Social Pharmacy (2015)

Chapter 3. NUTRITION and HEALTH

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FOOD

It is defined as any substances which when taken into body can be utilized to provide heat or energy to maintain or to compensate wear and Tear of tissue and regulate the body process.

Functions of food

1. To provide heat and energy for mechanical work
2. To maintain the wear and Tear of tissue Essential for growth of the body
3. Provide the power to the body to build resistance against infectious disease
4. It Is Essential to satisfy hunger
5. It is essential for maintenance and regulation of body temperature

CLASSIFICATION OF FOOD

1. According to origin

a. Animal origin: example meat, fish, eggs, milk
b. Plant origin: source example green vegetable, fruits, oils, dry fruits

2. According to function

a. Energy building foods like carbohydrates, fats, protein
b. Bodybuilding fruits like meat, fish, eggs ,milk
c. Protective foods like milk and green vegetables

3. According to nutritive values

Example animal food, fats, oils, nuts, cereals and spices

4. According to chemical composition

Example Carbohydrate, protein, fat, minerals, vitamins

NUTRITION

It is a science of food & its relationship to health.

Nutrition is the process by which body utilizes food for grow, maintenance & healthy living.

Nutrition are specific dietary constitution such as Carbohydrates, Proteins, Fats, Vitamins & Minerals.

Objective of Nutrition

- 1. To promote the physical & mental growth & development of human beings.
- 2. Building & repairing of tissues & cell damaged by infection & injuries.
- 3. To provide energy for doing works.
- 4. To protect the human beings from infections & deficiency disorders.

NUTRITIENTS

- Organic & inorganic complexes contained in food are called nutrients. OR
- Useful chemical substances derived from food by the body are called nutrients.
- The nutrients which provides energy, helps to grow well & normal development & repaired of tissues.

- 50 different nutrients supplied by foods to our body.
- Each nutrients has its own specific function.
- Most of the foods contains more than 1 nutrient.
- Nutrients are divided in to two parts mainly as Macronutrients & micronutrients

MACRONUTRIENTS

- They are the nutrients use in the largest amounts by the body.

- Macronutrients are the nutritive components of food that the body needs for energy and to maintain the body's structure and systems.

- These are the carbohydrates, proteins & fats

- They contribute to the total energy intake as:

Carbohydrates 60-80%

Fats 10-30%

Proteins 7-15%

- For proper utilization of macronutrients need micronutrients.

MICRONUTRIENTS

- It requires in small quantity as so called Micronutrients i.e. vitamins& minerals.
- The quantity of nutrients requires depends upon age, sex, weight, physical activity and health status of the body.

CARBOHYDRATE

- Carbohydrate consists of carbon, hydrogen and oxygen.
- It is the main source of energy and one gram of carbohydrate after oxidation yield 4 Calories of energy.
- All carbohydrate have to be changed into glucose and Fructose before they are absorbed into the body by means of the juices present in the gastrointestinal tract.
- Daily requirement of carbohydrate is 400 to 500 gram

- Sources of Carbohydrates

a) Animal source: example Honey, milk & milk products.

b) Vegetable source: example potato, fresh fruits, green vegetables, corn, rise, sugarcane etc.

- Functions:

They are the main source of energy.

PROTEIN

- Protein are complex organic nitrogenous compound composed of carbon, hydrogen, Nitrogen, Oxygen ,Phosphorus & Sulphur.
- Proteins are made from simple compound known as amino acids. There are 24 amino acids which is needed by the body out of which 9 are essential amino acids.
- Each protein on oxidation gives 4.1 Calories of energy.
- Daily requirement of protein for adult is 1 gram per kg of body weight.

1. Essential amino acids:

Essential amino acids are those which are not synthesized in the body but are essential for the body growth and development .

Ex: leucine, lysine, iso-lysine, methionine, Threonine, tryptophan, valine, histidine, phenylamine.

2. Non-essential amino acids:

Non-essential amino acids are those which can be synthesized in the body.

Ex: Alanine, Aspartic acid, Glycine, Glytenic acid, Proline, Cystine, Arginine, Aspargine, Aspartate, Serina, Thyrosine, Ornithine.

Sources of protein

Animal source: fish, eggs, milk, meat, cheese

Vegetables Source: Nuts, soybean, cereals, pulses, Beans.

Functions

- Used for growth and development of the body
- For repair and maintenance of body tissue
- For maintenance of osmotic pressure
- For the synthesis of antibiotics enzymes hormones hemoglobin and coagulation factor

Effect of protein deficiency

- The deficiency of protein may leads to low birth weight, mentally retarded and undeveloped child.
- In adults it may lead to loss of weight, increase in the susceptibility to the infection & delay in wound healing.
- Protein-energy **malnutrition** (PEM) is a common childhood disorder and is primarily caused by deficiency of energy, protein, and micronutrients.
- Kwashiorkor and Maramus

Kwashiorkor	Marasmus
1. Occurs due to deficiency of protein in the diet.	1. Occurs due to deficiency of protein, carbohydrate and fat in the diet.
2. Child shows oedema in lower legs, lower arms and usually in face.	2. No swelling.
3. Appetite is poor. Skin shows no change.	3. Appetite is usually good. Skin is flaky with diffused pigmentation.
4. Irritable, moaning and apathetic.	4. Quiet and apathetic.
5. It occurs in children from one to five years of age.	5. It occurs in infants up to one year of age.

FATS

- Fats are composed of carbon, hydrogen and oxygen.
- They differ from carbohydrates that the percentage of oxygen is more in Carbohydrate than fat.
- Some of the fats are liquid at room temperature

  Example: Groundnut oil, vegetable oil.
- Some of the fats are Semi solid at room temperature

  Example: butter, ghee
- Fat is also a good source of heat and energy.
- The1 gram of Fat provide 4 Calories of energy.

- The fatty acids which cannot be synthesized in the body are known as essential fatty acid it must be incorporated in diet

  Example: Linolic & linoleic acid,

  Lilolic & lilolinic acid

- Some of the fats which are synthesized in the body are known as non essential fatty acid

  Example: cholesterol and triglyceride

Sources of fats:

Animal fat: example fish, milk, eggs, cheese butter

Vegetable fats: example grains and vegetable oil

Functions of fat:

- They are the main source of energy and provide double energy.
- They provide support to the main organs of the body for example kidney, intestine, heart.
- Fatty layer below the skin plays an important role in maintaining the body temperature.
- Fats protect the body from external heat and cold.

EFFECT OF FAT DEFICIENCY

- In the deficiency of essential fatty acids may lead to rough and dry skin.
- Constipation
- Weakness
- Mood swings
- Increased susceptibility to infection

Effect of excess fat in diet:

- It may also lead to increase in blood cholesterol level which may causes heart diseases.
- Obesity

MINERALS

- Body has 24 mineral acids which are mainly absorbed from food, these minerals salts are very useful for maintenance and growth of body.
- They are classified into two major classes;

a. Major minerals ex. calcium Phosphorus Sodium Potassium

b. Trace minerals ex. iodine, iron, zinc, fluorine

Sources of minerals

- Vegetable sources: garlic, onion, green, vegetable
- Animal sources: meat, eggs, milk

FUNCTIONS OF MINERALS

- They maintain rigid structure of body such as a bone, teeth.
- They form a part of every cell
- They maintain tone and proper functions of muscles of body.
- They maintain electronic balance in the body fluid.
- They stimulate digestive secretions and are necessary for growth of the body.

Some important minerals are;

1. Potassium

- Potassium helps in maintaining the pH of the various body fluids also helps in contraction of muscles in transmission of nerve impulses.

- The daily requirement of potassium chloride varies from 5 to 7 gram and excess is excreted through urine.

- Deficiency disorders of potassium:

Hypokalemia

Vomiting

Diarrhoea

2. CALCIUM

- Calcium is the most common mineral present in human body.
- 99% of calcium is stored in the bones and teeth and remaining 1% is found in blood muscles and fluid between the cells.

- Deficiency disorders of calcium leads to osteoporosis

3. SODIUM

- Sodium the body needs a small amount of sodium to maintain the normal blood pressure and normal function of muscles and nerves

- Deficiency of sodium causes hyponatremia

4. IODINE

- It is an essential micronutrients.
- It is required for synthesis of thyroid glanc hormone for example thyroxine (T4) & tri iodothyroxine (T3) that contain 3 to 4 atoms of iodine.
- It is needed for normal growth and development of body.
- Human body contains 50 gram of iodine and blood level is about 8 to 12 microgram per liter.
- Deficiency of iodine may leads to Goiter(hypothyroidism), retarded physical development and mental function.

5. IRON

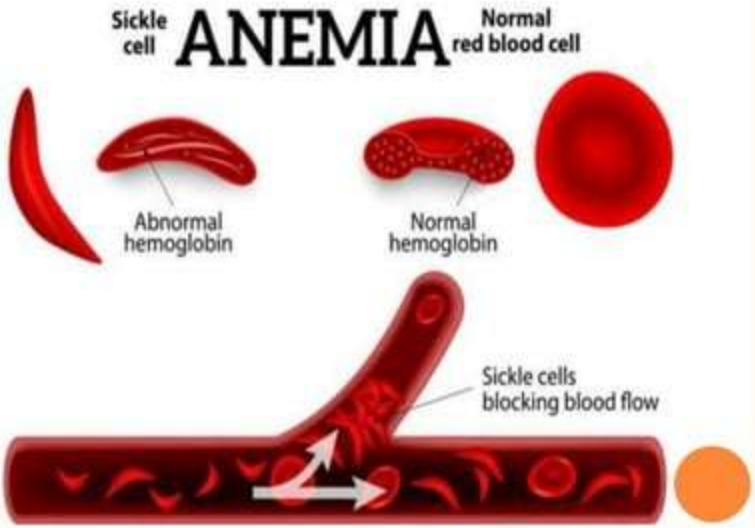
- It is necessary for formation of hemoglobin, brain development, regulation of body temperature.
- The important function of iron is oxygen transport and cell respiration
- Deficiency of iron causes anemia

What is Anemia?

Anemia is a condition where the body does not have enough red blood cells to carry enough oxygen to various tissues and organs.Women are more prone to anemia especially during pregnancy or if they have heavy periods.

Symptoms:

- Fatigue
- Weakness
- Pale skin
- Cold hands and feet.
- Irregular heartbeats
- Shortness of breath
- Dizziness
- Chest pains



6. ZINC

- It is the main component of many enzyme.
- It is required for synthesis of insulin in pancreas.
- Deficiency: Its deficiency causes retarded growth and skin disorders.

7. FLUORINE

- It is necessary for normal mineralization of bones and formation of dental enamel .
- Deficiency inadequate intake of fluorine is associated with the dental caries

VITAMINS

- Vitamins are the complex organic chemical substances, which are essential for normal growth and development of the body.

- They do not supply energy like fat and carbohydrate but they act as protective to the body against inhaled infection or disease.

- Classification of Vitamins

They are classified into two major classes

a. Fat soluble vitamin: Ex. vitamin A D E and K
b. Water soluble vitamin: Ex. vitamin B complex vitamin C

FAT SOLUBLE VITAMIN

1. VITAMIN A

- It is fat soluble vitamin and commonly known as Retinol.
- It is essential for integrating the epithelial cells throughout the body.
- It is essential for new cell growth & visional purpose.
- It is anti infective and growth promoting vitamin
- Daily requirement for an adult is 5,000 units and for a growing children or pregnancy is varies from 6000 to 8000 Unit.

- Sources of Vitamin A

a. Animal source: example cod liver oil, butter ,Shark liver oil, ghee, Eggs.

b. Vegetable source: carrot, cabbage, mango.

- Deficiency :
- It causes night blindness it leads to retarded growth and resistance to the bacterial infection.
- It also causes anorexia (Lack of sleep) & Xeropthalmia (whiteness of eyes), dryness of skin, respiratory infections like common cold.

2. VITAMIN D

- It is essential for the calcification of bones and teeth, there are two Pro vitamins of vitamin D known Ergosterol & 7-D-hydrocholesterol which are converted into vitamin D2 (Ergocalciferol) and Vitamin D3 (cholecalciferol) respectively.
- This vitamin D present in UV sunlight

Sources of vitamin D

- Vegetables source: green vegetables Cauliflowers, cabbage, carrot.
- Animal sources: egg yolk, cod liver oil, Ghee

Deficiency

- The deficiency of Vitamin D3 causes rickets and also causes dental caries.
- It also causes osteomalacia generally found in pregnant and lactating mother.

3. Vitamin E

- Vitamin E is also known as tocopherol, which is stable to heat and light but it destroyed on oxidation.

Sources of Vitamin E:

beet, cereals and some vegetable oil

Deficiency: It causes anemia and neuromuscular disease in children.

4. VITAMIN K

- **Is called Phytonadione.** It is fat-soluble vitamin, which is stable to heat it is essential for formation of prothrombin and other blood clotting factors.
- It is available in two form that is vitamin K1 and K2 vitamin. K 1naturally available in green vegetable and Vitamin K2 is available in fish milk

Sources of vitamin K:

- It is present in Green Leaves that is Spanish cauliflower, carrot

Deficiency

- Its deficiency leads to decrease in prothrombin formation and it causes prolongation of blood clotting that's why weakness, anemia occurs due to excessive blood loss.

WATER SOLUBLE VITAMINS

1. VITAMIN B1

- It is known as thiamine.
- It is soluble in water and alcohol but in soluble in fat.
- It is essential for normal growth and development of body.
- Daily requirement is 2 milligram


Beri-beri

Sources: rice, pulses, nuts, cereals, fish, milk.

Deficiency:

Beri-beri, loss of appetite

2. VITAMIN B2

- It is known as riboflavin which is yellow pigment
- It is required for protein fats and carbohydrate metabolism.
- Daily requirement is 2 to 3 mg.

Sources

- Milk, East, eggs, liver, green vegetable beet

Deficiency

It leads to pellagra, diarrhoea, dermatitis, dementia.

3. VITAMIN B3

- It is called as nicotinic acid.
- It act as coenzyme for fat protein and carbohydrate metabolism.
- Daily requirement is 12 to 18 milligram

Source Grains, cereals, meet, yeast, liver, green vegetables

Deficiency it leads to weakness, mental depression

5. VITAMIN B5

- It is also called as pantothenic acid.
- It is important in biosynthesis of corticosteroid.

Sources: chicken, milk, fish, egg yolk, yeast, mushrooms, sweet potato and all grains.

Deficiency: headache, fatigue, irritability, gastro-intestinal problems.

4. Vitamin B6

- It is known as pyridoxine.
- It is exist in 3 form pyridoxine, pyridoxal, pyridoxy amine.
- It is essential for metabolism of amino acid, fats and carbohydrates.
- Daily requirement is 2 milligram

Sources

- It is present in liver of fish, eggs, meat, wheat cereals and leafy vegetables.

Deficiency

- It deficiency leads to epilepsy.

6.VITAMIN B9

- It is important for synthesis of nucleic acid and also need for normal development of blood cells.

Sources:

Eggs, leafy green vegetables, beet, citrus fruits.

Deficiency leads to anemia, diarrhea, dysentery, gastrointestinal disturbances.

7. VITAMIN B12

- It is known as Cynocobalamine due to the presence of cobalt.
- It is red crystalline and amorphous powder soluble in water.
- It is essential for Carbohydrate, protein, fat metabolism and RBC's formation.

Sources

It is found in animal source only, vegetable force does not contain Vitamin B12.

Ex. liver, eggs, meat, milk

Deficiency

Generally it is noticed that those patients who are strictly vegetarian leads to anemia, disturbance in DNA synthesis, and disturbance in carbohydrate fat and protein metabolism.

8. VITAMIN C

- It is also known as ascorbic acid.
- It is water soluble vitamin which destroyed by exposure to air and heat.
- Daily requirement is 13 to 16 milligram

Functions

It is essential for maintenance of cellular structure. It is essential for formation of RBC's. It increases resistance of body to fight against infection.

Sources

Main source of vitamin C are fresh fruits and vegetables like lemon, Orange, Cabbage, Cauliflower cereals. Amla is rich source of vitamin C.

Animal sources meet, milk, fish, eggs

Deficiency leads to anemia, dental caries, loss of weight, delay in wound healing, bones become brittle.

Vitamin	*Diseases and their symptoms*	*Available from*
A (Retinol)	poor vision, night-blindness	spinach, carrots, butter, mangoes
B_1 (Thiamine)	extreme weakness, beri-beri	eggs, meat, yeast
B_2 (Riboflavin)	retarded growth, bad skin	green leafy vegetables, beans, peas, milk
B_{12} (Cyanocobalamin)	anaemia	non-vegetarian food like meat
C (Ascorbic acid)	scurvy, swollen gums, loose teeth	lime, lemon, oranges
D (Calciferol)	rickets, brittle bones in children which break or bend easily	milk, fish, liver oil
K (Phylloquinone)	excessive bleeding due to injury	green leafy vegetables

Diseases Caused due to Deficiency of Minerals

Name of minerals	*Diseases and their symptoms*	*Available from*
Calcium	brittle bones, excessive bleeding, bad muscular movement	milk, green leafy vegetables
Phosphorus	bad teeth and bones	pulses, cereals, milk
Iron	anaemia, lack of red blood cells	green vegetables, pulses, meat
Iodine	goitre, enlarged thyroid gland	fish, salt from sea water
Copper	low appetite, retarded growth	pulses and leafy vegetables

IMPORTANCE OF WATER AND FIBRES IN DIET

WATER

- Water forms the major components of body mass. Human body can survive only a few days without water. Lack of water increases blood pressure, malfunctions heart and also results in failure of kidney.

- Whole body contain about two third of water to its total weight, out of which blood contain 79%, brain 80% and bone about 10% of water hence water is integral part of body.

Importance of water in diet

- It helps in the transport of nutrients, oxygen and waste product in and out of cells.
- It is required for all digestive, absorption, circulatory and excretory function.
- It is required for utilizing the water soluble vitamin.
- It is required for maintaining proper body temperature.
- It helps in eliminating the byproducts of body metabolism excess electrolyte and urea.
- It regulate the body temperature through sweating.
- It moisten mucous membrane of lungs and mouth.
- It lubricates and cushions the joint.
- It helps in digestion and prevent of constipation.
- It moisture is the skin and maintaining its texture and appearance.
- It helps to create saliva.

Dietary Fibr

The carbohydrates (E.g, pectin, cellulose, hemicellulose) and some non carbohydrates substances (e.g. lignin) are collectively called as dietary fibre. Fibre is found in vegetables, fruits and grains.

- Recommended intake for dietary fibre is 25 grams per day for Adult female & 38 grams per day for adult males.
- During pregnancy or breastfeeding women should aim for at least 28 grams per day.

Sources of Fibers:

- Soluble fibres are soybean, beans, oats, cereals, Chia avocados, ripe bananas, skin of Apple.
- vegetable such as broccoli, carrot, sweet potatoes, onions, nuts etc.
- Insoluble fibres are whole grain foods, wheat and corn, beans, peas, nuts and potato skin.
- vegetable set as green beans, cauliflower, kiwi fruits, grapes, tomatoes.

Importance of fibres in diet

1. It provides some nutrients called Roughage.
2. It helps in intestinal peristalsis movement. Fibres helps in keeping bowels working regularly and the large intestine healthy.
3. It increases the weight and size of stool and soften it. Bulky stool can easily passes & decreases the chances of constipation.
4. High fibre diet and reduces the risk of developing hemorrhoids small pouches in colon and colorectal cancer.
5. Soluble fibres reduces total blood cholesterol level by reducing low density lipoprotein or bad cholesterol level.
6. High fibre food also reduces blood pressure and inflammation.
7. In Diabetic patients soluble fibre shows the absorption of sugar that helps in maintaining blood sugar level. the risk of type 2 diabetes can also be reduced by including in soluble fibre in diet.
8. Increase in dietary fibre intake reduces the risk of death that may occurs due to cardiovascular disease and all cancers

BALANCED DIET

- A diet which includes a variety of foods in adequate amounts and in correct proportions to supply all essential nutrients which promote and preserve good health.

- A balanced diet includes both sufficient and nutritious food to ensure good health.

- A normal balanced diet contains sufficient amount of fiber and the other nutrients provide the appropriate amount of energy and adequate amounts of water.

- A balanced diet should provide around 50-60% of total calories from carbohydrates, about 10-15% from proteins and 20-30% from fat.

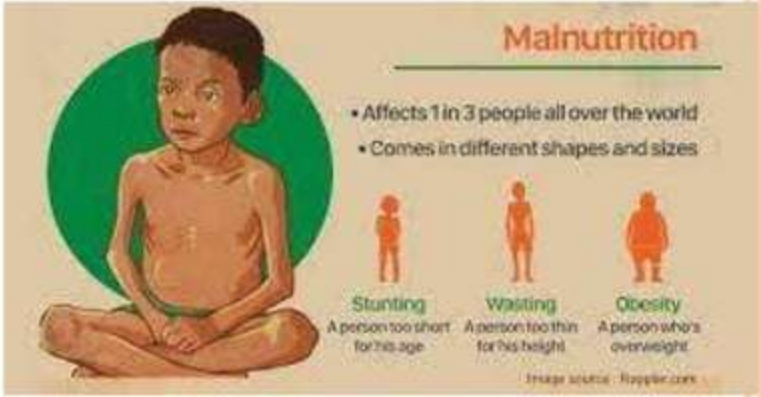
Benefits of Balanced Diet

- It increases energy improve the body functioning boost the immunity system and prevents weight gain
- It meet the nutritional need to avoid nutritional deficiency
- It prevent the risk of developing certain disease like diabetes, cancer, heart disease.
- It helps in treating the diabetes and high blood pressure
- It makes an Individual energetic & helps to fight stress

Dietary goals:

- Dietary fat should be limited to approximately 20-30 % total daily intake
- Excess consumption of carbohydrate should be avoided
- fat should be restricted
- Salt intake not more than 5 grams per day
- Reduce junk food

Malnutrition



As per WHO Malnutrition refer
to deficiency, excess or imbalance
in a person's intake of energy and nutrients.

The term malnutrition covers to broad group of conditions one is under nutrition which includes stunting (low height for age), wasting (low weight for height) underweight (low weight for age) and micronutrient deficiency and second is overweight, obesity and diet related non communicable diseases.

Nutrition deficiency diseases

- A nutritional deficiency occurs when the body does not absorb or get from food the necessary amount of nutrients.

Causes of nutrient deficiency diseases:

- Nutritional intake
- Chronic health conditions
- Acute health conditions
- Medication and
- Impact the level of both macronutrients and micronutrients in the body

Name of minerals	Deficiency Disorder
Potassium	Hypokalemia, Vomiting Diarrhoea
Calcium	Osteoporosis (brittle Bones)
Sodium	Hyponatremia
Iodine	Gioter, hypothyroidism, retarded physical development and mental function
Iron	Anemia
Zinc	Retarded growth and skin disorders.
Fluorins	Dental caries

Vitamin	Name of Vitamin	Deficiency Disorder
Vit. A	Retinol	Night Blindness , Xeropthalmia, Anorexia
Vit. D	Ergocalciferol, Cholecalciferol	Rickets, Dental Caries, Osteomalacia
Vit. E	Tocopherol,	Anaemia and Neuromuscular Disease
Vit. K	Phytonadione	Anemia
Vit. B1	Thiamine	Beri-beri, Loss of Appetite
Vit. B2	Riboflavin	Pellagra, Diarrhoea, Dermatitis, Dementia
Vit. B3	Nicotinic Acid.	Weakness, Mental Depression

Vitamin	Name of Vitamin	Deficiency Disorder
Vit. B5	Pantothenic Acid.	Headache, Fatigue, Irritability, Gastro-intestinal Problems.
Vit. B6	Pyridoxine	Epilepsy.
Vit. B12	Cynocobalamine	Anemia, Disturbance in DNA
Vit. C	Ascorbic Acid.	Dental Caries, Loss of Weight, Delay in Wound Healing, Brittle Bones

JUNK FOOD

- Junk food are food item with very small or no nutritional value (example cold drinks, burgers oily food, Bakery product, candies & pizza). They are rich in fat, salt and calories.

- Nutritional intake of the body reduces with increased consumption of junk food and this eventually leads to deficiency of essential nutrients thereby causing health related problems.

Ill effect of junk food

1. Constipation- most fast foods don't contain high dietary fiber contents, which result in constipation.

2. Heart Disease and Stroke- junk food has poor nutritional values, is high in salt, and has saturated fat which can elevate cholesterol and increased blood pressure. And these two factors are two significant causes of heart diseases and strokes.

3. Blood Sugar Spike- One of the most noticeable negative side effects of fast food is increasing blood sugar levels in the body. White flour has sugar amounts due to which there's an increase in insulin in the body that also may lead to obesity.

4. Dental Problems- The sugar and carbohydrates in fast food produce acids that can damage tooth enamel which can bring poor dental hygiene. Moreover, the added salt and sugar in fast food sticks to the teeth which may lead to tooth decay and cavities

5. May Cause Skin Issues- Junk food has carbohydrates and fats which can trigger acne and other usual skin problems.

6. High Blood Pressure- Fast food is generally heavy in sodium which can elevate blood pressure or aggravate existing heart problems, including congestive heart failure.

7. Bloating and Puffiness-Some packed and fast foods are high in sodium. Moreover, sometimes additional sodium is also added as flavoring or preservatives. And too much sodium can make it problematic for your body to retain water, and it will make your stomach feel bloated or swollen.

8. Increase in Anxiety- One of the other harmful effects of junk food is that its lack of omega-3 fatty acids which can cause stress & unstable mental states.

9. Risk of Obesity- One of the worst effects of eating junk food is obesity. Fast food is filled with cholesterol and has high-calorie content, so it can make your belly heavy.

10. Hiked Cholesterol Levels- Many of the junk food we eat is made of animal-based products or is deep-fried. And it makes the food high in fat content. Due to fat, cholesterol levels may increase and lower your HDL, the good cholesterol.

CALORIFIC AND NUTRITIVE VALUE OF VARIOUS FOOD

- Calorific value/ Energy value of food indicates how much energy the human body can gain through metabolism.
- The energy value of foodstuffs, expressed in calories (cal) or kilocalories (kcal) per 100 g/100ml.

1 g fat	37 kJ (9 kcal)
1 g carbohydrates	17 kJ (4 kcal)
1 g protein	17 kJ (4 kcal)
1 g alcohol (ethanol)	29 kJ (7 kcal)
1 g polyhydric alcohols (polyols)	10 kJ (2.4 kcal)
1 g dietary fibre	8 kJ (2 kcal)

- Nutritional value or nutritive value as part of food quality is the measure of a well-balanced ratio of the essential nutrients carbohydrates, fat, protein, minerals, and vitamins in items of food or diet concerning the nutrient requirements of their consumer.

Table 3.5: Nutritive Value of Cereals per 100gm

Nutrients	Raw Rice/Millet	Wheat (Whole)	Maize (Dry)
Protein (gm)	6.8	11.81	11.1
Fat (gm) olk	0.5	1.5	3.6
Carbohydrates (gm)	78.2	71.2	66.2
Thiamine (mg)	0.06	0.45	0.42
Niacin (mg)	1.9	5.0	1.8
Riboflavin (mg)	0.06	0.17	0.1
Minerals (gm)	0.6	1.5	1.5
Energy (kcal)	345	346	342

Table 3.7: Nutritive Value of Different Green Leafy Vegetables per 100gm

Vitamins and Minerals	Palak	Cholai	Maithee	Bathua	Dhania	Saag
Vitamin A	5,600	5,500	2,300	1,740	6,918	1,300
Vitamin B	800	1500	1150	750	850	900
Vitamin C	30	100	50	35	135	50
Iron	10	25	17	42	18	20
Calcium	70	390	400	150	184	400

fruits is recom...

Table 3.8: Nutritive Value of Some Common Fruits (per 100gm of Edible Portion)

Names	Calories	Calcium (mg)	Iron	Carotene	Vitamin C (mg)
Fresh Fruits:					
Banana	104	10	0.5	124	7
Grapes	71	20	1.5	0	1
Guava	51	10	0.27	0	212
Mango	74	14	1.3	2,210	16
Orange	48	26	0.32	2,240	68
Papaya	32	17	0.5	2,740	57
Sitaphal	104	17	4.31	0	37
Amla	58	50	1.2	9	600
Dry Fruits:					
Dates	317	120	7.3	44	3
Raisins	308	87	7.7	2.4	1
Almonds	655	230	5.09	0	0
Cashew nut	596	50	5.81	0	0
Ground nut	567	90	2.5	37	0

Table 3.9: Composition of Meat, Fish and Eggs (gm/100gm)

	Protein	Fat	Minerals
Meat (goat)	21.4	3.6	1.1
Fish	19.5	2.4	1.5
Egg (hen's)	13.3	13.3	1.0

Table 3.11: Nutritive Value of Milks Compared (Value per 100gm)

	Buffalo	Cow	Goat	Human
Fat (gm)	6.5	4.1	4.5	3.4
Protein (gm)	4.3	3.2	3.3	1.1
Lactose (gm)	5.1	4.4	4.6	7.4
Calcium (mg)	210	120	170	28
Iron (mg)	0.2	0.2	0.3	-
Vitamin C (mg)	1	2	1	3
Minerals (gm)	0.8	0.8	0.8	0.1
Water (gm)	81.0	87	86.8	88
Energy (kcal)	117	67	72	65

FORTIFICATION OF FOOD

Food fortification is defined as the practice of adding vitamins and minerals to commonly consumed foods during processing to increase their nutritional value.

It is proven, safe and cost-effective strategy for improving diets and for the prevention and control of micronutrient deficiencies.

Ex. Milk is fortified with vitamin D

Fruit juices is fortified with Calcium

Types of fortification

1. Large scale food fortification
2. Biofortification
3. Home fortification/ point-of-use Fortification

TYPES OF FORTIFICATION

1. Large scale food fortification

- Industrial for large-scale fortification involvement addition of micronutrients at the time of processing to commonly consume food. (salts, oil, sugar, condiments)
- Edible oil are commonly used vehicle for fortification.

2. Biofortification

- The process through which food crops can be grown to improve their nutritional value is term as biofortification.
- Generally it focuses on boosting Iron, zinc and Pro- Vitamin A in different food crops through plant breeding or Agronomically

(adding mineral fertilizers).

- Ex. Iron biofortification of rice, beans, Maize and sweet potato
- Zinc biofortification of wheat, rice, beans, sweet potato and corn

3. Home fortification/ point-of-use Fortification

- Point of use fortification is the addition of vitamins and minerals to food that has been cooked and is ready to be eaten.

Benefits of food Fortification

1. This is an excellent method to improve the health of a large section of the population.
2. Fortification is a safe method of improving nutrition among people. The addition of micronutrients to food does not pose a health risk to people. The quantity added is so small and so well regulated as per prescribed standards.
3. It does not require any changes in food habits and patterns of people. It is a socio-culturally acceptable way to deliver nutrients to people.
4. It does not alter the characteristics of the food—the taste, the feel, the look.
5. It can be implemented quickly as well as show results in improvement of health in a relatively short period of time.
6. This method is cost-effective.

INTRODUCTION TO FOOD SAFETY

- Food safety is defined as keeping food safe to eat at every stage of (purchasing, receiving, storage, preparing, cooking, hand holding, pulling, reheating and serving) handling as it passes through the flow of food from farm to table.

- In practice food hygiene and food safety both terms may be used interchangeably.

- Proper and safe handling of food is essential to prevent food borne diseases.

Tips for safe food handling

1. Knives and sharp equipment should be handled with care.
2. Knives should be washed and dried after used to prevent rusting and cross contamination.
3. Knife should be store in a knife Rack and the ages should be kept away from the hard objects to prevent the blades from getting blunt.
4. Crack or chipped plates should not be used.
5. Children should not be allowed around the food preparation area.
6. Food should not be left uncovered for a longer period
7. Food which is not to be used immediately should be store in a refrigerator.
8. Food worker should not cough speed smoke and sneeze near food.
9. Food worker should not touch their nose teeth here and here while handling food.
10. Handling for shaking a dirty handkerchief near food should be avoided.

11. Those working in a kitchen should have clean hands to prevent the spread of microorganisms.
12. Food workers should frequently wash their hands a soap dispenser should be used instead of soap bar.
13. A dish cloth should not be used for wiping perspiration for hands.
14. Hands should not be dried with a paper towel.
15. Hands should not be wash in sinks used for food preparation.
16. Gloves should be used to protect damage skin.
17. Clean and washable protective clothing should be worn while cooking.
18. Food workers should maintain personal hygiene while receiving, storing, cooking, processing, packagin,g transporting or distributing the food.

Food Adulteration

- Adulterant means any poor quality material or substance which make the food unsafe or sub-standard quality.

- Food Adulteration is the practice of adulterating food or contaminating food material adding adulterants.

- Addition of adulterant reduces the nutritive value of food and also contaminate them, leaving them in appropriate for consumption.

- Adulteration is either incidental or unintentionally

Ex. Milk can be diluted by adding water to increase its quantity and starch powder is added to increase its solid content.

Reasons for food product adulteration

1. It is done as a part of business strategy.
2. It is done to increase the quality & quantity of food production and sale.
3. It is done due to make maximum profit from food item by fewer investment.
4. It is done to form an imitation of other food substance.
5. It is done due to increase food demand for rapidly growing population.
6. It is done due to lack of knowledge on proper food consumption

Table 3.15: Common Adulterants Added to the Food Products

Food Products	Adulterant	Harmful Effects
Milk and Curd	Water and starch powder.	Stomach disorders.
Ghee, Cheese and Butter	Mashed potatoes, vanaspati and starch powder.	Gastrointestinal disturbances and other stomach disorders.
Grains	Dust, pebbles, stones, straw, weed seeds, damaged grain, etc.	Liver disorders, toxicity in the body, etc.
Pulses	Dyes, chemical and lead chromate.	Stomach disorders.
Coffee Powder	Chicory, tamarind seeds powder.	Diarrhoea.
Tea	Artificial colouring agents.	
Sugar	Chalk powder, washing soda, urea, etc.	Stomach disorders and kidney failure.
Pepper	Dried papaya seeds and blackberries.	Severe allergic reactions including stomach and skin irritations.
Mustard Seeds	Argemone seeds.	Abdominal contractions, sluggishness and increased excretion.
Edible Oils	Mineral oil, Karanja oil, castor oil, and artificial colours.	Gallbladder cancer, allergies, paralysis, cardiac arrest, and increased LDL cholesterol.
Turmeric Powder	Pesticide residues, sawdust, chalk dust, industrial dyes, metanil yellow dye arsenic, lead metal, etc.	Cancer and stomach disorders.
Chilli and Coriander Powder	Redbrick powder, rhodamine B dye, red lead, dung powder, soluble salts, water-soluble synthetic colours and other common salts.	Metal toxicity, cancer, lead poisoning, tumour, variations in blood pressure and other stomach related disorders.
Cinnamon Sticks	Cassia bark.	Liver damage, low blood sugar, mouth sores and increased risk of cancer.
Cumin Seeds	Coloured grass seeds, sawdust and charcoal dust.	Stomach disorders.

Prevention of adulteration

World Health Day is celebrated globally every year on 7th April, WHO aims to make everyone aware of the adulteration of food products and motivate them to have a healthy balanced diet.

Adulteration can be prevented as follow

1. Consumption of dark colour, junk and other processed food should be avoided.
2. All the grains pulses and other food products should be cleaned and stored.
3. Before buying food product like milk, oil and other pouches the seal should be checked for validity.
4. Product having FSSAI validated label along with the license number, list of ingredients manufacturing date, its expiry date should be checked.

ARTIFICIAL RIPENING

- In nature fruits Ripen after attainment of proper maturity.

Natural changes associated with ripening are softening of the fruit, changes in colour and development of characteristic like aroma and flavour.

There is also a reduction in soreness and increase in sweetness of the fruit. Usually fruit produces ethylene gas as a plant hormone naturally which ripens the fruits.

- Instead of waiting for the natural process for ripening when artificial substances are used to accelerate the ripening of fruit the process is called as artificial ripening

- Artificial ripening agents are used to increase the speed of ripening.

- Fruits are placed in wooden crates cover with hay, which are then placed one over the other and wood fire is Lit below them. The smoke produced contain ethylene which causes ripening. Many fruits can be ripen by placing them in plastic cage.

- Ex. Banana are transported when they are hard and green, to avoid damage at the time of shipping and transportation, once they reach the destination they are exposed to ethylene gas for ripening.

- Effect of artificial ripening

1. Ethylene glycol: Diethylene glycol triethylene glycol methyl all and aldehydic oxidation products are the major impurities of Ethylene glycol. Diethylene glycol is a highly toxic organic solvent that leads to acute renal failure and can causes death when ingested

2. Ethephon:

It is mainly used as an insecticide, fruits and vegetable takes lesser time to ripen in the presence of Ethephon.

It leads to burn injury and fatal systematic poisoning on skin exposure.

3. Calcium carbide: It can also affect the neurological system by inducing prolonged hypoxia. It causes symptoms like headache, dizziness, high sleepiness, memory loss, cerebral oedema, numbness in the legs and hand, general weakness cold and damp skin, low blood pressure and seizure.

4. Arsenic and phosphorus poisoning include vomiting, diarrhoea, weakness, burning sensation in the chest and abdomen, thirst, problem in swallowing ,burning of eyes, permanent eye damage, ulcer on the skin, mucus, nose and throat.

PESTICIDE

Pesticide is defined as any substance use for preventing, destroying and controlling the pest, includes unwanted species of plant, insects, rodents bacteria, fungi etc.

Ex. Insecticide
Herbicide
Rodenticide
Bactericide
Fungicide
Larvicide

Benefits of pesticides

1. Major advantage of pesticides is that they can save farmer by protecting the crops from insect and other pests.
2. They control pest and plant disease vector.
3. In agriculture, use of pesticides will help to improve the productivity.
4. Use of insecticide will help to control the vector borne diseases such as malaria.
5. Herbicides and insecticides are used to maintain the turf on sports pitches, cricket ground and golf course. Insecticide protect buildings and other wooden structure from damage by termites and wood boring insect.

Hazards of pesticides

1. The toxic chemical present in pesticides are purposely released in the environment, each pesticide is intended to kill a certain pest still a large number of pesticides do not reach their target and eventually enter in the air, water, even food and contaminate them.
2. Use of pesticides shows direct impact on human health it shows short-term effects like headache and nausea and chronic effect like a cancer and harm to human reproductive health.
3. Use of pesticides reduces the general Biodiversity in the soil, if there are no chemicals in the soil, this soil quality is higher and allows higher water retention which is necessary for plant to grow.
4. It shows soil contamination.
5. In addition to killing insect or weeds pesticides can also be toxic to other organisms including bird, fish, beneficial insect and non-target plants.
6. Pesticide shows surface water and groundwater contamination .
7. Heavy treatment of pesticides on soil can causes decreased in population of beneficial soil microorganisms.

GENETICALLY MODIFIED FOOD

Genetically modified foods are those food which are derived from organisms whose genetic material has been modified by using modern biotechnology, gene Technology, Recombinant DNA technology and genetic engineering.

Foods manufactured via. genetically modified organisms are termed as genetically modified food

Ex. Corn, Soya, Cotton

Advantages of GMF

1. Genetically modified food have been developed for improving yield or productivity.
2. They prevent the crops from plant disease or increase the tolerance of herbicides.
3. Genetically modified food have more resistant to insect and other pest.
4. Under poor weather condition there will be good quality and sufficient crop yield is obtained. It helps farmers with producing greater amount of crops or foods.
5. It help with reducing Greenhouse gas, emission, soil erosion and environmental pollution, this means the General Health and beauty of the environment will be improved
6. Genetically modified food is more nutritious in terms of Vitamin and mineral content. It helps with reducing deficiency of such nutrient around the world.

8. It has been proven that genetically modified crops do not need pesticides to become stronger against various type of insect pest that destroy them

9. With genetic engineering farmer will have more income which they can spend on fulfilling basic needs.

10. It help to decrease in global warming.

11. Due to higher yield and lower cost, food prices would go down. As people in poorer countries spend over half of their income on food alone, this means automatic reduction of poverty.

Disadvantages of genetically modified food

1. They might contribute to the rise in allergic reaction.
2. It can create more weeds.
3. It can damage the environment.
4. It can create new diseases.
5. It can be dangerous to other insect that are important to our ecosystem example butterfly.
6. Genetically modified food is having on natural test compared with ordinary food.
7. GMF is not totally safe to eat main causes disease even death.

DIETARY SUPPLEMENTS / FOOD SUPPLEMENTS-

- Dietary supplement is the product intended to supplement in the diet to enhance health.

- Dietary supplement are marketed as tablets, capsule, soft gels, powders and liquids.

Dietary suppliments:

1. Vitamins,
2. Minerals,
3. Fibers,
4. Proteins etc.

Benefits of dietary supplements

1. It helps to prevent the nutritional deficiency diseases.
2. It help to reduce the risk of chronic diseases like cancer heart diseases, osteoporosis or type 2 diabetes.
3. It help to improve the immune system.
4. It help to improve the overall health.
5. It improving the athletic performance.
6. It helps to enhance the personal appearance.

NEUTRACEUTICALS

In 1989 Stephen Defelice
discovered the term nutraceutical
from nutrition and Pharmaceutical.

Nutraceutical is defined as food or food ingredient that provide Medical and health benefit i.e. prevent the disease and promote the health.

Ex. Phenolic compound, fatty acid, minerals, carbohydrate derivatives, isoprenoids, cellulose, ascorbic acid etc

Classification of nutraceuticals

Depending upon various characteristic nutraceuticals are classified into following major classes:

1. Nutraceuticals according to their food source
2. Nutraceuticals according to their mechanism of action
3. Nutraceuticals according to their chemical nature
4. Nutraceuticals according to their higher content in specific food items

1. Nutraceuticals according to their food source

Table 3.20: Nutraceuticals Grouped by their Food Source

Sources	Examples of Nutraceuticals
Plants	Ascorbic acid, quercetin, capsaicinoids, lycopene, β-carotene, catechins, curcumin, ellegic acid, anthocyanates, cellulose, α-tocopherol, and pectin.
Animals	Conjugated Lenoleic Acid (CLA), EPA, DHA, choline, lecithene, ubiquinone, and sphingolipids.
Microbes	Yeast, *Lactobacilus acidophilus*, and *Streptococcus salvaricus*.

2. NUTRACEUTICALS ACCORDING TO THEIR MECHANISM OF ACTION

Table 3.21: Nutraceuticals Grouped by Mechanism of Action

Anticancer	Positive Influence on Blood Lipid Profile	Antioxidant Activity	Anti-Inflammatory	Osteogenetic or Bone Protective
Capsaicin	β-Glucan	i) CLA	i) Linolenic acid	i) CLA
Genestein	γ-Tocotrienol	ii) Ascorbic acid	ii) EPA	ii) Soy protein
Daidzein	δ-Tocotrienol	iii) β-Carotene	iii) DHA	iii) Genestein
α-Tocotrienol	MUFA	iv) Polyphenolics	iv) GLA (γ-Linolenic Acid)	iv) Daidzein
γ-Tocotrienol	Quercetin	v) Tocopherols		v) Calcium
CLA	ω-3 PUFAs	vi) Tocotrienols	v) Capsaicin	vi) Casein phosphopeptides
Lactobacillus acidophilus	Resveratrol	vii) Indole-3-carbonol	vi) Quercetin	vii) FOS (Fructooligosaccharides)
Sphingolipids	Tannins	viii) α-Tocopherol	vii) Curcumin	
Limonene	β-Sitosterol	ix) Ellagic acid		viii) Inulin
Diallyl sulphide	Saponins	x) Lycopene		
Ajoene	Guar	xi) Lutein		
α-Tocopherol	Pectin	xii) Glutathione		
Enterolactone		xiii) Hydroxytyrosol		
Glycyrrhizin		xiv) Lutcolin		
Equol		xv) Oleuropein		
Curcumin		xvi) Catechins		
Ellagic acid		xvii) Gingerol		
Lutein		xviii) Chlorogenic acid		
Carbosol		xix) Tannins		
L. bulgaricus				

3. NUTRACEUTICALS ACCORDING TO THEIR CHEMICAL NATURE

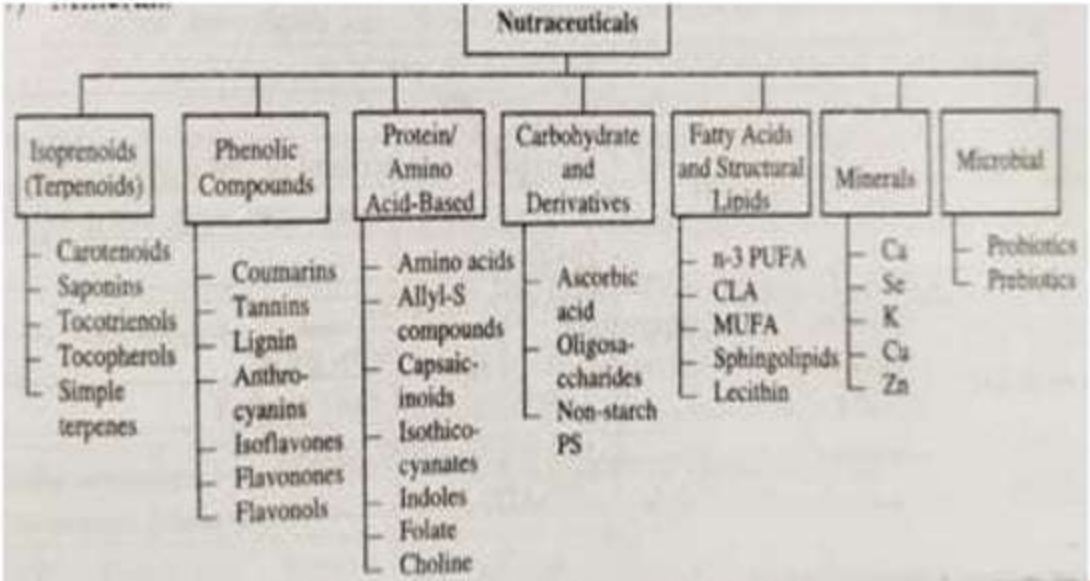


Figure 3.1: Organisational Scheme for Nutraceuticals

4. NUTRACEUTICALS ACCORDING TO THEIR HIGHER CONTENT IN SPECIFIC FOOD ITEMS

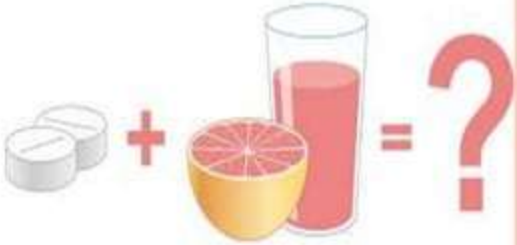
Table 3.22: Foods with Higher Content of Specific Nutraceutical Substances

Neutraceutical Substances/Families	Foods of Remarkably High Content
Allyl sulphur compounds	Onions, garlic
Isoflavones (e.g., Genestein, Daidzein)	Soybeans and other legumes, apios
Quercetin	Onion, red grapes, citrus fruit, broccoli. Italian yellow squash
Capsaicinoids	Pepper fruit
FPA and DHA	Fish oils
Lycopene	Tomatoes and tomato products
Isothiocyanates	Cruciferous vegetables
β-Glucan	Oat bran
CLA	Beef and dairy
Resveratrol	Grapes (skin), red wine
β-Carotene	Citrus fruit, carrots, squash, pumpkin
Carnosol	Rosemary
Catechins	Teas, berries
Adenosine	Garlic, onion
Indoles	Cabbage, broccoli, cauliflower, kale, Brussels sprouts
Curcumin	Turmeric
Ellagic Acid	Grapes, strawberries, raspberries, walnuts
Anthocyanates	Red wine
3-n-Butyl Phthalide	Celery
Cellulose	Most plants (component of cell walls)
Lutein, Zeaxanthin	Kale, collards, spinach, corn, eggs, citrus
Psyllium	Psyllium husk
Monounsaturated Fatty Acids	Tree nuts, olive oil
Inulin, Fructooligosaccharides (FOS)	Whole grains, onions, garlic
Lactobacilli, Bifidobacteria	Yogurt and other dairy product
Catechins	Tea, cocoa, apples, grapes
Lignans	Flax, rye

Benefits of Nutraceuticals:

1. Nutraceutical increases the health value of human diet.
2. They help people to live longer.
3. They help people to treat specific medical conditions.
4. They present food for population with special requirement.
5. They are not showing any side effect.

DRUG FOOD INTERACTION



- When food and drugs taken simultaneously it can alter the body's ability to utilized particular food or drug or causes serious side effect.
- A drug food interaction occurs when your food and medicine interfere with one another.
- When the body is unable to use a nutrient due to a drug that has been taken, then nutrient- drug interaction has occurred
- These interactions can happen with both prescription and over-the-counter medicine, herbal product, and dietary supplements.

Table 3.28: Some Common Food-Drug Interactions

Drugs	Food/Nutrient	Interactions
Allopurinol	1) Avoid low protein diet de 2) Avoid low fluid content	1) A low protein diet will result in higher blood levels of this drug. 2) The individual should drink plenty of fluids while taking this drug. ½
Antacids: Aluminium/Magnesium hydroxide/Simethicone 1) Aluminium carbonate basic 2) Aluminium hydroxide	Avoid high protein meals	High protein meals decrease the neutralising capacity of the antacid.
Calcium channel blockers: 1) Felodipine 2) Nifedipine	Avoid grapefruit juice	Drinking grapefruit juice with this drug will result in higher than desired blood levels of the drug. These higher

3) Amlodipine		levels may be harmful and cause adverse effects.
Carbamazepine	Avoid grapefruit juice	Drinking grapefruit juice with this drug will result in higher than desired blood levels of the drug. These higher levels may be harmful and cause adverse effects.
Cephalosporins: 1) Cefotetan 2) Cefoperazone 3) Cefamandole 4) Cefmetazole 5) Moxalactam	Avoid alcoholic beverages	Drinking alcohol with these drugs can develop disulfiram reaction characterised by flushing, vomiting, rapid breathing, and rapid heart rate.
Disulfiram	Avoid alcoholic beverages	Drinking alcohol with this drug can develop disulfiram reaction characterised by flushing, vomiting, rapid breathing and heart rate.
Iron: 1) Ferrous sulphate 2) Ferrous gluconate	1) Consume foods rich in Vitamin C 2) Avoid dairy products with iron	1) These food items enhance the amount of iron the body absorbs. 2) Taking this drug with food reduces the amount of iron the body absorbs.

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Thank You…….