we will first focus on preventive strategy for food allergies. Having studied about the pathophysiology of the allergic responses, can you suggest measures means by which we can prevent these adverse reactions? Let us help you in this task. You may recall studying earlier about the three steps involved in the allergic reaction process i.e. first sensitization, followed by expression of the disease and symptoms in the second and third step. Based on these three stages of allergic sensitization/elicitation of disease, the preventive strategies too can be classified under three stages, namely:

- *Primary Prevention:* Focuses on blocking *sensitization and development* of *IgE-mediated response.* These strategies would be useful for those individuals who have an atopic disposition but no sensitization.
- *Secondary Prevention:* Attempts to inhibit *expression of the disease despite sensitization.* These are used for the patients who have been sensitized but do not express the disease or only expresses one type of disease (e.g., atopic dermatitis) but not other disorders (e.g., asthma)
- *Tertiary Prevention*: Targets the *control of factors that* cause *symptoms.* This strategy would be appropriate for patients who have expressed the disease and needs to limit symptoms.

The first step for prevention is to identify what can and cannot be done. Many strategies, you would realize, in primary, secondary, and tertiary prevention may be similar but are utilized differently according to sensitization and expression of the disease. If a treatment works for allergy symptoms (tertiary), it may be used to prevent expression in a sensitized individual (secondary). If a treatment works for both tertiary and secondary prevention, it may then be utilized to prevent sensitization in primary prevention.

Let us further, dwell on measures we could adopt in primary, secondary and tertiary prevention. Current research in primary allergy prevention focuses on blocking IgE-sensitization, e.g. environmental control. Some areas that are important and require investigation/emphasis at the primary level would include:

- How do we identify the high-risk infant during the perinatal period?
- How does avoiding exposure to food allergens affect expression of allergy?

- Is there a role for maternal avoidance of allergens during the prenatal period and during lactation?
- Is there a critical time during pregnancy and/or during the postnatal period when allergen exposure is most likely or least likely to sensitize?
- Is there a critical dose required to cause or prevent sensitization?
- What is the role of the infant diet, including breast-feeding, non-milk formula, delayed introduction of specific foods, delayed introduction of "at risk" foods (e.g., milk, egg, peanuts).
- What are appropriate environmental control measures to limit infant exposures to allergens? (e.g., dust mites, animal dander)

Secondary allergic preventive measures will focus on:

- initiating prospective surveillance of infants, young children and adults for expression of sensitization, including sensitization to certain foods (e.g., egg, peanut, milk) and aeroallergens (e.g., dust mites, cat dander, pollens, moulds etc.),
- implementing indoor environmental control measures prior to disease expression,
- using pharmacologic therapy and/or immunologic modulation in patients with allergic disorders (e.g., atopic dermatitis) to prevent subsequent expression of other disorders (e.g., asthma), and
- avoiding environmental irritants (e.g., tobacco smoke, air pollutants).

The tertiary allergy prevention, as you already know, focus on patients with symptoms. Hence, the strategies will target the factors that increase symptoms. These would include *environmental control* at home, school, workplace etc., *avoidance of factors* (exposure to allergens, environmental irritants) that cause symptoms and *patient and family education.* Among these measures, the patient and family education, is crucial. Let us get to know it better.

Family and Patient Education

Remember, involvement of the family and all other relevant caretakers along with the patient is crucial for prevention and management of the reactions. The goal of all patient education should be to help patients (and families) take the actions needed to control their symptoms and improve care. Educating the patient about strict avoidance of the foods to which the patient is sensitive is the only proven therapy for food allergy. A child with food allergy must not accept food from classmates or friends. The child, parents and ALL caregivers need to understand this. Just providing a list of "allowed foods" may not be beneficial as ingredients frequently change. Instead, ENCOURAGE PATIENTS AND FAMILY MEMBERS TO READ LABELS. Parents must learn to read labels carefully to avoid allergens. Often, the offending food can come in different forms or have a variety of names. For example, a child allergic to milk must avoid whey, a protein found in milk. By law, a food ingredient must be listed on the label, but allergenic components can accidentally get into foods. Children may also be taught. how to read food labels and ingredient list. Parents will also need to be watchful when their child is in daycare, school, a restaurant, or at parties. Further, with advancement in technology, individuals also need to be aware that a new method of growing produce, called biolechnology, may pose a risk to the allergic child or adult. For example, genetic material from peanuts is being transferred to tomatoes and other produce to develop better-looking (but not necessarily better tasting) produce. In this context, it would be required that new products be labeled to identify common allergens. Therefore, consumption of such genetically modified foods may need more caution.

Patient education, therefore, is critical and should include:

- Allergen identification (e.g., how to read food labels),

- Avoidance strategies and counseling,
- Symptom recognition,
- Cautions regarding the possibility of a life-threateningreaction,
- What to do in case of accidental ingestion,
- Development of a treatment plan, and.
- Consult a doctor immediately.

Tailoring the educational approach to the need of the patient is crucial. Using simple language and clear-easy-to-follow instructions/steps and providing written and verbal information will be useful. Some suggestions to help prevent allergic diseases and promote better outcomes for the patient include:

- Promote breast-feeding. Although breastfeeding is one way to delay a child's exposure to allergens, certain allergens from foods in a mother's diet can be passed through breast milk and cause a reaction in an infant. Under this situation, particularly if a family has a history of food allergies and the mother is breastfeeding the child, it may be recommend that major allergenic foods, such as dairy products, eggs, peanuts and tree nuts, fish and shellfish, and soy, may be eliminated from the mother's diet,
- Discourage the early introduction of solid and "at risk" foods (e.g., milk products, eggs, peanuts etc.),
- Reduce dust mite levels in homes and avoid exposure to animal dander (tiny scales shed from skin or hair),
- Screen for allergy at all routine check-ups,
- Increase understanding of allergy and allergic disorders among patients and their families,
- Encourage the use of educational support groups for patients with allergic diseases,
- Encourage the awareness of allergen/environmental control measures at work, school, and home,
- Promote ways to reduce or eliminate environmental tobacco smoke, and.
- Promote legislative support for research, environmental control measures, and public education about allergic disorders.

The preventive measures discussed above so far focus mainly on allergic reactions. Let us now focus on food inlolerance. Taking a few simple steps can help prevent the symptoms associated with food intolerance. These steps include:

- Help the patient/child learn which foods in what amounts cause symptoms and limit the intake to amounts the body can handle.
- Inform the patient that when dinning out, ask the waiter/cook/server about ingredients of a recipie. Some meals may contain foods, which the individual cannot tolerate and that may not be evident from the description on the menu.
- Encourage the patient/family members to read food labels and check the ingredients for problem foods. Ensure that they do not forget to check condiments and seasonings. They may contain MSG or another additive that can lead to symptoms.

We hope the measures discussed above will go a long way in helping and guiding you to counsel patients suffering from food allergies and food intolerance. Let us now proceed over to the check your progresss exercise 3 to reinforce our understanding of the concepts studied above.

Check **Your** Progress Exercise **3**

1. What is the primary treatment for food allergy and food intolerance?

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2. Are some nutritional supplements helpful in treating food allergies? Comment.

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3. Elaborate on the strategies you would adopt to prevent food allergy.

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4. What handy guidelines would you give to the patients and their family to prevent themselves from food allergy and intolerance.

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6.6 LET US SUM UP

The term "hypersensitivity" is general and may include true allergies, reactions that do not affect the immune system (food intolerance), and reactions for which the cause has yet to be determined. This unit focused on the immune-mediated and the non immune-mediated adverse food reactions, namely food allergy and food intolerance. Food allergy is a condition which is rarely curable in which specific foods cause an immediate and often dramatic physical reaction such as vomiting, diarrhoea, cramps, wheezing, swelling of the airways, a severe drop in blood pressure etc. In food allergy, food sets off what is known as an IgE mediated reaction in the body. Eggs, cow's milk, peanuts, wheat, soya and fish cause most of the allergic reactions in children. Peanuts, walnuts or almonds, fish, and shellfish (such as shrimps, crayfish, lobsters, crab) cause most of the allergic reactions in adults. Food intolerance, on the other hand, is often linked to other health problems, when the body has difficulty in digesting a particular food and therefore reacts against it, and its symptoms too are somewhat similar to food allergies, but far less defined. Examples of well-understood intolerances are lactose intolerance and phenylketonuria.

Diagnosis of these adverse reaction (food allergies and food intolerance), we learnt is based on clinical history and on the response to a carefully designed elimination diet and on food challenge. The primary treatment for managing food allergies is eliminating the offending food or foods. In food intolerance, however, the aim must be to eat a diet with a tolerable dose of food chemicals including a wide variety of foods. Preventive strategies may be classified as primary, secondary or tertiary level. It is the tertiary level that targets the control of factors that cause symptoms which is most crucial. Environmental control at home, school, workplace etc., avoidance of factors (exposure to allergens, environmental irritants) that cause symptoms and patient and family education are important components of tertiary preventive strategy.

6.7 GLOSSARY

Anaphylaxis : it refers to a rapidly developing and serious allergic reaction that affects a number of different areas of the body at one time. severe anaphylactic reactions can be fatal.

Atopic : relating lo, or caused by a hereditary predisposition toward developing certain hypersensitivity reactions, such as hay fever, asthma, or chronic urticaria, upon exposure to specific antigens.

Dermatitis : dermatitis is a term literally meaning "inflammation of the skin"

Flavonoids : the term flavonoid refers to a class of plant secondary metabolites most commonly known for their antioxidant activity.

Perinatal : relates to the period around childbirth, especially the five months before and one month after birth activity.

Phenylketonuria : a genetic disorder in which the body lacks the enzyme necessary to metabolize phenylalanine to tyrosine.

Rhinitis : is an inflammation of the mucous membrane of the nose with symptoms of sneezing, itching, nasal discharge and congestion.

Urticaria : it is defined as the appearance of hives caused by a specific stimulus. A hive, or wheal, is a circular, red, spongy lesion that evolves and changes over minutes to hours.

6.8 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

1. Adverse reaction can be defined as a clinically abnormal response or reaction of the body to exposure to food regardless of mechanism. For example, an abnormal response to a food by our immune system results in a food allergy feactions caused by problems with digestion or metabolism are called food intolerance.

2. Food allergies are immune mediated as they involve the generation of antibodies, which are immunoglobulins produced by plasma cells in response to an antigen which is an allergen. Immunoglobulins has been identified in the role of allergy in humans.

3. Allergy is a complex process which within a few hours can affect various parts of the body starting from mouth, reaching the skin and finally to lungs, all the while stimulating immune cells. The symptoms of an allergy include itchy mouth/ tongue, skin rashes such as hives or eczema. Airway obstruction, asthma in lungs. GI symptoms manifest as vomiting, diarrhoea, or pain in abdomen.

4. Food allergies are common with other common day-to-day useable seemingly harmless food products. Egg, cow's milk, peanut, wheat, soya and fish cause most of the allergic reactions in children. Peanuts, walnuts, fish and shellfish cause most of the allergic reactions in adults.

Check Your Progress Exercise 2

1. Food Intolerance is non-immune mediated and is a mere digestive response to food unlike food allergy which involves the body's immune system. Food intolerance is a non-allergic hypersensitivity which can occur due to a number of reasons, when compared with allergy which is involved in the reaction of food item (allergen) with the body's immune system.

2. The common causes of food intolerance include metabolic reaction to enzyme deficiency e.g: lactose intolerance, or due to physical reactions to a food additive. Reaction to pharmacological agents in food, as well as, food poisoning.

3. Elimination diets are therapeutic trials where the diet eliminates several foods depending on patients medical and dietary history. This diet eliminates all possible allergens such as food additives, common allergenic food like eggs, cow's milk, wheat, corn, soya, citrus fruits, peanuts etc. Removal of basic identifiable common allergens from food can help identify the allergen in food.

4. Food challenge is a method of confirming a diagnosis or continued existence of a food allergy or intolerance.

   This procedure is primarily of value since it may be used over a period of.time. (months/ years) to re-evaluate whether a childhood food sensitivity still exists as certain type of allergies and intolerance spontaneously remit or are outgrown e.g. lactose intolerance, gluten entropathy etc.

Check Your Progress Exercise 3

1. Primary treatment of food allergies/intolerance involves complete exclusion/ elimination of the offending allergen even in trace amounts. This is a complex process if the allergen is a common food of several food products (e.g. milk, wheat), This should be followed by proper dietary management by providing alternate food sources to maintain an optimum nutritional status.

2. Nutrition supplements are helpful in treating food allergies. For instance, probiotics may be useful for those suffering from lactose intolerance. Yoghurt/curd/pre-digested milk may be better tolerated as compared to milk.

3. The incidence of food allergies can be reduced or prevented through primary, secondary and tertiary measures. Read the measures listed in section 6.5 and answer accordingly.

4. Look up the guidelines on page 148/149 and prepare a list.