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Hyperactivity and Chemical Colours and Additives

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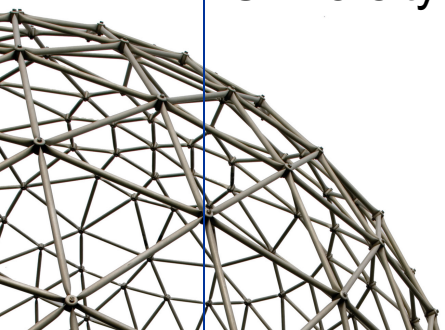

Overview

- What are chemical colours and additives?
- Hyperactivity
- Feingold
- Research debate
- UK FSA
- USFDA
- Summary

What are Food Additives?

A food additive is any substance intentionally added to food for a specific function (for example to preserve or colour it) that is not normally eaten as a food or used as a characteristic ingredient in food

All food additives, whether they are natural or artificial, must go through rigorous safety assessment and approval procedures, and must comply with European Union (EU) legislation.

Benzoates

Benzoic acid (E210) and other benzoates (E211, E212, E213, E214, E215, E216, E217, E218 and E219) are used as food preservatives to prevent yeasts and moulds from growing, most commonly in soft drinks

They occur naturally in fruit and honey

Benzoates could make the symptoms of asthma and eczema worse in children who already have ADHD/hyperactive conditions

What are Chemical Additives and Colours?

- common food additives: include antioxidants, preservatives, colours, emulsifiers, stabilisers, gelling agents, thickeners, flavour enhancers, flavourings, and sweeteners
- food colours: include Tartrazine (E102), Carmoisine (E122), Sunset yellow (E110), Quinoline yellow (E104), Allura red (E129), Ponceau 4R (E124)

Tartrazine (E102)

Tartrazine (E102) is a yellow colour used in a range of foods including soft drinks, sweets and sauces

Studies have shown that eating foods or drinks containing tartrazine can cause nettle rash (urticaria), dermatitis (an allergic skin condition), asthma, or rhinitis (runny nose) in a very small number of people

The use of tartrazine has decreased in recent years.

E951 Aspartame

- Aspartame sugar substitutes cause worrying symptoms from memory loss to brain tumours. But despite US FDA approval as a ‘safe’ additive, aspartame is one of the most dangerous substances ever to be foisted upon an unsuspecting public.
- Aspartame is an intense sweetener, approximately 200 times sweeter than sugar. It has been used throughout the world in soft drinks and other low-cal or sugar free foods since 1974. It was first approved for use in the UK in 1982. It is known by the name NutraSweet, aspartame or E951.

Hyperactivity

Hyperactivity - a range of behavioural difficulties that have a negative impact on learning, memory, movement, language, emotional responses, and sleep patterns

- no single test for diagnosing hyperactivity
- children tend to be over-active, unable to concentrate, and prone to making sudden and often inappropriate decisions

What Causes Hyperactivity?

- we don't know the precise cause of ADHD
- there is evidence for a strong genetic influence
- differences in the brain activity of ADHD children compared to those of non-ADHD children, particularly in areas that regulate attention, concentration and impulse inhibition

(Simon H and Stern TA (2002) What causes attention-deficit hyperactivity disorder? Review available online on http://Hyperactivity and artificial food colours)

Feingold

- food could have an effect on children's behavior became popularized in the 1970s by allergist Benjamin Feingold, MD,
- Feingold diet - advocated a diet free of more than 300 food additives to treat hyperactivity
- Feingold BF (1977) Behavioral disturbances linked to the ingestion of food additives. Delaware Medical Journal; 49(2):89-94,1977

Susan's Child

As Susan served breakfast for Jimmy, her six-year-old son with attention deficit disorder (ADD/ADHD), little did she know that the tasty foods he was gobbling up — a blueberry muffin, a bowl of Fruit Loops, and a glass of Sunny D Citrus Punch — would worsen his ADHD symptoms, making him

more **inattentive and fidgety**

Research Debate – 1970s onwards

Through the 1970s, scientific papers claimed that 30 to 50 percent of hyperactive children improved when placed on a diet free of substances including AFCs and salicylates (salicylates naturally occur in fruits and vegetables like apples, cherries, grapes, oranges or tomatoes

Others tested this diet and various food additives during the 1970s and 1980s, with variable results - some found a large effect of diet on behaviour and some found little effect

WARD (1997)

Ward, Neil I. Journal of Nutritional and Environmental Medicine, 7 (4), 333-342 (1997)

A questionnaire evaluation of 486 hyperactive children (HA) (82% boys, aged 7-13 years and 18% girls, aged 8-13 years) showed that more than 60% of cases reported a positive behavioural response (i.e. increased problems) in relation to consuming or being exposed to synthetic colourings and flavourings, food and beverage preservatives, cow's milk and associated products, chemical detergents and perfume

WARD (1997)

Trace element measurements undertaken by inductively coupled plasma mass spectrometry showed that a low zinc and iron status is associated with hyperactive children when compared with control children for blood serum, urine and washed scalp hair (HA < C). In many cases, hyperactive children also had very highly significant raised levels of aluminium, cadmium and/or lead (HA > C), particularly in urine and washed scalp hair samples.

WARD (1997)

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Hyperactive children with a known behavioural response following the consumption of a beverage containing tartrazine, E102 (n = 23), sunset yellow, E110 (n = 12) and amaranth, E123 (n = 12) were given a dose of chemical food colour (50 mg) and their zinc levels (blood serum and urine) and behavioural activity were monitored for 120 min.

A sex- and age-matched control group was also studied.

Only hyperactive children showed a significant reduction in blood serum zinc levels and an increase in urinary zinc output following the consumption of E102 and E110. Amaranth had no effect on their zinc status over the study time period.

There were no significant changes in the zinc levels for control children for all three chemical food colours.

The main behavioural changes were observed in the hyperactive children given E102 and E110. For the 23 children who consumed a tartrazine beverage there were increased levels of overactivity (n = 18 children), aggressive (n = 16) and/or violent (n = 4) activity, poor speech (n = 2), poor coordination (n = 12), and the development of asthma and/or eczema (n = 8). Most of these were severe or moderate changes.

Only one control child showed minor behavioural responses to tartrazine.

Research Debate American NIH (1982)

1982, the American National Institute of Health (NIH) concluded that diet restrictions helped a small percentage of children with ADHD

It recommended more research and noted that progress in this area is hindered by our limited understanding of ADHD and a lack of working standard diagnostic procedures

For instance, many children with ADHD also have food allergies

Since food allergies may, by themselves, cause behavioural problems, some children diagnosed with ADHD may not have primary ADHD in the first place

Research Debate – into 2000s

Recent studies and reviews have however found a substantial dietary effect on ADHD

2004 review examined 15 double-blind, cross-over trials using similar Artif. Food Colours (AFC)

Under an AFCs-free diet, the average behavioural improvement was between one third and one half the size of that typically seen with medication treatment and occurred in ADHD as well as normal children, which do not support the hypothesis that “hyperactive” and “normal” children may react differently to these compounds

Another study, in 2004, has confirmed these results in preschool children

Research Debate

Schab DW and Trinh NH (2004) Do artificial food colors promote hyperactivity in children with hyperactive syndromes? A meta-analysis of double-blind placebo-controlled trials. Journal of Developmental & Behavioral Pediatrics 25(6): 423-434

Bateman B, Warner JO, Hutchinson E, Dean T, Rowlandson P, Gant C, Grundy J, Fitzgerald C and Stevenson J (2004) The effects of a double blind, placebo controlled, artificial food colourings and benzoate preservative challenge on hyperactivity in a general population sample of preschool children Archives of Disease in Childhood 89: 506-511

McCann D, Barrett A, Cooper A, Crumpler D, Dalen L, Grimshaw K, Kitchin E, Lok K, Porteous L, Prince E, Sonuga-Barke E, Warner JO, Stevenson J. (2007) Food additives and hyperactive behaviour in 3-year-old and 8/9-year-old children in the community: a randomised, double-blinded, placebo-controlled trial. The Lancet 370(9598):1560-7.

Research Debate IOW (2004)

The effects of a double blind, placebo controlled, artificial food colourings and benzoate preservative challenge on hyperactivity in a general population sample of preschool children [Bateman *et al.,* (2004) Archives of Disease in Childhood, **89,** 506-511]

- 1873 children were screened in their fourth year for the presence of hyperactivity at baseline (HA), of whom 1246 had skin prick tests to identify atopy (AT)
- children were subjected to a diet eliminating artificial colourings and benzoate preservatives for one week; in the subsequent three week within subject double blind crossover study they received, in random order, periods of dietary challenge with a drink containing artificial colourings (20 mg daily) and sodium benzoate (45 mg daily) (active period), or a placebo mixture, supplementary to their diet
- Behaviour was assessed by a tester blind to dietary status and by parents' ratings

Research Debate
IOW (2004)

Bateman *et al.*, (2004) Archives of Disease in Childhood, **89,** 506-511

Results:

- significant reductions in hyperactive behaviour during the withdrawal phase
- significantly greater increases in hyperactive behaviour during the active than the placebo period based on parental reports
- effects were not influenced by the presence or absence of hyperactivity, nor by the presence or absence of atopy
- no significant differences detected based on objective testing in the clinic

Conclusions:

There is a general adverse effect of artificial food colouring and benzoate preservatives on the behaviour of 3 year old children which is detectable by parents but not by a simple clinic assessment

Subgroups are not made more vulnerable to this effect by their prior levels of hyperactivity or by atopy.

Research Debate Southampton (2007)

- Professor Jim Stevenson and a team of researchers from The University of Southampton
- levels of hyperactivity in a randomly selected sample of 297 children
- over a six-week period each child's food intake was regulated to ensure that, apart from those introduced during the study, all food additives were removed from their diet
- each day, the children were given a drink which either contained one of two mixtures of food colours and benzoate preservative, or just fruit juice – with all the drinks looking and tasting identical
- established a positive correlation between food additives and the incidence of hyperactivity in children

Southampton (2007) and EFSA

2008, the European Food Safety Authority (EFSA) evaluated the study and concluded that there was limited evidence that the mixtures of additives tested had an effect on the activity and attention of some children

Although the findings from the study could be relevant for specific individuals showing sensitivity to food additives in general or to food colours in particular, it was found not to be possible at present to assess how widespread such sensitivity may be in the general population

Irish (2009)

Connolly *et al.*, Food Additives & Contaminants: Part A, Dec 2009

Pattern of intake of food additives associated with hyperactivity in Irish children and teenagers

- **to ascertain the pattern of intake of two mixes (A and B) of the seven target additives in Irish children and teenagers using the Irish national food consumption databases for children (*n* = 594) and teenagers (*n* = 441) and the National Food Ingredient Database**
- the preservative sodium benzoate exceeded the previously used dose in both children and teenagers
- **no child or teenager achieved the overall intakes used in the study linking food additives with hyperactivity**

BMJ (2008)

Food additives and hyperactivity: Jacobson, M. (2008). Food dyes should be banned BMJ 2008;336:1144 (24 May)

- a recent randomised placebo controlled trial in 297 children aged 3-9 years provides evidence of increased hyperactive behaviour after they ate a mixture of food colourings and a preservative (sodium benzoate)
- the children were from the general population and did not have attention-deficit/hyperactivity disorder
- the trial found an adverse effect of the mixture on behaviour as measured by a global hyperactivity aggregate score
- the daily dose approximated that found in two 56 g bags of sweets

Research Debate – India (2010)

Dixit *et al.,* 2010 (State of Uttar Pradesh, India)

- investigated the nature and levels of colours in food items
- 478 edible foodstuffs were analysed, and of six permitted colours, **Sunset Yellow FCF** (SSYFCF) and **Tartrazine** were most popular, and two non-permitted colours, namely **Metanil Yellow** and **Rhodamine B**, were encountered
- 59% of foods employing permitted colours exceeded the maximum allowable limit, with average quantities crossing the threshold of 100 mg kg-1 in most food commodities
- intake of SSYFCF exceeded the acceptable daily intake (ADI) for children and adolescents by 88% and 39%, respectively
- results indicate that children and adolescents are more vulnerable to higher intakes of food colours compared with the adult population

(FOOD ADDITIVES AND CONTAMINANTS PART A-CHEMISTRY ANALYSIS CONTROL EXPOSURE & RISK ASSESSMENT, 27(2),181-189)

The Research Problem

Overall evidence is inconclusive and, in the best case, difficult to interpret

Studies have used very different ways of assessing diet effects: some tested full diets and others single ingredients; some added and others removed food ingredients; some tested children who were sensitive to certain foods and others tested children with ‘conduct’ problems or with ADHD, etc.

Legislation - EU (2008)

2008, the European Union introduced new legislation with regards to the use of food additives (Regulation (EC) No. 1333/2008; European Commission)

- stipulates that any food on sale in the European Union that contains particular food additives (Sunset Yellow, Carmoisine, Tartrazine, Ponceau 4R, Allura Red, and Quinoline Yellow) be labelled to indicate that these additives 'may have an adverse effect on activity and attention in children'

FSA

Research funded by the FSA has suggested that consumption of mixes of certain artificial food colours and the preservative sodium benzoate could be linked to increased hyperactivity in some children.

It is important to remember that hyperactivity is also associated with many other factors in addition to certain additives, so dietary advice may help manage hyperactive behaviour but may not be the total solution.

Other factors include premature birth, genetics and upbringing.

European Food Safety Authority (EFSA)

- reviewed the evidence linking preservatives and colourings with hyperactive behaviours from 22 studies between 1975 and 1994 and two additional meta-analyses.
- 16 of the studies reported positive effects in at least some of the children
- the EFSA point out that hyperactivity has a wide range of social and biological causes, and exclusively focusing on food additives may "detract from the provision of adequate treatment" for children with the disorder

The Last Straw

Increasing numbers of children are taking drugs for hyperactivity--2.4% of children in the state of Western Australia

The United Nations requested all Governments to exercise utmost vigilance in preventing the overdiagnosing of ADD and any medically-unjustified treatment with methylphenidate (Ritalin) and other stimulants. The World Health Organization (WHO) was asked to investigate and provide expertise to national public health authorities (UNITED NATIONS NATIONS Information Service INCB ANNUAL REPORT 1995
28 February 1996)