

Diet in the treatment of autism: The evidence

There are lots of different 'diets' said to be useful treatments for autism or its spectrum of related disorders Autistic Spectrum Disorders (ASD), but the orthodox medical guidelines say there isn't enough evidence for diet to be recommended as a treatment. This document attempts to summarise the theories and evidence behind diet and autism, to help you make up your own mind.

NB - This document was written by Zoe Connor, dietitian, in November 2006. Since then there may have been other studies published.

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Why will so few dietitians or doctors recommend diet for treatment of ASD?

There is not enough 'good quality' evidence for the use of these 'treatments', and sometimes changing around a person's diet or giving them high doses of vitamins or minerals can actually be harmful.

Many doctors and dietitians do realise that for some individuals with ASD, changing their diet has helped with things like diarrhoea, constipation, or concentration. However this is very different from having enough evidence to recommend diet to help the majority of people with ASD.

What do we mean by good quality evidence? Why isn't it enough that you've seen improvements in some individuals?

The evidence that is needed to really prove that a treatment works should:

1. use **lots of people** or 'subjects'
2. be '**randomly assigned**' to a 'group'
3. be '**controlled**' - there is more than one 'group' of 'subjects' with one group being the 'control' - no treatment takes place for the control group, whilst another group receives the treatment. The researchers then compare the results of the treatment groups to the results of the control.
4. be '**crossed-over**' (possibly) - so that everyone gets to have a chance at being in the treatment group, after a few weeks, or months, the treatment and control group swap over..

5. have results monitored by **specialists** - e.g. doctors or psychologists who use well designed methods to assess whether the subjects have changed their behaviour or symptoms
6. be **blinded** - so the researchers and specialist assessors do not know which subjects were in the treatment group or the 'control'.
7. or **double blinded** - this is where the subjects themselves do not know whether they are in the treatment group or control group.
8. give '**significant**' results - the comparison of the assessments of the subjects carried out before and after the treatment are analysed statistically. A 'significant' result shows that the changes that occurred are unlikely to have happened by chance. To show a treatment is significant, you need a large group of 'subjects'

The double blinded bit is important in diet and ASD. Some experts have said that some of the improvement in behaviour parents may see in their child with ASD when they for example put them on a gluten free diet may be from the extra attention the child is getting and the change in routine in eating, as more effort is needed to get their child to eat the new foods. It also might be that when the gluten foods are cut out, foods with lots of artificial additives are also cut out, and so then is the improvement down to the gluten or the additives. The way researchers can get round this is by all the subjects in research study being put on a gluten-free diet, and then the control group is given capsules to take every day with gluten in, while the treatment group takes identical capsules with no gluten in.

Good quality studies are expensive, need a lot of planning, and a lot of people with ASD or parents of children with ASD being willing to make dramatic changes to

their diet, and giving up their time for assessments and observations. This is why there is not enough good quality evidence! There is research like this planned for some diets for ASD but it will be a few years before we have the results.

Here is a summary of some of the most popular 'diets' and some of the theories and research that has been published so far.

Gluten-free and casein-free diet

Involves: Avoiding gluten and casein. Gluten is a protein contained in wheat, barley and rye, and there is a similar protein that should be avoided in oats. Bread, pizza, pasta, pastry, biscuits, some breakfast cereals, and some processed foods contain gluten. Casein is a protein in cow's milk and similar proteins that should be avoided are in goat's and sheep's milk. Yogurt, cheese, butter, some margarines, ice-cream, milk chocolate, biscuits, and some processed products contain casein.

Theory: People with ASD have a gut which is abnormally 'leaky', that lets poorly digested casein and gluten proteins into the blood stream, which then affect mental function, and influence behaviour - almost like morphine and other 'opioid' drugs.

Evidence Although some research has found an increased 'leaky gut' for a particular starch in a small number of children with ASD (43% of a sample of 21 had an increased intestinal permeability for lactulose compared to none in 40 controls), this does not mean that the gut is more 'leaky' for the larger peptides.

There is no evidence showing that the leaky gut exists or that people with ASD have proteins in their bloodstreams from food that affect their brain function.

Studies have demonstrated improvements in communication and cognitive function, with regression on dietary challenge [i, ii]. The only paper to meet the inclusion criteria of a Cochrane review is a randomised control study which found a significant reduction in "autistic traits" in the diet group compared to controls [iii]. The Cochrane review found insufficient evidence to recommend GF/CF diets in the treatment of ASD, but acknowledged that it is an important area of future investigation.

About urine tests: Some non-profit organisations in the UK offer urine tests with the theory that they show abnormal casein and/or gluten derived peptides (broken-down protein) in the urine. There is no quality published data to support this. Reports that the levels of another peptide seen in this analysis - indolyl-3-acryloylglycine (IAG) - were higher in people with ASD than in the wider population have been discounted [iv].

Exclusion of phenolic compounds and foods high in salicylates

Involves: Exclusion of a wide range of foods including cheese, chocolate, tomatoes, oranges, bananas, yeast extract, some food colourings and many other fruits and vegetables.

The theory: That some individuals lack the enzymes needed to break down compounds in these foods, so their consumption may inhibit the body's usual

sulphation detoxification pathways [v], and lead to raised levels of neurotransmitters such as serotonin.

The evidence: A very small study found a group of 20 children with ASD to have a worse 'sulphation capacity' than a control group [14]. Whether this relates to diet has not been investigated. There is no evidence to suggest that avoiding these foods is beneficial.

Exclusion of various food additives

Involves: Avoiding a wide range of food additives, which commonly include colourings (E100- E199), the flavour enhancer monosodium glutamate (MSG, E621), the sweetener aspartame (E951), flavourings (not given E-numbers), benzoate preservatives (E210-219) and caffeine.

The theory: That people with ASD are intolerant to these additives, which affects their behaviour.

The evidence: There is no evidence that people with ASD should avoid food additives. All food additives are regulated by the government for safe use in the UK, but some people show intolerance to individual or groups of food additives numbers. There have been studies of mixed quality for the following additives - *Aspartame* - has been linked with worsening of depression [vi], altered brain activity in people with epilepsy [vii], and migraine [viii, ix, x]. All the information on the internet claiming aspartame to be highly toxic have been unproven.

Monosodium glutamate (MSG, E621) - One paper links the intake of the flavour enhancer MSG with migraine [xi].

Artificial colours and benzoates - A double blind placebo controlled trial of 400 healthy preschool children found an increase in hyperactive behaviour when given a drink of sunset yellow (E110), tartrazine (E102), carmoisine (E122), and ponceau 4R (E124) and sodium benzoate (E211) compared to placebo [xii]. A meta-analysis of 15 double blind placebo controlled cross-over trials reported that removing artificial food colours is 30% to 50% as effective in improving ADHD symptoms as stimulant medication, without side effects [xiii].

Yeast free diet

Involves: There is no standard 'yeast free' diet, but it often excludes natural and refined sugars (including fruit), fermented foods such as breads, vinegar, alcohol, cheese, soy sauce, coffee and processed meats.

The theory: Eating less yeast and sugar reduces the growth of yeasts in the gut, which in theory make the gut more leaky and make an individual suffer from intolerances.

The evidence: There have been some scientific reports that **some** children with autism have more unfriendly bacteria in their gut (increase in amount and number or upper and lower intestinal clostridia species) [xiv]. Overgrowth of these unfriendly bacteria and yeasts can cause gut problems.

Yeast overgrowth in the gut is usually identified by a doctor and then treated by prescribed medications. There is **no evidence** that eating less sugar and dietary yeasts (which are not the same as gut yeasts) helps.

Ketogenic diet

Involves: Eating a diet very low in carbohydrates (such as bread, rice, sugars, pasta, potatoes)

The evidence: A well designed pilot study of 30 children with ASD found improvements on the Childhood Autism Rating Scale in all 18 who tolerated the diet. For 10 children, the improvement was average to significant [^{xv}].

Warning: Don't try this one without the support of an experienced dietitian, and regular check-ups from a doctor. Ketogenic diets can have side-effects of kidney stones and severe constipation.

High doses of vitamin B6 and magnesium supplements

The theory: Individuals with ASD have an impaired ability to convert Vitamin B6 to pyridoxal-5-phosphate, an active cofactor for (amongst other things), the formation of key neurotransmitters, and so need high doses to correct this.

The evidence: A study of 35 children with ASD found them to have 75% higher plasma levels of total vitamin B6 than 11 "typical children" [^{xvi}]. None of each group

was on supplements. A study of 34 children with ASD found significantly lower plasma concentrations of magnesium compared to 14 control subjects [xvii]. There is some weak evidence for improvement in ASD behaviour following high doses of vitamin B6 and magnesium, but well respected independent reviews (Cochrane) of the evidence have found that these studies were inadequately designed and too small to make any recommendations [xviii].

Warning: The doses of vitamin B6 used by some researchers (15-30mg/kg/d or 700-1000mg/d [xix, xx]) exceed the safe upper limit for vitamin B6 (10mg/d). Long term doses above 200mg/d have been associated with neuropathy, low serum folic acid, night restlessness and rashes, and over 2000mg/day can cause nerve damage. In most, but not all reported cases, the damage has been reversible [xxi]. It would be particularly ill advised to give high doses of vitamin B6 to children who are unable to communicate feelings of neuropathy.

Supporters of vitamin B6 therapy say that the side effects of neuropathy are rare and that taking magnesium at the same time (10-15mg/kg/d or 380-500mg/d) reduces side effects. They hypothesise that the therapeutic effect of B6 and magnesium is due to an abnormal metabolism or a deficiency and advise that if no improvements are seen within 4 weeks, therapy is unlikely to help and should be stopped.

Essential fatty acid supplements

The theory: That omega 3 rich supplements (such as fish oils) improve the composition and function of the phospholipid bilayer in cell membranes and have a subsequent effect on nerve transmission and brain function [xxii.] Families are advised to wait 3 months to see any improvements in behaviour or function as oils take time to build up in the fatty tissue.

The evidence : researchers have found abnormal levels of plasma phospholipid fatty acids [xxiii] and fatty acids in red blood cell membranes [xxiv] in individuals with autism compared with controls. Similar abnormalities have been reported in dyslexia [xxv], ADHD [xxvi] and mood disorders [xxvii]. In one group, the abnormal levels of highly unsaturated fatty acids (HUFAs) were linked to abnormal levels of a phospholipid enzyme, which resolved with eicosapentaenoic acid (EPA) supplementation [xxviii] . There is some evidence that omega 3 fat supplements improve other neurodevelopmental disorders such as mood disorders [xxix, xxx], learning difficulties [xxxi] and developmental coordination disorder [xxxii]., but none specifically for ASD. There is only one published case study describing the positive impact of fish oil on a patient with ASD [xxxiii], and no there are no randomised controlled trials.

Some organisations advocate the use of hemp oil rubbed into the skin as a therapeutic option, but there is no evidence for this.

Vitamin C supplements

The theory: That high doses of vitamin C have effects on the dopaminergic neurotransmitters in the brain.

The evidence: Researchers in the USA reported improvement in sensory motor symptoms in a double blind placebo controlled trial of 20 children with autism given high doses of ascorbic acid (8g/70kg/day) [xxxiv].

Warning: High doses of vitamin C can be harmful. The recommended daily amount is 40mg per day.

Vitamin A supplements

The theory: That in autism there is a disruption of the G-alpha protein, affecting retinoid (vitamin A) receptors in the brain.

The evidence: Two case studies report improvements of social skills after treatment with natural cis forms of vitamin A in cod liver oil [xxxv]. At a cost this protocol can be obtained from the website for use by paediatricians [xxxvi].

Warning: High doses of vitamin A can be harmful. The recommended daily amount is 0.7 mg a day for men and 0.6 mg a day for women.

Dimethylglycine (DMG) supplements

The evidence: this non-essential amino acid (also known as pangamic acid, calcium pangamate and 'vitamin B15') is anecdotally reported to improve behaviour and communication in some children and adults with ASD in doses of 60-600mg/d. A double blind placebo controlled crossover pilot study of low dose DMG and placebo in 8 autistic males did not find any significant differences [xxxvii].

Diets for which there is no published evidence

Feingold diet

This involves the elimination of artificial colourings, flavourings and preservatives, aspartame and salicylates [xxxviii].

Rotation diets

This involves the avoidance of eating the same food again within a number of days, e.g. three to five days.

The body ecology diet

This advocates eating a diet of foods that are kept as close to their natural state as possible, with gluten excluded, and number of special foods that are purported to re-establish the intestinal flora and heal the body, such as fermented coconut juice and raw butter [xxxix].

The Specific Carbohydrate Diet™

This advocates the elimination of grains, sucrose and lactose with the theory that this will modify intestinal bacteria growth [x^l]. This is a very restrictive diet which can be very imbalanced nutritionally

Probiotics

Commonly taken as yogurt drinks or powders, but no evidence for use in ASD treatment.

Conclusion/disclaimer. Striving towards a healthy balanced diet is recommended for all children. There is no particular diet or supplement that is known to help with ASD. And although it is possible that some dietary changes help some individuals, there is no evidence yet to know which individuals might benefit from trying which interventions. Dietary changes can be difficult to achieve, expensive, and possibly harmful to the health. Long-term dietary changes such as those common for the treatment of ASD can result in nutritional deficiencies, growth stunting, worsening of faddy eating, and some supplements could cause damage. However, doctors and dietitians should be are open to supporting individuals or parents that wish to try different dietary interventions.

It is wise to only make dietary changes under the supervision of a professional with adequate knowledge of diet, nutrition and health of children. Please beware of often well-meaning but inadequately regulated and often inadequately trained nutritionists/ nutritional therapists/ or other self-styled nutrition experts, particularly when dealing with the diets of children under 5.

To read more about diet and autism see www.NutritionNutrition.com/autism.html

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