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Food Additives: An Overview

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I. INTRODUCTION

After air and water, food is the third most important necessity of life. Air and water remain almost the same, but human food has evolved with human civilization. We find different types of food varieties in different areas. Vegetables, fruits, whole-grain products, meat, poultry, fish, meat and beans, all come under the category of food.

Food is any substance consumed i.e eaten, drunk or otherwise taken into the body to sustain life, consisting essentially of proteins, carbohydrates, fats, vitamins and minerals used in the body of an organism to sustain growth and vital processes and to furnish energy.

Food additives are substances or mixtures of substances other than basic foodstuff added intentionally or unintentionally to the food to improve its appearance, flavor, texture or storage properties. Food additives can be present in food as a result of some aspect of production, processing, storage or packaging.

Food Additives have been used for many years to preserve, flavor, blend, thicken and color foods and have played an important role in reducing serious nutritional deficiencies among consumers. These ingredients also help ensure the availability of flavorful, nutritious, safe, convenient colorful and affordable foods that meet consumer expectations year-round.

Food additives are of two types

1. Unintentional or Incidental

They become a part of food by entering through some ways of production, processing or packaging. They have no function in the finished food.

Example- Pesticide residue, plant growth regulators and components of processing and packaging machinery as lubricants.

2. Intentional Additives

They perform specific functions. They are added to food in carefully controlled amounts.

A. Unintentional or Incidental Food Additives

Following are some Unintentional or Incidental Food Additives

1. Fertilizers

Generally, an excessive amount of Nitrogen fertilizers are used. So, the Nitrate ions concentrate in leafy vegetables. These bioaccumulate in their consumers. Cattle that graze on it ,their meat or milk contains high nitrate content. Nitrate is not harmful, but it gets reduced to nitrite, which is toxic and causes Blue baby syndrome and stomach cancer. Nitrite reacts with hemoglobin curtailing its oxygen carrying capacity and in rare cases the disease proves fatal.

2. Insecticides

Organophosphates and carbamate insecticides are highly toxic. Organochlorines are less toxic but when they are present in the human diet, they elicit well-documented effects.

Example-They activate enzymes in the liver, which rapidly metabolize the drugs, so drugs are broken down more easily than desirable.

If pesticides prevail in the human body the breastfed babies imbibe excessive amounts of insecticide via the mother's milk.

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3. Fungicides

Ingestion of flour and wheat seeds treated with Organomercury fungicides lead to incidence of Mercury poisoning.

4. Herbicides

Dioxins cause chloracne, a skin infection. In some cases, it causes liver damage and psychological problems. It is a human teratogen and carcinogen, causing soft tissue sarcoma and non-Hodgkin's lymphomas. It disrupts the body's Hormonal, Reproductive and Immune systems.

II. INTENTIONAL FOOD ADDITIVES

There are many food additives which are intentionally added to the food for some or the other cause. Following are some important and commonly used additives:-

2.1 Preservatives

These are chemical agents which retard or hinder undesirable changes in the food. They interfere with the cell membranes, enzyme activities and the genetic mechanisms of food spoilage microorganisms

Example- Sodium benzoate in soft drinks, Calcium propionate in bread, salt in meat products, Sugar in jellies and sorbic acid in cheese. Fumigants like Ethyleneoxide are used to control microorganisms in spices and dried fruits. Sulfites are used in food processing to prevent enzymatic browning of fruits and vegetables.

2.2 Antioxidants

These are chemicals which inhibit the oxidation of fats, otherwise the fatty foods will become rancid. In that case potato chips, salted nuts and breakfast cereals would have no shelf life.

Example- BHA (Butylated hydroxyanisole), BHT(Butylated hydroxytoluene),Propyl gallate, and sulphite etc.

2.3 Sequestrants

Substances that tie up the metal ions that might otherwise promote the deterioration of food are called sequestrants or metal scavengers. Traces of metal ions such as iron and copper present in the processed food catalyze oxidation reaction producing rancid odors and flavors in the food product.

Example- EDTA (ethylenediamine tetra acetic acid), Citric acid, Adipic acid, etc.

2.4 Acidulants

These are mostly organic acids which affect a wide array of food properties. They are commonly added to fruit juices, squashes, jellies and cheese. They enhance the flavor, control pH, aid meat curing agents and control viscosity & hardness of food products.

Example- Acetic acid, Lactic acid, Succinic acid and Phosphoric acid.

2.5.Surface active substances

These include wetting agents, emulsifiers and lubricants.

Example- Lecithin Mono and Diglycerides added to Bakery goods enable the food to stay fresh for a longer time and have a better texture.

2.6 Stabilizers and Thickeners.

They stabilize and thicken the food product by combining with water to increase the viscosity and form gel.

Example- CMC (Carboxymethyl cellulose), Carrageenan, Amylose, Gelatin and Pectin.

They are used in gravies, pie-fillings, sausages, cake-toppings, chocolate, milk drinks etc.

2.7. Bleaching and Maturing Agents

They bleach the food product and increase their baking performances.

Example- In milled flour benzoyl peroxide is added as a bleaching and maturing agent. Bromates and iodates are used to bleach and improve baking performance of the bread.

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2.8 Natural supplements

These are naturally occurring substances, which are added to food products to enhance their food value.
Example- Vitamin A to Margarine, vitamin B, Iron and Calcium to cereal products, Vitamin C to fruit juices, Vitamin D to milk, Iodine to Salt, Amino acid Lysine to wheat flour.

2.9 Colorants

They are used to make food appetizing and attractive. Synthetic colors are used because they excel in coloring power, color uniformly, give desired hue and cost less.
Example- Indigo, Carmein, Erythrocin, Tartrazine and Allura red are used in Carbureted beverages, Candies, Gelatin, Desserts, Cakes and cookies etc.

2.10.Non-nutritive sweeteners

They are used in canned fruits, frozen desserts, and salad dressings.
Example- Saccharine, Cyclamates and Aspartame etc.

2.11 Flavors

They are commonly used in puddings, pastries, soft drinks and ice-creams.
Example-Vanillin gives Vanilla flavor, Ethyl butyrate is used for pineapple flavor, Methyl anthranilate gives grape flavor.

2.12. Flavor enhancer

These reagents do not have their own flavor but they intensify the flavors of other compounds present in food products.
Example Monosodium glutamate (MSG) is commonly used in baby foods.

Risks caused by some specific food additives

1. Sodium Nitrate and Nitrite

They are used as additives for stored meat products. Nitrite prevents botulism in cured and canned meat products, stabilizes meat color and flavor, inhibits the growth of bacterium *Clostridium botulinum*. From sodium nitrite N-nitrosamine is formed in food and body, which is toxic, carcinogenic and mutagenic in a wide range of experimental animals. It causes tumors in the stomach and liver and binds directly to DNA.

2. Diethyl Pyrocarbonate

It is antimicrobial when it is added to fruit juices, wine and beer. It prevents them from developing bacteria. These beverages contain some amount of amino acids and proteins which yield ammonia. When Diethyl pyrocarbonate reacts with ammonia in pH range 4 to 9, it forms Urethane (Ethyl carbonate), which is carcinogenic.

3. BHA and BHT

They are antioxidants. They inhibit the oxidation of food fat, especially unsaturated fat. In rats these antioxidants get absorbed with fat in the small intestine and then pass on to the liver while detoxifying these compounds the liver gets enlarged and its functions are altered. Higher levels of antioxidants slow down the rate of synthesis of DNA and RNA, which reduces the rate of cell division and growth. Adverse effects have not been observed in humans.

4. Phosphoric Acid

It is the only inorganic acid which is used in Cola type soft drinks and canned meat products. Excessive intake of phosphoric acid reduces the optimum Calcium Phosphorus ratio in the body and leads to Osteoporosis.

5. Brominated Vegetable Oils

They are used in soft drinks as emulsifying functional aids, so that the flavoring oils will not separate from the aqueous liquid mixture. The precipitate of materials observed in squashes does not appear in soft drinks, because they contain

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brominated vegetable oils, which give a clear appearance. Brominated fat does not metabolize easily. Children consuming large quantities of soft drinks have been shown to have high levels of bromine, a toxic substance in their tissues. W H O has discouraged the use of brominated vegetable oils.

6. Potassium bromate

It is a bleaching and maturing agent for flour. When bromate was fed to rats it increased the incidence of kidney tumor; some countries have banned its use

7. Saccharine

It is a Calorie free artificial sweetening agent. It is 300 times sweeter than sugar. It produces bladder cancer in rats. Infants and pregnant women are advised to avoid saccharine

8. Cyclamate

It is an artificial sweetener 30 times sweeter than sugar. It causes bladder cancer in rats. Certain countries have banned Cyclamate.

9. Monosodium glutamate (MSG)

It is a flavor enhancer. It imparts a fifth taste named UMANI. It is used in frozen non-vegetarian foods, dry soup mixes, cheese spreads etc. When injected in newborn mice, it causes injury to brain cells but no adverse effect in mature rats have been observed. In adults, in small numbers, Chinese restaurant syndrome occurs in which burning sensation at the back of neck, facial pressure, chest pain and headache are noticed.

10. Guar gum

It is a long chain carbohydrate, used to thicken and bind foods. It is widely used in the food industry and can be found in ice-cream, salad dressings, sauces and soups. It is high in fiber and has been associated with a multitude of health benefits. In some people it may have adverse effects because it can swell 10 to 20 times causing obstruction in the oesophagus or small intestine. Mild symptoms like gas bloating or cramps in some people are noticed.

11. Trans fats

They are a type of unsaturated fat that have undergone hydrogenation, which increases shelf- life and improves the consistency of the product. It is found in many types of processed foods like baked goods, Margarine, microwave popcorn and biscuits. It increases several markers of inflammation, a major risk factor for heart disease.

Uses of intentional food additives

1. They improve or maintain nutritional quality of food.
Example- Addition of Vitamin A and D to margareen.
2. They improve shelf life and curtail wastage.
Example addition of Calcium propionate to keep bread from becoming stale.
3. Make food more readily available throughout the year and throughout the country.
Example- Citric acid in fruit juices
4. Maintain food quality characteristics;
Example- Corn starch is added to sugar to prevent lumping.
5. Facilitate fast and convenient preparation of food.
Example- Phosphate additives in products like instant pudding;
6. Make food more appealing.
Example-By using artificial colors and flavors.

Intentional food additives should not be used if these :-

1. Deceive the customer by covering up the use of quality ingredients or faulty manufacturing properties;
2. Cause substantial reduction in foods' nutritional value.

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3.Produce an effect that could be obtained by otherwise manufacturing processes.
4. Are in excess to legally prescribed limit

III. CONCLUSION

Additives cannot be written off completely. No highly developed society can exist without food additives. These immediately become necessary when areas of food production are separated from centers of population concentration and the food must be transported under conditions that negate spoilage. The consumer's choice must be based on the analysis of risks versus benefits. Informed choice is an open source. It is an individual's right provided the individual is enlightened enough to exercise his right diligently. Certain food additives have been linked to some pretty scary side effects. There are plenty of others that can be safely consumed as part of a healthy diet. For the safety the consumers should start reading the ingredient labels while grocery shopping to take control of their diet and determine what is really being added to their favorite foods. Additionally, they should try cutting back on processed and packaged foods incorporating more fresh ingredients.

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