

Case Study

SHERBET! TWO CASES OF FOOD-ADDITIVE REACTIONS

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INTRODUCTION

Food additives are used extensively in the food industry and include thousands of natural and synthetic substances used as flavourants, colourants, preservatives, sweeteners, antioxidants and thickeners.¹

Many patients blame food additives as the cause of a wide variety of symptoms. Early literature (pre-1990s) overestimated the prevalence of food-additive reactions as a result of poorly designed trials. Many of the cases of adverse reactions to food additives in the medical literature are anecdotal or characterised by poorly controlled challenge procedures.² More recent evidence suggests that additive-associated reactions are relatively rare, with a prevalence of 0.23% in a population-based study.^{3,4} Relatively few food additives have been convincingly demonstrated to cause urticaria, angioedema, asthmatic reactions or anaphylaxis. Some groups, such as asthmatics with sulphite sensitivity, appear to be at higher risk of food-additive reactions.

The mechanism of reaction to several food additives is not completely understood. In very few cases, symptoms are typical of IgE-mediated reactions; several other immunological or non-immunological mechanisms may play a role, leading to a variety of presentations. This case report describes two different reactions to food additives in two different children, both occurring while eating 'sherbet'!

CASE 1

A nine-year-old girl was seen in the allergy clinic at the Red Cross War Memorial Children's Hospital for asthma, allergic rhinitis and eczema. She described an episode of hives about 20 to 30 minutes after eating yellow-coloured sherbet. She also described similar hives on two occasions within 30 minutes of eating yellow-coloured potato crisps. A panel of cellular antigen stimulation tests (CAST) to food additives showed a highly positive result to tartrazine (232 pg/ml, positive is >100 pg/ml), and a 'weakly reactive' grading to red food colourant mix (19 pg/ml, positive is >100 pg/ml). CAST tests were negative to sodium benzoate and sodium glutamate. She regularly ate red sweets/icing without a reaction, hence the weak reaction to red food colouring was not deemed to be clinically relevant. On the basis of recurrent reactions to 'yellow-coloured' foods

coupled with a highly positive CAST test, a diagnosis of tartrazine sensitivity was made and she was advised to go on a tartrazine-free diet, under dietetic guidance. Interestingly, she more recently tolerated the yellow potato crisps to which she had initially reacted and, subsequently, found that these particular crisps had been reformulated to become tartrazine-free.

CASE 2

A seven-year-old girl with no previous atopic history presented at a school fair with a dramatic and unusual constellation of symptoms within minutes of eating a sachet of sherbet. The sherbet was manufactured in China but the sachet did not state the exact ingredients. The girl experienced a sudden severe pounding headache, dizziness, a feeling as if her face was going to 'burst' with pressure, and a burning sensation in her legs. Her mother noted that she also had tachycardia and immediately took her to an emergency department. By the time she was seen at the ER approximately one hour after the incident, her symptoms had almost completely abated and she was discharged without further intervention. She presented to a private practice for an allergy consultation and to rule out a food allergy to commonly allergenic food, fearing contamination of the sherbet with nuts.

A skin-prick panel to peanut, cashew, hazelnut, walnut and almond was negative. CAST tests to sodium benzoate, sodium glutamate and red and blue food colourant mixes were negative.

On the basis of the very suggestive history, a diagnosis of 'MSG-complex syndrome' was made ('Chinese restaurant syndrome') and she was counselled that normal amounts of dietary MSG would be insufficient to trigger a reaction, but that large amounts of MSG such as those found in some Chinese food may cause a symptom complex similar to the one she experienced, and were best avoided.

DISCUSSION

Only a small fraction of the thousands of agents added to our food have been associated with cutaneous or anaphylactic reactions. The above two cases demonstrate different reactions to the confectionery 'sherbet'. In South Africa, sherbet is a powder made from bicarbonate of soda,

sugar and a variety of flavourants/colourants, designed to provide a 'popping' sensation on the tongue. It is not to be confused with the American 'sherbet', which is a food of frozen fruit juice with a dairy product such as milk added. In the first of the two cases, the tartrazine added as a colourant was assessed to have been responsible for the hives associated with the sherbet, and in the second case an 'MSG-complex syndrome' was deemed to have been responsible.

REACTIONS TO TARTRAZINE

Tartrazine is a synthetic lemon-yellow azo dye derived from coal tar that is primarily used as a food colourant, also known as Yellow 5 (E102).^{5,6,7} It is widely used in the making of potato crisps, jams, confectionery, drinks, and even some vitamins, medications and shampoos/cosmetics. Tartrazine is banned in Austria and Norway, but still widely available in most other areas of the world, including the United States and South Africa.⁵

The prevalence of tartrazine-induced adverse reactions is unknown, but it is thought to be less than 0.12% of the general population.⁸

Tartrazine-induced urticarial reactions have been described in various case series, though they are thought to be rare.^{6,7} Other rare side-effects described with tartrazine have been bronchospasm/asthma, persistent rhinitis symptoms and an exacerbation of eczema.⁹ There is insufficient evidence to support the exclusion of tartrazine from the diet of asthmatics.¹⁰ Hyperkinesia and learning disorders in children have been attributed to the ingestion of tartrazine, but this is controversial, with no scientific backing, hence a definite conclusion cannot be drawn.⁵

REACTIONS TO MONOSODIUM GLUTAMATE (MSG)

Glutamic acid is a non-essential amino acid that is a normal constituent of food protein, constituting about 20% of dietary proteins.^{1,2} When added to food in the form of a sodium, potassium or calcium salt, glutamic acid provides a unique taste and flavour-enhancing properties which enhance palatability. Glutamate is recognised by the taste receptors as a distinctive taste dubbed 'umami', a brothy, mouth-watering savoury sensation. MSG is rapidly and effectively metabolised by the intestinal mucosa and liver.

Glutamate salts are widely used in the food manufacturing and restaurant industries and flavour a variety of foods, including crackers, potato crisps, soups, frozen dinners, salad dressings, and Chinese and other Asian food. Glutamate and its salts carry the additive labels E620-625, and can be labelled as per the list in Table I.

The normal dietary intake of glutamates in the United States is around 1 g/day from naturally occurring forms, and an additional 0.5 g from added MSG. Naturally occurring high levels of glutamates are found particularly in tomato

TABLE I: FOOD LABELLING OF THE GLUTAMATES

FORM OF GLUTAMATE	E-NUMBER
Glutamic acid	E620
Monosodium glutamate (MSG)	E621
Monopotassium glutamate	E622
Calcium diglutamate	E623
Monoammonium glutamate	E624
Magnesium diglutamate	E625

and Parmesan cheese. Normal dietary levels of MSG are deemed to be safe and MSG is generally recognised as safe by the Food and Drug Administration in the United States. However, certain people may be sensitive to MSG consumed at high levels.

MSG has anecdotally been associated with headaches and even some psychiatric symptoms; however, extensive research has failed to substantiate this relationship.¹¹⁻¹² Associations with urticaria and asthma have been described, but these are deemed to be rare.¹¹⁻¹² Large doses of MSG in excess of 3 g, especially if ingested on an empty stomach without concomitant food, may initiate the so-called 'MSG-symptom complex'.²

THE MSG-SYMPTOM COMPLEX ('CHINESE RESTAURANT SYNDROME')

In 1968 the first case of so-called 'Chinese restaurant syndrome' was published describing numbness at the back of the neck, general weakness and palpitations after dining in a Chinese restaurant.^{13,14} The prevalence of the MSG-symptom complex is unknown; however, in 1979 Kerr et al used a National Consumer Panel to select a population-representative group and found the prevalence of MSG-symptom complex after the ingestion of high doses of MSG to be 2%.¹⁵ Although MSG is strongly believed to be the causative factor in the so-called Chinese restaurant syndrome, an association has never been demonstrated under rigorously controlled conditions. Symptoms of the MSG-complex syndrome are described in Table II.^{2,13,14}

The symptoms are self-limiting and usually abate within hours (as soon as the MSG has been metabolised), without specific intervention. Simple measures such as paracetamol may ease some of the symptoms.

TABLE II: SYMPTOMS DESCRIBED IN THE MSG-COMPLEX SYNDROME

- Flushing
- Headache
- Sweating
- Chest pain
- Sensation of facial pressure or burning
- Numbness or burning around the mouth, throat or other parts of the body
- Back pain
- Nausea
- Fatigue
- Uncommonly arrhythmias or difficulty in breathing

The pathophysiology of MSG-symptom complex remains elusive. It is definitely not an allergic reaction but, rather, it seems to be a 'chemical' reaction. The mechanism of these reactions has been proposed to involve an exaggerated sensitivity to the MSG, which is metabolised after ingestion to glutamate, a major excitatory amino acid neurotransmitter. Glutamate is also a precursor to acetylcholine, which could be responsible for some symptoms.¹⁶ Nitric oxide production and consequent vasodilatory action has also been proposed as an associated mechanism of symptoms.¹⁷ What is clear is that it is not a classic 'allergic reaction', therefore positive allergy tests are not required to diagnose the syndrome.

CONCLUSION

Confirmed reactions to food additives and preservatives are rare and probably overdiagnosed. The mechanism of reaction is frequently poorly understood and this has led to a lack of standardised tests to diagnose such reactions. However, food-additive reactions should be considered in cases when there are recurrent symptoms after consumption of certain processed/packaged foods, but no classical reaction to the pure or fresh form of the foods. Patients should beware of foods such as 'sherbet,' which may be loaded with food additives and are often poorly labelled.

This article has been peer reviewed.

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