FOOD ADDITIVES: Friends or Foes?

When Marie Antoinette was told that the peasants had no bread to eat, she arrogantly urged them to eat cake. The starving peasants would undoubtedly have gladly availed themselves of the delicacy, whereas today even a hungry person might show some hesitation before consuming a modern cake.

Why? Because of concern that wheat seeds were possibly treated with a mercurial fungicide, the growing stalks with the insecticide “parathion”, and the harvested grain with a variety of fumigants, including sulphur dioxide. The flour may have been bleached with chlorine dioxide and conditioned with sodium stearoyl lactylate. The shortening used was likely preserved with butylated hydroxytoluene, the flavour enhanced with synthetic vanillin, and the decorations made more brilliant with synthetic food dyes. Indeed, apprehension about food today is not limited to cakes. There is a growing concern among the public that our food supply is not as safe as it could be and that we are being slowly poisoned by the “chemicals in our food”.

“You are what you eat”

There is no question that the old adage of “you are what you eat” rings true, at least to a certain extent. It is now well established that coronary heart disease, some types of cancer, certain allergies, adult onset diabetes, and perhaps a number of other illnesses have a nutritional component. Cutting down on fat and salt consumption while increasing the intake of fibre can undoubtedly reduce the risk of some of these diseases. There are, however, a number of other concerns about a diet-disease link which fall into a more nebulous category.

These concerns involve possible links between artificial sweeteners, preservatives, food dyes and cancer, between the consumption of certain food additives and hyperactivity in children, and between food additives and severe allergic reactions. While some adverse reactions exist, and have been well documented, the large scale condemnation of all food additives is not scientifically warranted.

“Natural foods”

The “natural food” movement of the 1980s has often equated food additives with “toxins” and “poisons” and has repeatedly urged people to avoid “chemicals”. The fact that the most poisonous substances in the world, such as the botulism toxin and a variety of animal venoms, are perfectly natural is conveniently dismissed. The implication is that synthetic materials are dangerous whereas natural substances are safe.

No mention is made of the carcinogen “safrole” in sassafras leaves, widely sold in health food stores, or the arsenic content of their highly prized kelp tablets. The notion that scientific and medical advances are characterized by overcoming nature is never referred to. Indeed, illnesses are “natural”, whereas their treatment with medications is not; walking is “natural”, whereas flying is not; food poisoning is “natural” but its prevention with preservatives is not.

Toxicity

The scientific fact is that toxicity is a very complicated business and has nothing to do with the natural vs synthetic dichotomy. First of all, there is the question of dose. A substance which is dangerous in high concentrations may be perfectly safe in small doses. For example, the naturally occurring toxin “solanine”, found in potatoes, is routinely consumed by people without ill effect. Yet, there have been cases of adverse effects in people who have consumed large quantities of improperly stored potatoes.

There may also be some substances which are not safe in any amount. In theory, a single molecule of a cancer causing substance, such as benzopyrene in smoke, can trigger a reaction which eventually results in the disease.

There are also substances that are only toxins as a result of cumulative effects. Certain compounds, such as the notorious dioxins, may build up in the body even though daily exposure is minimal. It is the accumulated total that may eventually cause the symptoms years later.

There is also the question of biochemical individuality. People do not react to most chemicals in a uniform fashion. While cyanide will kill anyone, relatively few people show an adverse reaction to the yellow food dye “tartrazine”, for example. Furthermore, the reaction that different chemicals produce in different people can range in severity from a mild rash or stuffiness to anaphylactic shock and death.

The human immune system does no distinguish between food additives and the natural ingredients in food in terms of safety or toxicity. It does seem reasonable that reducing exposure to different substances can result in a reduced likelihood of a dangerous reaction. The bottom line is that some chemicals cause reactions in some people some of the time, in some people all of the time, and in some people none of the time, irrespective of their source but depending upon the dosage.

A large body of evidence tells us that our bodies handle small chemical insults very well. Nature abounds with
substances which are dangerous in high doses but apparently irrelevant in small amounts. There are compounds in radishes, for instance, which, when isolated and fed to animals in large doses, are known to impair the activity of the thyroid gland. Myristicin, found in small amounts in carrots, can act as a hallucinogen. Tyramine, found in cheese, is very effective at elevating a person’s blood pressure. Yet, we know that the large majority of humans do not suffer from any such effects when they consume these foods - even to excess. Similarly, most people can safely consume most food additives.

**Safety**

However, there is no blanket statement that can be made about safety. Each additive must be considered individually and its safety judged on the basis of available scientific evidence along with the risk-to-benefit ratio. Some additives, such as the phosphates used to retain water in packaged turkeys, are superfluous and benefit only the manufacturer. Others, like artificial sweeteners, are important to some consumers (i.e. diabetics) and others, like the notorious nitrites, are essential in certain foods to prevent the formation of the deadly botulism toxin. There are a number of serious questions to be asked about the use of food additives. These, however, should be addressed in the proper perspective, with the realization that the scientifically conscious consumer today can avail himself of a food supply that is better and safer than it has been at any time in our history.

We have come a long way from the “good ol’ days” when chalk was added to watered down milk to make it look whiter, when compounds of arsenic were sprinkled on meat to retard spoilage, when copper salts were added to vegetable to make them appear greener, and when life expectancies were compromised by food and water born epidemics of cholera, typhoid, and dysentery. Even though these concerns have been put aside, we must realize that we do not live in a risk free world.

Safety is not absolute, it is only relative. The consumer’s desire for absolute safety is often based on scientifically naïve and emotional reactions. Nothing can be guaranteed to be perfectly safe for everyone under all conditions. Some people may have a sever reaction from inadvertently tasting or even just smelling a cookie made with peanuts while millions of children grow up happily consuming peanut butter sandwiches on a daily basis. The hydrazines naturally present in mushrooms or the allyl isothiocyanate in mustard or the alcohol in wine may represent a greater lifelong danger to some people than pesticide residues in their food or traces of chloroform in their tap water. Decisions about the safety of our food supply should be made based on the assessment of data gathered by the scientific method, with the realization that absolute safety is an unrealistic concept. The hazards of chemicals in our life can be evaluated only on a relative basis, after a careful judgement of the facts and a weighing of alternatives.

**PRESERVATIVES**

There is no question that contamination of food by microorganisms is the major cause of food related illness and death in the world. Millions of cases of diarrheal disease are caused by the rapid growth of Salmonella bacteria in the intestinal tract which are introduced by contaminated foods. There is extensive suffering from the ingestion of toxins produced by Staphylococcus bacteria in spoiled food and there are deaths from botulism poisoning.

Some effects of tainted foods are more insidious. Certain molds, such as those found on improperly stored peanuts, produce trace amounts of the carcinogenic aflatoxins. Fortunately, a number of physical and chemical processes are available to reduce the risk of food spoilage and contamination.

**Antimicrobial agents**

Certain chemicals can inhibit, although not kill, a variety of fungi, yeasts, molds, and bacteria. Sodium benzoate, for example, occurs naturally in cranberries and prunes and is effective in controlling the growth of yeast and bacteria. It is used extensively in beverages, jams, jellies, pickles, and margarine. Sodium or calcium propionate, on the other hand, is effective against molds and bacteria but not yeasts. Therefore, it is an ideal substance for the prevention of contamination in bread as the compounds does not interfere with the yeast used to generate leavened bread.

Undoubtedly, however, its presence alarms some people who do not like the idea of “chemical additives” in this important staple. This fear is unfounded, since propionates occur extensively in nature and are metabolized by the body like any other fatty acid. Swiss cheese, in fact, contains a much higher concentration of propionates than that found in any food in which it is a preservative.

Acetic acid, the active ingredient in vinegar, is also effective against yeasts, bacteria, and some molds. It is responsible for the preservative effect of the pickling process. Derivatives of sorbic and para-aminobenzoic acids (“sorbates” and “parabens”, respectively) are also used as preservatives in baked goods, beverages, juices, and flavour extracts. All of these antimicrobials are used at concentrations of less than 0.3% by weight and are not considered to pose any health hazard at all.
Antioxidants

Rancidity in fatty foods is the result of the breakdown of fats into odorous smaller molecules in the presence of oxygen. These compounds are not by themselves dangerous but may signal that the food has been around longer than it should be.

Unsaturated fats, due to the presence of the double bond, are especially prone to oxidation, forming a variety of organic acids. A number of additives are available to slow down this process. They work by intercepting the free radical species generated in the process. BHT (butylated hydroxytoluene), BHA (butylated hydroxyanisole), and propyl gallate are widely used in potato chips, vegetable oils, shortening, candy, and a variety of convenience foods at concentrations of less than 0.01%.

BHT is often added to cereal packaging where it migrates into the cereal, in order to “help maintain freshness”. Studies have attempted to determine whether or not there are any hazards associated with these antioxidants. Some researchers found that they cause cancer, others that they prevent the disease. In one study, rats lived the equivalent of twenty man-years longer when fed BHT. In another, the same chemical was judged to be responsible for the production of abnormally high levels of liver enzymes in laboratory animals.

In any case, antioxidants are not essential materials. They lengthen the shelf life of cereals from about four months to one year. This is not necessarily beneficial, since other degradative processes, that don’t proceed through oxidation, may occur and result in staleness or loss of flavour. The fact that even in identical products, not all manufacturers use these chemicals implies that they are dispensable. Furthermore, most products which are preserved with BHA and BHT can be criticized on other nutritional grounds, such as their high fat content, and should be minimized in the diet.

Sulfiting agents

The only food additives to have been conclusively linked with human death are the sulfiting agents. These chemicals, which include sulfur dioxide, potassium metabisulfite, sodium bisulfite, sodium metabisulfite, and sodium sulfate, are used for a variety of purposes by the food industry. In solution, they all give the bisulfite (HSO$_3^-$) ion, which is the active compound or species.

The inhibition of growth of yeasts, molds, and bacteria is one of the most important effects of these compound. Sulfur dioxide, for example, has been used since antiquity to control undesirable microorganisms encountered in wine making. Sulfites are used for a similar purpose in about 1100 prescription medicines in North America - which can result in severe problems for people susceptible to sulfites!

These compounds can also slow the discolouration of freshly cut fruits, vegetables, and shrimp, by interfering with the action of the enzymes that are responsible for the discolouration or “browning” reactions. Salad bars used to routinely spray vegetables with sulfites to prevent wilting but this practice is no longer allowed. Another reaction, known as “non-enzymatic browning”, is also inhibited by sulfites. This is of great importance in the dried fruit industry. Sulfites are also used as dough conditioners and bleaching agents. For example, Maraschino cherries are bleached “white” by sulfites before being dyed red.

There is no question that some people respond adversely to even minute amounts of sulfiting agents. The reaction can range from hives, wheezing, and itching, to death by respiratory failure. A 56 year old women died after eating raisin bread due to the fact that the raisins had been preserved with sulfites. The substance was not listed on the label since the raisin are considered a “secondary” ingredient. Another diner died in a restaurant after eating potatoes which had been treated with sulfites. A ten year old girl suffered the same fate after eating guacamole in a Mexican restaurant. Other deaths have been associated with the consumption of salads, beer, and wine.

All these victims, like most others who react severely to sulfites, were asthmatics. In some cases, the allergic response was intensified when the emergency technicians administered epinephrine or lidocaine - which are preserved with sulfites. Nowadays, alternatives to the sulfites are available in many cases. Citric and malic acids derived from fruits can reduce spoilage in salad bars. A new product, called “Snow Fresh”, is a mixture of sodium acid pyrophosphate, citric acid, ascorbic acid, and calcium chloride. The substance has no anti-microbial effect, but when dissolved in water, it effectively extends the colour, texture, and quality of processed fresh fruit and vegetables by inhibiting enzymatic browning.

It is estimated that 5-10% of asthmatics show serious sulfite sensitivity. In North America, this means that up to a million people are potentially at risk. Reactions can also occur in non-asthmatics. Statistically, about one quarter of recorded adverse reactions are seen in people with no prior history of asthma. In rare cases, a single high dose of sulfites can trigger life long asthma. There is also the possibility that sulfur dioxide may enhance the dangerous effects of certain carcinogens like benzopyrene. Governments have taken steps to control the use of sulfites. Their use on salad bars bas been outlawed and labelling requirements have been made more stringent.

Nitrites
One of the most deadly poisons known to mankind is the toxin produced by the Clostridium botulinum organism. It is seven million times more toxic than cobra venom and products its effects on the central nervous system by blocking the action of the neurotransmitter, acetylcholine. Symptoms can range from double vision and difficulty swallowing to paralysis and death. The spores of this organism lurk in many foods and under the right conditions (lack of oxygen and low acidity), they become active liberating their toxins. Sausages are the classic example of the type of food which can be affected, and the word “botulism”, in fact, derives from the Latin “botulus”, meaning sausage.

Nitrite additives are used to minimize the risk of botulism poisoning from sausages, hot dogs, cold cuts, and bacon. They are also responsible for imparting the characteristic flavour and pink colour to cured meats. But they are not without their opponents nor controversy.

The actual active ingredient is a metabolic product of nitrite, nitric oxide (NO). This compound reacts with the pigments, myoglobin and haemoglobin, in the blood to produce nitrosylmyoglobin and nitrosohaemoglobin. Nitrite can, however, also impair the oxygen carrying capacity of haemoglobin in the blood by converting it to inactive methaemoglobin.

Accidental poisonings from large doses of nitrite, far in excess of those used in processed foods, are well known. Such mishaps have involved the inadvertent filling of a salt shaker in a restaurant with sodium nitrite or consuming water with an extremely high nitrate content. The latter is a concern because bacteria in the human body can convert nitrate to nitrite. This is of special importance in areas where wells may be contaminated by fertilizer run-off. Infants are especially susceptible to nitrite poisoning, which is sometimes referred to as “blue-baby syndrome” due the cyanotic effect of haemoglobin loss.

The concern about the relatively small amounts of nitrites used as food additives began in the 1960s when it was noted that domestic animals fed fish meal preserved with nitrites were dying of liver failure. The problem was traced to a group of compounds called “nitrosamines”. These are formed by a chemical reaction between the naturally occurring amines in the fish and sodium nitrite.

Nitrosamines are potent cancer causing agents and their potential presence in human foods became an immediate worry. An examination of a wide variety of foods treated with nitrites revealed that nitrosamines could, indeed, form under certain conditions. Fried bacon, especially when “done to a crisp”, consistently showed the presence of these compounds. Nitrosopyrrolidine, a known carcinogen, is apparently produced when high temperatures cause proteins to break down to their component amino acids. One of these amino acids, proline, then degrades further to a compound called “pyrrolidine” before reacting with nitrite. The formation of nitrosamines in cooked cured meats can be reduced by the presence of Vitamin C or E, compounds which block the nitrosation reaction. Piling those tomatoes and that lettuce on the BLT sandwich makes more sense than ever - given that vegetables are rich in antioxidants. (Of course, it makes even more nutritional sense to skip the bacon entirely!)

Today, ascorbic acid (Vitamin C), or the very similar erythorbic acid, are routinely added by manufacturers to cured meats to lessen the risk of nitrosamine formation. These compound also enhance the preservative effects of nitrite by promoting the conversion of nitrite to the active nitric oxide. This allows for less nitrite to be used. In recent years, the nitrite levels in foods have been continuously reduced to the point where most foods now contain less than 100 parts per million or 100 milligrams per kilogram of food.

**MONOSODIUM GLUTAMATE (MSG)**

The flavour enhancer, monosodium glutamate or MSG, may be the most maligned of all food additives. Most people assume that MSG is one of those questionable substances unleashed upon the public by modern chemical technology. This is not the case. Glutamic acid and its derivatives are widespread in nature. Have you, for example, ever wondered why mushrooms and tomatoes are used in so many recipes or why Parmesan cheese is such a great companion to many dishes?

For centuries, Oriental chefs have flavoured their protein containing foods with seaweed and soy sauce. It was, however, only in 1908 that a Japanese researcher discovered that the active ingredient responsible for the flavour enhancement was monosodium glutamate, a salt of a commonly occurring amino acid. Today, MSG is produced on a massive scale by a fermentation process in which beet sugar is converted to glutamic acid by the actions of specific bacteria. Over 25,000 tones of the substance are consumed in North America per year, mostly as an additive in food. Unfortunately, MSG is sometimes added by manufacturers to compensate for using less meat or poultry in a processed food.

Glutamic acid is one of the building blocks of proteins, and is widely distributed in human tissues. An average human contains over 2 kilograms of glutamate as a component of protein. Some glutamate, about 10 grams, is also found in the free form, mostly in the brain and muscles. In this form, glutamate serves as a neurotransmitter, or chemical communicator, used by sensory nerves entering the central nervous system.

Glutamic acid also occurs widely in foods. The wheat protein, gluten is about 36% glutamic acid by weight...
while the milk protein, casein, is about 225. The ability of mushrooms and tomatoes to intensify the flavour of certain dishes can now be seen to be due to their high content of free glutamic acid. Parmesan and Camembert cheeses also owe their characteristic taste, at least in part, to the same compound. The difference in flavour between veal and beef has also been linked to an increased level of free amino acids associated with maturity. The beneficial effects of aging meat (i.e. prime rib) with respect to flavour has also been attributed to an increase in the amounts of free glutamic acid as the protein break down. It should then be obvious that glutamic acid is prevalent in the foods that we eat on a daily basis. Indeed, calculations show that the intake of naturally occurring glutamic acid from foods is about sixty times greater than from the MSG used as an additive. So, why all the concern about MSG?

In 1968, an American doctor of Chinese ancestry, Dr. Ho Man Kwok, noted a tightness in his chest and jaw, along with a headache and a burning sensation in the back of his neck, a short time after eating a meal in a Chinese restaurant. He coined the term “Chinese Restaurant Syndrome” (CRS) for these symptoms. Further investigation revealed that the symptoms could be produced in some others as well and that the culprit appeared to be the soup which, in traditional Chinese cooking, was well laced with MSG. The MSG is quickly absorbed from the soup which is consumed on an empty stomach. The temporary excess of glutamate may conceivably disrupt the nervous system, leading to the discomforting symptoms which normally disappear within an hour.

The extent of CRS is controversial. There is no doubt that some people actually do suffer from this condition, and that in some cases it can be induced by the intravenous administration of MSG. The subjective symptoms, however, are not consistent and the objective symptoms such as heart rate, blood pressure, and skin temperature are unaltered during an attack. The response to double blind challenges is also inconsistent. People with reported CRS often do not react to MSG in capsules. The possibility, of course, exists that the symptoms appear only when MSG is consumed together with some other ingredient in Chinese food.

A much more serious, but fortunately very rare response to MSG, is an asthmatic attack. There is at least one recorded case of respiratory arrest in a woman within an hour of consuming a meal of won ton soup, almond chicken, and Szechuan beef. She had not eaten for 11 hours before the meal and was also known to be sensitive to sulfites. In this particular case, a double blind challenge did reveal that MSG was the likely cause.

There have been other concerns as well. A 1969 rodent feeding study concluded that massive doses of MSG destroyed brain cells. This finding led to the voluntary elimination of MSG from baby foods by manufacturers which had been used to please the mothers’ palate in the first place. The relevance of this study to humans, however, is very questionable since a number of subsequent studies with primates showed no effect upon injection or force feeding of MSG.

The general conclusion, based upon the scientific evidence, is that some people show an idiosyncratic response to MSG when they are exposed to high doses on an empty stomach. Symptoms may vary, and are not reflected by objective measurements or by blood levels of glutamate. In rare cases, in sulfite sensitive individuals, large amounts (5 - 10 grams) of MSG may trigger asthmatic attacks. As far as the general population is concerned, the percentage of people subject to CRS (about 2%) is lower than that of people who have allergic reactions to other foods.

Today, glutamate research is focussed on the role of the substance as a neurotransmitter. It is believed that about half the nerve cells in the brain use glutamate as a chemical communicator and that the brain damage caused by a lack of oxygen, as in a stroke, is actually due to the release of excessive amounts of glutamate triggered by oxygen starvation. This release causes overstimulation of brain cells which leads to their death. The search is on for drugs which can block glutamate receptor sites on nerve cells and thus help reduce the damage. It is of interest that compounds closely related to the street drug phencyclidine (PCP) have actually shown some potential in this regard. There is even hope that certain diseases of the nervous system, such as Parkinson’s and Alzheimer’s may respond to glutamate blocking therapy.

Although excessive levels of glutamate in the brain may prove damaging, nobody is suggesting that these levels can be caused by dietary intake. Even the allegation that CRS is caused solely by MSG is on rather shaky ground scientifically. Indeed, if this were the case, and given the fact that both mushrooms and tomatoes are high in naturally occurring glutamate, we should be witnessing an epidemic of CRS among pizza eaters as well!

FOOD DYSES

Perhaps the most controversial of all food additives are the food dyes. It would seem that, in this case, even the smallest risk should be evaluated with the utmost scrutiny since these chemicals are only present for cosmetic purposes. They have no nutritive value. This cosmetic effect, however, is not without value since studies have shown that a food’s appearance affects the way its flavour is perceived. For example, less than 35% of subjects in one study were able to taste lemon flavour in a pink pudding and most people can not detect orange flavour in a pink lollipop.

In some case, the addition of colours meets consumers’ demands for a product that has uniform appearance week in, week out. Of course, dyes can also be used to deceive by improving the appearance of an inferior product. Some white bread is dyed with caramel or molasses to give the appearance of whole multi-grain bread. Yellow dye is sometimes used...
in cake mixes to suggest the presence of eggs. Orange dye in a drink can compensate for the little fruit juice actually used. Often, nutritionally poor foods are made more inviting by the presence of an attractive colour. The world could survive quite well without bright red Maraschino cherries or multi-coloured Fruit Loops.

There are basically three types of food dyes in common use today: natural dyes, nature identical dyes, and synthetic dyes. Natural dyes are derived from animal, vegetable, or mineral sources while nature identical and synthetic dyes are industrially produced by appropriate chemical reactions. All three types must be thoroughly tested for toxicity before government approved for use.

Natural dyes include the anthocyanins extracted from grape skins, titanium dioxide from minerals, betanins from red beets, carotenoids from carrots, chlorophylls from green plants, and cochineal red derived from female coccid insects which are found as parasites on certain types of cacti. There are certain restrictions on the use of these dyes. For example, titanium dioxide (which is also used in paints and liquid paper) is allowed only to the extent of 1% by weight in food while some dyes, such as marigold extract and iron oxide, are limited to chicken feed and dog and cat food, respectively.

Nature identical dyes are laboratory produced but their molecular structure is identical with the natural substance. For example, the canthaxanthin used in foods and synthesized in the laboratory is identical with the Canthaxanthin found in pink flamingos in every possible way.

Synthetic dyes used to be referred to as “coal tar” dyes since the first such colours synthesized by William Henry Perkins in 1856 did, indeed, derive from coal tar. Today, the starting material is the much more appetizing purified petroleum extract. The term “coal tar” which, in any case had been associated with an undeserved stigma, is no longer used. These dyes are generally referred to by a number assigned them by the Food and Drug Administration in the U.S., although their common and chemical names are often used as well. For example, the commonly encountered Red No. 2, Red No. 40, Red No. 3, Blue No. 2, and Yellow No. 5 are also referred to as amaranth, allura red, erythrosine, indigotine, and tartrazine, respectively.

The term “certified dye” is also used to describe synthetics. This does not refer to any safety aspect in terms of health, but rather to the fact that each manufactured batch is tested and found to conform to high purity standards. Similarly, natural dyes are called “uncertified”, not because of safety concerns but because they do not have to be tested by authorities for purity. Synthetic dyes produce intense colours and therefore are used in very small amounts. The estimated average North American daily intake of these substances in 300 milligrams.

The first attempt at regulating the use of food dyes was made in the U.S. in 1906. Up to this time, dyes were often indiscriminately used without much regard for safety or purity. The same batch of colour used to dye cloth could find its way into confectionery. Unethical merchants sometimes used highly toxic salts of lead and copper to dye candy and sold thorn leaves treated with copper oxide as Chinese tea.

The Pure Food and Drug Act of 1906 severely restricted the types and amounts of dyes which could be used. Extensive revisions in 1938 and 1980 have attempted to ensure that the dyes on the market conform to health and safety standards in light of the latest scientific information available. The general trend has been to apply more and more restrictions to the available colours. In Canada, food dyes are governed by the Food and Drugs Act which is administered by the Health Protection Branch.

There are some significant differences between the two countries in the dyes allowed. Red No. 2, for example, is allowed in Canada but not the U.S., whereas the situation is reversed for Red No. 4. Carbon black can be used to dye jelly beans in Canada but not south of the border. Norway and Greece do not allow any synthetic dyes at all. All of this reflects the fact that interpretation of animal feeding experiments can sometimes be ambiguous. The different conclusions based upon the same body of scientific evidence also suggest that if there is a danger associated with food dyes, it is likely to be minor.

The first food dye to be the target of extensive criticism and intense evaluation was Red No. 2. Two Russian studies in 1970 alleged that amaranth was carcinogenic and embryotoxic. Several American follow-up studies came to equivocal conclusions, but nevertheless the U.S. government banned the dye. The Canadian, Japanese, and most European governments’ interpretation was that the U.S. studies were flawed and that there was no reason to restrict the use of Red No. 2. It is probably the most widely used food dye in Canada today.

Presently, the safety of Red No. 3, a dye used extensively in candies, baked goods, Maraschino cherries, drugs, and cosmetics is being reevaluated. A large number of animal studies have been conducted using this dye, with only one showing an adverse effect. In this 1982 study, male rats receiving a very high dose of the substance (4% of their total lifetime diet) had higher incidences of thyroid tumours. Other concerns about this colourant include its affect on behaviour. The suggestion has been made that somehow erythrosine interferes with the functioning of the nervous system. Studies in human have so far failed to identify any of the alleged adverse effects. Similarly, there is so far no scientific justification for the banning of Blue No. 2 and Yellow No. 6, as desired by some consumer groups, since allegations of tumour formation have not stood up to scientific scrutiny.

The most legitimate safety concerns appear to be about Yellow No. 5 or tartrazine. This colourant has been
linked with allergic reactions in a few sensitive individuals who, generally, are aspirin intolerant, allergic, or asthmatic. Symptoms may include hives, itching, runny nose, and asthma. Although double blind studies have not shown a statistically significant number of adverse reactions, most authorities agree that in rare cases, tartrazine sensitivity does exist. Consequently, this dye is the only one that has to be identified by name on food labels. Although tartrazine does not represent a major health risk to most people, curtailment of its use in some areas is indicated. For example, its use in certain children’s asthma medication is clearly inappropriate.

One of the most pervasive, but scientifically dubious, claims has been that food dyes along with other food additives and some naturally occurring compounds are responsible for hyperactivity in children. In 1973, Dr. Benjamin Feingold, a California allergist, noted that some aspirin intolerant children showed behaviour disturbances after taking salicylate containing medication. Since some aspirin intolerant people are also sensitive to Yellow No. 5, he concluded that artificial colours could be responsible for hyperactivity. He reported that on a special diet which avoided a variety of natural and processed foods, along with certain drugs, about 50% of his patients showed improvement. While a number of well controlled subsequent studies have shown that the statistics quoted by Feingold were subjective and unrealistic, some have inferred from double blind challenges that food dyes in doses of four to six times the average daily intake may impair learning performances in children who are already hyperactive. The accumulated evidence to date indicates that food additives do not make children hyperactive but that hyperactive children, in a small percentage of the cases, may be adversely affect by very high doses of food colourants.