

Food regulators claim that food colours and other additives are safe and thoroughly tested before approval. What they usually fail to mention is that these 'thorough' tests don't include behavioural toxicology – that is, checking to see whether additives affect behaviour or learning ability, especially in children.

*Food Intolerance Network founder and 'Fed Up' author **Sue Dengate** details the possible effects of food colours and reveals that many of us don't even know we are being affected.*

Food additives **Showing their true colours**





Since the consumption of processed food became widespread in the 1970s, regulators have simply ignored the behavioural aspect of food additives. This changed dramatically in April 2008 when UK food regulators recommended a 'voluntary' ban on the use of six artificial colours due to their effects on children's behaviour and learning. For the first time officials had taken behavioural toxicology seriously.

What are artificial colours?

The processed food industry as we know it started in the US in the 20th century with the discovery of refined pectin that enabled jams and jellies to be made cheaply just from sugar and water. Artificial colours and flavours were used so that real food such as fruit could be left out, thus reducing costs. Originally, artificial colours were made from coal tar. Although now made synthetically, artificial colours are still often referred to as coal tar dyes. Of these, dyes with a particular chemical structure called *azo* are the most likely to cause asthma, urticaria and allergic rhinitis (hayfever) in susceptible consumers. Azo dyes were the first additives to be recognised as harmful and a number have been banned for carcinogenicity. Some researchers suspect that all azo dyes are possible carcinogens. Other adverse effects of artificial colours include allergic reactions such as anaphylaxis to patent blue (131) and indigo carmine (132) when used as diagnostic agents to colour lymph vessels.

Natural colours

Due to a consumer backlash against artificial colours, food scientists are constantly searching for new colours from natural sources such as plants, animals or minerals. Many new colours have been introduced into our food supply in the last ten years and the discovery of a new colour for natural blue Smarties in the UK has been announced with much publicity. It is described as a seaweed derivative produced from two species of cyanobacteria (blue-green algae). Natural colours cost more because the materials for them have to be grown instead of made in a laboratory. According to the food industry, so much colour is used in manufactured foods in the US that it is not possible for all colours to be derived from natural sources. Some of the colours listed below such as 160d, 160e and 172 can be made synthetically.

The 'natural' label is no guarantee of safety. Natural colour annatto 160b can cause the same range of adverse reactions as artificial colours. In one study of 60 patients with urticaria, more were affected by annatto than any artificial colour. Anaphylaxis to annatto has been reported in the medical literature. As well as causing children's behavioural problems, asthma and skin rashes, this colour seems to be associated with head banging in young children, a condition never mentioned in parenting books prior to the 1970s, yet now considered to be a normal stage of development. Older children are

sometimes able to explain that their previous head banging was to relieve severe headaches caused by annatto.

Colours in organic foods

Natural colours are not necessarily suitable for use in organic foods because under organic standards the term 'natural' means that both the source and extraction process have to be natural. As well as the chemicals used in processing, other concerns about natural colours include the possibility of genetically modified ingredients and the five per cent labelling loophole, which means that if other additives such as preservatives are used, they do not have to appear on the ingredient list because the colour additive forms less than five per cent of the final product. There is also debate about the safety of various ingredients such as aluminium and the possible presence of salicylates in colours derived from plants for people who are salicylate sensitive.

Adverse effects of chemicals are related to dose. Although the colour exists in nature, when concentrated extracts are used, it may be possible to consume much higher doses than in natural food. For example, excessive doses of canthaxanthin (161g) are known to cause retinal spotting, sensitivity to glare, impaired

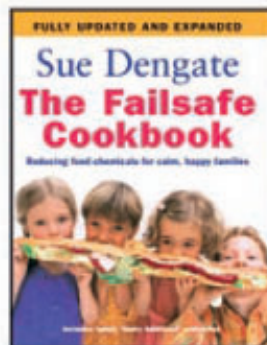
twilight vision and delayed dark adaptation. The small amounts used as food colours in pickles, sauces, confectionery and fish farms are considered safe by regulators, but some researchers have expressed concerns about extreme consumers.

Of all colour additives, caramel colours are by far the most common, accounting for about 98 per cent of all colouring matter added to products. You can find them in a wide range of foods and drinks including cola drinks, gravy and other brown foods, brandy and whisky.

Colours in medicine

When reading labels on medication, you need to be aware that medication with 'no azo dyes' may contain other potentially harmful colours. Since colours are regarded as 'inactive' ingredients, regulations regarding pharmaceuticals including medications, vitamins and supplements do not require colours to be listed on the label. You can usually find a description of the colours on the CMI (Consumer Medicine Information) sheet available from pharmacists or on the Internet: appgonline.com.au

However, these do not always give enough information. For example, if your medication lists Opalux or Opadry colours, these could contain tartrazine (102), sunset yellow (110),



The *Failsafe Cookbook* and *Fed Up* have opened the eyes of thousands of desperate parents to the adverse effects of synthetic additives and natural chemicals in foods.

Now fully revised and updated.

'A reminder to all parents to take a closer look at what their children are eating' *The Age*



see www.fedup.com.au for more information

erythrosine (127), indigo carmine (132) or brilliant blue (133). You need to find out more about the ingredients of those products – see more information to follow or do an Internet search.

Those most at risk

Your exposure to colour additives depends on where you live. Additives intake varies from

many per day in westernised countries to none for millions of people in subsistence villages. Food manufacturers change ingredients frequently and even in global brands the use of additives varies. Traditionally, English-speaking countries, especially the US, Canada, Australia, New Zealand and the UK, have been more accepting of additives than European populations but that has changed with the

Natural colours

- 100 curcumin – turmeric
- 101 riboflavin – vitamin B2
- 120 cochineal – from beetles, can cause allergies including anaphylaxis
- 140 chlorophyll – green colouring in plants, e.g. spinach
- 141 chlorophyll copper complexes
- 150a caramel I plain caramel
- 150b caramel II caustic sulphite caramel
- 150c caramel III ammonia caramel – possible immunotoxicity especially if vitamin B6 intake is low
- 150d caramel IV sulphite ammonia caramel – possible gastrointestinal symptoms in large doses
- 153 carbon black – carbon from vegetable matter, some concerns about possible carcinogenesis
- 160a beta carotene – from carrots; other vegetables and fruits
- 160b annatto – from the seed coat of a tropical tree, full range of intolerance and allergic effects
- 160c capsanthin – paprika extracted from peppers
- 160d lycopene – tomato extract
- 160e carotenal – found in tomatoes, pink grapefruit
- 160f carotenoic esters – one of the carotenes from plants
- 161a flavoxanthin – found in calendulas
- 161b lutein – found in green leaves, marigolds, egg yolks, used to feed hens
- 161c cryptoxanthin – found in gooseberries, orange rind, egg yolk, butter
- 161d rubixanthin – found in rosehips
- 161e violoxanthin – found in yellow parsies
- 161f rhodoxanthin – found in the seeds of yew trees
- 161g canthaxanthin – found in mushrooms, crustacea, flamingo feathers, also synthetic; possible twilight vision impairment in large doses; used in foods such as confectionery, pickles, also in fish farms
- 162 beet red – beetroot extract
- 163 anthocyanins – extract of grapeskin or similar
- 164 saffron, crocetin, crocin – from crocuses
- 170 calcium carbonate – limestone, chalk, also used as a calcium supplement
- 171 titanium dioxide – possible concerns regarding nanoparticles
- 172 iron oxides red, yellow, orange, brown, black – debate concerning possible toxicity
- 173 aluminium – surface decoration only, possible concerns about neurotoxicity not proven
- 174 silver – possible adverse effects from large doses
- 175 gold – considered very safe
- 181 tannins – from nut galls, considered safe in small doses as additives in wine and other alcoholic drinks



Children are not the only ones affected by food colours. In 1999, English health officials investigating a number of complaints about asthma and other allergies from patrons of popular curry restaurants found more than half the dishes surveyed contained excessive use of artificial colours tartrazine (102), sunset yellow (110) and ponceau 4R (124).

UK now pressing for change. Paradoxically, while western consumers are moving to reject artificial additives, developing food processing industries in countries such as Nepal are starting up with cheap, highly coloured products such as artificial jams.

Colours and ADHD

For more than 30 years, researchers and parents have been reporting behavioural effects of additives, from American paediatrician Dr Ben Feingold who blamed hyperactivity on diet in 1975, to independent scientists at the CSPI (Center for Science in the Public Interest) who recommended a ban on artificial colours in their 1999 report, 'Diet, ADHD and behaviour: a quarter century review'. Despite the failure of many early studies to show adverse effects, in 2004 a large review of careful scientific studies showed a significant effect of food additives on children with ADHD (attention deficit hyperactivity disorder). So why the turnaround

now? The answer is the Southampton University Study.

Led by psychology Professor Jim Stevenson, the study was funded by the UK Food Standards Agency and published in the leading medical journal *The Lancet* in September 2007. During the investigation, 300 children in two age groups were given drinks containing a high concentration of additives, an average concentration of additives or a placebo with no additives at all. The results showed that the highest concentration of additives affected the children the most. More importantly, the study showed that children without ADHD could be affected. Regulators who were used to ignoring complaints because they thought only a few children were affected now heard from researchers that artificial colours could cause 'psychological harm' to normal healthy children and that the number of children with ADHD could be reduced by about 30 per cent if the additives were banned.



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Is your child affected and you don't know?

People might think that parents would know if their children were affected by food additives but that's not what happens. The Southampton University study found that food additives can contribute to hyperactive behaviours – namely, overactivity, inattention or impulsivity. Previous research has shown that parents are not particularly good at recognising hyperactive symptoms in their own children. Yet these symptoms can be of vital importance in the long term. According to the Southampton team, food additives could affect a child's ability to benefit from schooling because increased hyperactivity is linked with educational difficulties, particularly reading, and reading difficulties can be associated with lifelong problems including lower income. Effects of additives can occur hours or even

days after they are eaten, so unless a parent is watching carefully, they are unlikely to make the connection.

There have been very few additive-free trials carried out in schools. In the only trial reported in a scientific journal, 803 New York schools removed 14 artificial colours, two preservatives (BHA 320 and BHT 321) and sugar from school meals over a period of four years. The result was a 16 per cent increase in academic ranking compared to the rest of the nation's schools and a significant decline in children classified as learning disabled, from more than 12 per cent to less than five per cent. Sugar has subsequently been found not to affect children's behaviour or learning ability. However, when schools reduce additive intake, they generally report that students are calmer and more cooperative.

Some possible effects of food colours

- * irritability, restlessness, difficulty falling asleep, symptoms of ADHD
- * mood swings, anxiety, depression, panic attacks
- * inattention, difficulty concentrating or debilitating fatigue
- * speech delay, learning difficulties
- * headaches, migraines, head banging in young children
- * eczema, urticaria (hives) and other itchy rashes
- * angioedema or swelling of the lips and so on, often associated with rashes
- * reflux, colic, stomach aches, bloating and other irritable bowel symptoms including constipation and/or diarrhoea, sneaky poos, stinky poos, bedwetting
- * frequent colds, flu, bronchitis, tonsillitis, sinusitis
- * asthma, stuffy or runny nose, constant throat clearing, persistent cough
- * joint pain, arthritis
- * heart palpitations, racing heartbeat

How many additives do you eat?

The problem for parents is that most consumers aren't aware of the additives they eat. Foods have changed so much over the last 30 years that additives are now used widely even in healthy foods such as bread, butter, yoghurt, juice or muesli bars as well as in junk food. A British survey in 2007 found that most consumers don't know which foods contain additives and underestimate how many additives they eat. On average, consumers eat 20 additives per day, or 19 additives per day if the foods they eat are home cooked. When additives are eaten many times a day every day from early childhood, parents will never know what additive-free behaviour is like.

In the US, where artificial colours are widely used, a desperate mother discovered that both her breastfed baby's sleep patterns and her toddler's behaviour improved when she avoided tartrazine (102). She had been eating tartrazine herself and feeding it to her two-year old in potato bread, yoghurt, canned soup, margarine, cough syrup, cakes, cake mixes, donuts, muffins, snack cakes, ice-cream, cookies, crackers, drink mixes, lemonade,

pudding mix, boxed meals, rice and pasta dishes, cheesecake, butterscotch candy, jelly and chips.

Adverse effects of artificial colours

Behaviour isn't the only effect of food colours. Long before children's behaviour became an issue, a range of symptoms had been associated with various additives including colours.

In the early 1950s, virtually the entire world population was on a low-additive diet. It is easiest to notice effects of additives when they are eaten only occasionally. As processed foods gradually became common, additive intakes increased. One of the earliest adverse reaction reports – six cases of childhood asthma associated with various artificial colours – was published in 1958. The next year, a report of reactions to tartrazine (102) in drugs appeared. Eight years later a case of severe, chronic asthma was linked to tartrazine in yellow vitamin tablets. These were followed by increasing reports of reactions to food colours and other additives. By the 1980s,

food additives were common. When additives are eaten every day, you don't see reactions. Instead, you see a chronic condition, or symptoms that come and go with no apparent cause. Research shows that the effects aren't obvious unless a reaction occurs within 30 minutes.

Babies and young children are most at risk from food additives because they eat and drink more relative to their body weight than adults. Even breastfed babies can be affected by additives because artificial colours and other food chemicals can pass through breastmilk. A young fully breastfed baby in Brisbane with an asthmatic cough subsequently developed wheezing and breathing problems at age four months on coloured antibiotics. He was medicated constantly for asthma for two years until the Royal Prince Alfred Hospital (RPAH) elimination diet showed that his asthma was related to a range of artificial colours, one natural colour (annatto 160b) and certain preservatives. Additives can also be absorbed through the skin. Through experience, his family learned that his asthma was related not only to colours in foods but also to toothpaste, shampoo and playdough with artificial colours.

Where the colours are

- sweets, bubblegum, chocolates
- cakes and biscuits including cream biscuits, wafers, ice-cream cones
- jellies, custard powders
- drinks including cordials, fruit-flavoured drinks, sports drinks, flavoured milks, icy poles
- topping syrups and milkshake flavouring
- packet savoury snacks including burger- or cheese-flavoured snacks, prawn crackers
- spices, tandoori mix, chutneys
- ready-made desserts such as custards, creme caramel
- takeaways including battered or crumbed fish
- medications and supplements
- personal care items from toothpaste to teething gel, antibiotics to vitamins, cough drops and antihistamines to protein powder supplements

Worst-case scenario

Anaphylaxis is a sudden allergic reaction involving at least two systems of the body such as the respiratory tract, skin, gastrointestinal tract or cardiovascular system. Symptoms usually occur within minutes to several hours after contact with the trigger. Reactions can range from mild to severe and life threatening. Asthmatics with a history of allergy have a particularly high risk of anaphylaxis.

In 1981, a medical journal described the case of a 25-year-old asthmatic medical student who experienced several sudden life-threatening attacks involving tightening of the throat, shortness of breath and hives over a few months which were eventually traced to foods and drugs coloured with tartrazine (102). His doctor commented that 'in spite of careful



Colours linked to intolerance reactions

Colour	FD&C No	Colour Index (CI)	Azo	Comment
E102 tartrazine yellow	Yellow #5	19140	Yes	UK ban recommended, banned in Finland, restricted use in Sweden and Germany
E104 quinolene yellow	Yellow #4	47005	-	UK ban recommended, banned in the US and Japan, Australian ban lifted in 2003
E107 yellow 2G	-	18965	Yes	Not in food in Australia
E110 sunset yellow	Yellow #6	15895	Yes	UK ban recommended, banned in Finland and Sweden
E122 azorubine/ carmoisine (red)	-	14720	Yes	UK ban recommended, banned in the US
E123 amaranth	Red #2	16185	Yes	-
E124 ponceau red	Red #4	16255	Yes	UK ban recommended, banned in the US, Canada, Sweden and Japan
E127 erythrosine red	Red #3	45430	-	-
E129 allura red	-	-	-	UK ban recommended
E131 patent blue V	-	42051	-	Diagnostic agent only
E132 indigo carmine	Blue #2	73015	-	-
E133 brilliant blue	Blue #1	42090	-	-
E142 food green	-	44090	-	-
E143 fast green	Green #3	42053	-	Banned in EU
E151 brilliant black	-	28440	Yes	-
E155 chocolate brown	-	20285	Yes	-
E160b annatto	-	75120	-	Natural colour

screening by an alert, educated patient', the student had suffered two more moderate attacks after eating foods later found to contain tartrazine. Such reactions to additives are rare but frightening for the families involved because colours are so widespread. The parents of a NSW preschooler who suffered similar reactions to tartrazine in 2007 were advised to carry an EpiPen® adrenaline injector at all times and to keep their child away from all azo dyes, including playdough, requiring allergy awareness at school and in everyone who ever cares for their child.

Allergy or intolerance?

Allergic reactions are generally quick reactions to the proteins in a few foods, involving symptoms such as itching or swelling. They are relatively easy to identify and can be confirmed by laboratory (IgE) testing. Most reactions to food additives are not this kind of reaction. Instead, they are intolerance reactions to chemicals, usually delayed, with a wide range of symptoms and many foods involved. Intolerance reactions can be extremely difficult to identify. There are no proven laboratory

Consumer colour backlash

In 1976, public outcry forced the Mars confectionery company to remove red M&M'S® from its traditional colour mix after the US Food and Drug Administration (FDA) banned the use of the red dye Amaranth Red#2 as a food additive as it proved to be carcinogenic in laboratory animals. Amaranth Red#2 was not actually used to colour the product but Mars thought it best to withdraw the colour anyway.

Red M&M's were reinstated with much fanfare in 1987, and are coloured with Cochineal (120). Cochineal (120) pink colouring – made from crushed beetles – is a natural colour that can cause severe problems. This colour does not cause food intolerance reactions such as hyperactivity and can be one of the safest colours for susceptible children. However, cochineal has been associated with rashes, breathing difficulties and life-threatening anaphylaxis.

tests for food intolerance and the way to confirm reactions is through elimination and reintroduction of the various chemicals.

Food regulators are in the difficult position of looking after the interests of both food manufacturers and consumers. Manufacturers like artificial colours because they are cheap and effective and, until now, food regulators have supported them. The US FDA (Food and Drug Administration) denies that artificial food colours cause problems other than hives in a pamphlet on food colours written by the food industry. Australian food regulators continue to deny behavioural problems in children, saying the science is 'weak'. Breaking this cycle, when announcing the UK food regulators call for a ban on artificial colours, Food Standards Agency Chair Dame Deidre Hutton announced it was 'time to put consumers first'.

Artificial colours are not the only additives than can affect children but they are cosmetic, used in foods targeting children, unnecessary and the easiest to remove, as can be seen by how well UK manufacturers have already adapted. Nestlé Rowntree in the UK experienced a nine per cent increase in sales after switching its iconic Smarties brand to all natural colours in 2006.

When food additives are dropped, it is usually due to consumer demand, not regulation. In the UK, the five largest supermarket chains have promised to remove artificial colours from their own brands, the UK branches of giant confectionery makers such as Cadbury and Mars Inc have pledged to remove artificial additives and many other firms are following suit. Support for an outright ban on artificial colours has also come from the Daily Mail 'Ban the Additives' campaign, actiononadditives.com and other community organisations.

Australian consumers who would like to see a reduction in artificial colours can register their opinions by emailing manufacturers directly through the Contact Us option on company websites. For more information and references, see fedupwithfoodadditives.info/factsheets/Factcolour.htm