NHS Highland

Food Additives and the Impact on Children's Mood and Behaviour

The effect of food additives on children's mood and behaviour is highly controversial and heavily contested. Food additives undergo rigorous safety testing before they are approved for safe food use. However, they are not tested routinely for their impact on mood, behaviour or concentration. Several recent pieces of scientific research have provided some evidence that certain food additives could affect the behaviour or concentration of some children. These are described briefly below.

Scientific research on the impact of food additives on mood, behaviour and brain function

1. A review of all previously published studies on food colours and hyperactivity concluded that they do have an effect on hyperactivity. This impact was approximately 30 to 50% as strong as the effect of medication for ADHD (Schab, 2004).

2. A study of 3 year old children with and without ADHD showed that food colours and a preservative (sodium benzoate) have a negative effect on behaviour compared to "placebo" according to parents ratings (placebo is like a dummy treatment that looks and tastes the same as the experimental substance). This study was "double blind" in design. This prevents bias (Bateman, 2004).

3. One "in vitro" study found that when colours are combined with either a flavour enhancer (monosodium glutamate) or sweetener (aspartame), cell development slows considerably. If this is also the case in live subjects, it could impair brain development. (In vitro means that the study was "test tube based" rather than using live animals or humans. This means that we cannot be sure how relevant this is in humans) (Lau, 2005).

4. Three double blinded studies have shown that aspartame can trigger migraine in adults who suffer from migraine (Eeden, 1994), (Lipton, 1989), (Koehler, 1988). Anecdotally, there are many reports of headaches and other neurological symptom from people who drink aspartame containing drinks.

5. Another study found that people suffering from clinical depression became more depressed when they were given aspartame containing drinks (Walton, 1993). There is also some evidence that it can inhibit an enzyme called acetyl choline esterase, which plays a role in memory and learning (Tsakiris, 2006). Food industry funded studies have declared aspartame to be safe and it is certainly legal. However, there are doubts about the effect of this additive on the brain function of vulnerable populations.

6. A large study of children without ADHD (or any other diagnosed difficulty), found that food colours and sodium benzoate have a significant impact on attention and hyperactivity scores. The study involved in 3 and 9 year old children and was "placebo controlled" and "double blinded" (Stevenson, 2007)

7. Artificial food colours E102 and E110 have been shown to cause deterioration in behaviour and zinc status in children with ADHD, but not in children without ADHD (Ward, 1997).

From the research described above, we have listed the additives that are most relevant, and could potentially have an impact on the mood, behaviour or concentration of some vulnerable children. Many vulnerable children will not be affected by these additives. However, none of these additives provide any nutritional benefit, and their removal from the diet is realistic and practical. Suitable alternatives are available. It is not practical or necessary to avoid all food additives or "E numbers". Most of them are perfectly safe and many are natural substances. The cautious approach would be to avoid foods containing the following food additives, or to deliberately test their impact (preferably more than once) by consuming some of the suspect food, and waiting for a reaction.

Additives to look out for:

Artificial yellow colours:
E102 tartrazine, E104 Quinoline Yellow, E110 Sunset Yellow
(sweets, jelly, soft drinks)

Artificial red colours:
E122 Carmoisine or Azorubine, E123 Amarinth, E124 Ponceau 4R or Cochineal Red A, E127 Erythrosine, E128 Red 2G, E129 Allura Red AC
(soft drinks, sweets, meat products, jelly)

Other artificial colours:
E132 Indigo Carmine, E133 Brilliant Blue, E142 Green S, E151 Brilliant Black, E155 Brown HT
(sweets, cake mixes, jelly)

Preservatives:
E210 – E219 Benzoates (most commonly used: E211 – sodium benzoate)
(soft drinks)

Artificial Sweeteners:
E951 Aspartame
(sugar free gum, diet yoghurt, instant drinking chocolate, soft drinks)

Flavour Enhancers:
621 Monosodium Glutamate
(stock cubes, packet soup, flavoured crisps, some Chinese takeaways, sausages and pies)

Alternatives:

Colours with fewer safety concerns include:

E100 -Turmeric, E101 - Riboflavin
E120 - Carmine or Cochineal
E140 & E141 - Chlorophyll
E160b - Annatto
E160c - Paprika Extract
E162 - Beetroot red
E163 – Anthocyanins

These colours are now used in some confectionery, soft drinks and jellies. The colours used will be shown on the ingredients list.

An alternative to aspartame is sugar. Too much sugar can, of course, be harmful. Ideally, children should get used to a less sweet diet. This helps them appreciate the more subtle sweetness of fruits and vegetables. Pure fruit juice, fruit smoothies, milk and water do not contain artificial sweeteners. However, most fizzy drinks, diluting juices and flavoured waters do. If in doubt, check the ingredients list. Note that some drinks are free from artificial sweeteners and colours, but still contain benzoate preservatives. Once again, check the ingredients list.

To avoid benzoate containing drinks, choose pure fruit juice, fruit smoothies or milk. A few diluting juices and fizzy drinks will be free from preservatives, artificial sweeteners or colours, but will usually contain added sugar.

Some stock cubes do not use flavour enhancers such as 621. Some crisps, especially ready salted, do not contain flavour enhancers such as 621. If in doubt, check the ingredients list. Sometimes Chinese take-aways will provide meals without monosodium glutamate if the customer asks for it to be left out.

Cautions:

1) Be careful with **"free from"** claims on the front of the pack. **"Free from artificial colours"** does **not** mean that it is free from preservatives or sweeteners. Also, foods that are free from food additives are not necessarily healthy. Some confectionery and ready salted crisps are "free from additives" but still high in sugar, fat or salt and low in nutritional value. However, they can be included safely as part of a healthy balanced diet.
2) There are many other aspects of nutrition that can affect the physical and mental health of children. A diet that contains lots of additive free crisps, soft drinks and sweets is still an unhealthy diet!
3) Diet is only one area that affects the behaviour and learning of children. Avoiding certain food additives may make a significant difference. However, for many children, good parenting, appropriate educational strategies and sometimes medication are also important.

Bibliography

Bateman B The effects of a double blind, placebo controlled, artificial food colourings and benzoate preservative challenge on hyperactivity in a general population sample of pre-school children [Journal] // Arch. Dis. Child.. - 2004. - Vol. 89. - pp. 506-511.

Eeden S K Van den Aspartame ingestion and headaches. A randomized cross-over trial [Journal] // Neurolgy. - 1994. - Vol. 44. - pp. 1787-1793.

Koehler S M The effect of Aspartame on migraine headache [Journal] // Headache. - 1988. - Vol. 28. - pp. 10-14.

Lau K Synergistic Interactions between commonly used food additives in a developmental neurotoxicity test [Journal] // Journal of Toxocological Sciences. - 2005.

Lipton R B Aspartame as a dietary trigger of headache [Journal] // Headache.. - 1989. - Vol. 29. - pp. 90-92.

Schab D W Do artificial food colours promote hyeractivity in children with hyperactive syndromes? A meta-analysis of double blind placebo controlled trials [Journal] // Journal of developmental and behavioural paediatrics. - 2004. - 6 : Vol. 25. - pp. 423-434.

stevenson J 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. [Journal] // The Lancet. - Sept 2007.

Tsakiris S The effect of aspartame metabolites on human erythrocyte membrane acetylcholinesterase activity. [Journal] // Phamacological Research. - 2006. - Vol. 53. - pp. 1-5.

Walton R G Adverse reactions to aspartame: double blind challenge in patients from a vulnerable population. [Journal] // Biol Psychiatry. - 1993. - 1-2 : Vol. 34. - pp. 13-17.

Ward N I Assessment of chemical factors in relation to child hyperactivity [Journal] // Journal of nutritional and environmental science. - 1997. - 4 : Vol. 7. - pp. 332-342.