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Autism: Nutritional Intervention

Autism is a complex metabolic disease affecting multiple organ systems. As such, nutrients are the core of the biomedical intervention to help alleviate autistic symptoms and, in some cases, restore the health of children with autism. Today, one in one hundred and fifty children are affected by autism, and most of them (3 out of 4) are boys.

In order to enlighten parents of the role of nutrition in treating autism, and how dietary changes, vitamins, and nutritional supplements benefit their children it is important to explain the causes of autism and the body chemistry problems that occur as a result of this disease. Autism is a multi-faceted disorder that may affect any and sometimes all of the major systems of the body [1]. Which system is affected depends on the biochemical individuality of each child. The more systems affected, the more severe the form of autism.

With this in mind, the nutritional intervention for each child may vary. What might prove to be effective for one child may not be effective for another. The biochemical pathways affected have guided researchers and Defeat Autism Now! clinicians to conclude that specific nutrient deficiencies are a common denominator for these children. Furthermore, the specific dietary interventions that have positive effect on autistic children are related to the biochemical pathways affected.

Once considered as an untreatable disease, autism is today treatable with nutritional intervention. As a result, there have been many reported cases of children that have recovered and their diagnosis of autism has ceased to exist.
CAUSES OF AUTISM

Autism is a condition often characterized by a failure to bond, lack of social interaction, avoidance of eye-to-eye contact, difficulties in language development, and repetitive behaviors known as “stimming” (self-stimulation) [1]. Attention Deficit Disorder (ADD), Attention Deficit Hyperactivity Disorder (ADHD), Pervasive Developmental Disorder (PDD) and Asperger Syndrome are considered diseases within the autism spectrum.

The fact that autism is common in twins implicates genetics as a contributing factor to the disease. Specifically, the C4B gene, which controls the function and regulation of the immune system, is involved in elimination of pathogens such as viruses and bacteria from the body. A deficient form of the C4B gene has been shown to have an increased frequency in autism, ADHD and dyslexia [2]. Family histories that include autoimmune diseases are frequently found in autistic children. Autoimmune disorders such as rheumatoid arthritis, insulin-dependent diabetes (type I), psoriasis, hypothyroid disease, lupus, and rheumatic fever are significantly higher in the family histories of autism-spectrum children than in typical children [3]. Children have shown an increased risk for autism if the mothers had asthma or symptomatic allergies during the second trimester of the pregnancy [4]. It has been well established that genes are influenced by environmental factors and truly understanding the genetic factors involved in autism requires understanding of the impact of the environment on the genetic code [5, 6, 7, 8].

Exposure to toxic chemicals and heavy metals during fetal development and after birth increases the risk of autism in genetically predisposed children. Toxic chemicals are found in contaminated water, breathing air inside the home and outdoors, foods, and amalgam dental fillings. Polychlorinated biphenyls (PCBs) and organophosphate pesticides are neurotoxic. A combination of neurotoxicants and genetic factors may account for nearly 25% of developmental problems [2]. Vaccinations containing live viruses are a heavy burden
for the infants’ immature immune system. In particular, the strains of the measles virus contained in the combined vaccination of measles, rubella, and mumps (MMR) has been linked to gastrointestinal disease in autistic children [9, 10]. Dr. Andrew Wakefield, gastroenterologist and researcher at the Royal Free Hospital in London, has described this gastrointestinal disease of the GALT (gut-associated lymphoid tissue) as measles enterocolitis [11, 12, 13]. The pertussis vaccine virus strain has also been implicated in autism. Furthermore, the methyl mercury (Thimerosal) contained in certain vaccines is another factor that contributes to the heavy metal toxicity of autistic children.

Immune dysregulation is common in autistic children. The environmental insult of a genetically susceptible child, such as exposure to mercury and to the weakened viruses in vaccines, stimulates an immune response by which not only the actual antigens are attacked but also the look-alike antigens. These look-alike antigens are actually molecular structures within the child’s brain. Autistic children have been found to contain autoantibodies to a central nervous system protein known as myelin basic protein (MBP) [14]. Clinical data has also established the etiological significance of viral infections in autism. Various herpes viruses are associated with verbal impairment, seizures, demyelination, and other autism-spectrum traits [1].

An enzyme vital for the digestion of gluten (contained in wheat, rye, oats, and barley) and casein (a milk protein) seems to be missing in most children with autism. This could be contributed to genetic reasons or the enzyme may be inactivated due to an autoimmune mechanism. The lack of this enzyme (DPP-IV) allows the accumulation in the body of dipeptides that resemble the chemical structure of opium or morphine. The body’s reaction to these dipeptides, called dermophins, is the same as with opium or morphine. This is why children with autism appear dazed and live in their own inner worlds. The consumption of gluten and casein by children lacking the DPP-IV enzyme causes inflammation of the
gastrointestinal tract and impairment of the immune system. This gastrointestinal status disrupts the intestinal flora and allows invasion by fungi, especially the yeast of the Candida species. As these species of yeast multiply, they excrete toxins, which further impair the central nervous and immune systems of these children. One of the effects of mercury toxicity is that it destroys components of the immune system (leukocytes and neutrophils), white blood cells that normally protect against fungi and bacteria.

Metallothionein (MT) is a protein involved in: (a) the regulation of zinc and copper levels in the blood; (b) detoxification of mercury and other toxic metals; (c) development and functioning of the immune system and brain neurons; (d) production of enzymes that break down casein and gluten; (e) response to intestinal inflammation; and (f) modulates behavior control, emotional memory, and socialization in the hippocampus region of the brain. It has been theorized that the marginal or defective functioning of MT of susceptible children that have had an environmental insult may be one of the primary causes of autism.

**BODY CHEMISTRY PROBLEMS IN AUTISM**

The chemistry of human metabolism is a complex process in which chemical reactions are involved in various interconnecting pathways. The importance of these pathways is indicated by the fact that death may occur if one step is missing or injured. Furthermore, the study of these pathways in autistic children has resulted in the diverse biomedical treatments available today.

Disruption of the metabolism of methionine has implications not only for autism and attention problems but also for cardiovascular disease, cancer, and Alzheimer’s disease. Methionine is an important amino acid provided by the diet that goes through transformations that end with two precious components of body chemistry: methyl (single carbon groups for building, activating, deactivating key molecules such as neurotransmitters, DNA, and RNA)
and thiol (small sticky molecules for detoxification and for holding the shape of big molecules). In many autistic children, both branches of the methionine path are broken [15]. The body depends on a constant supply of methionine. When it is not immediately available from food, a recycling mechanism exists. An intermediate molecule along the methionine pathway to thiol is the amino acid homocysteine. Homocysteine is the branch point in the path where methionine can be recycled by getting its methyl group back and converted back to methionine. The donor of the methyl group in this step is a form of vitamin B12 called methylcobalamin or methyl-B12, which works with an enzyme called methionine synthase in the conversion of homocysteine back to methionine. It is this step that is commonly damaged in autistic children. As a consequence, their bodies’ supplies of methionine run short. Furthermore, there is a shortage of the sticky thiol molecules at the end of this pathway. The most important of these sticky thiol molecules is reduced glutathione (GSH), which is one of the body’s chief detoxifying molecules and the keeper of the body’s healthy redox (reduction-oxidation) potential – which, in turn, results in a low level of oxidative stress. Moreover, with GSH in short supply, the mechanism by which methylcobalamin gets its methyl group becomes impaired. The impairment of the methionine pathway to methyl affects all the methylation reactions of our metabolism, which involve the transfer of a methyl group from one compound to another. These methylation reactions are required for many of the most vital pathways: the building or repair of every cell in our body, the silencing or activation of genes, the silencing of viral genes, the
methylation of the dopamine receptor in order to bind with dopamine (a process that transforms lipid membranes, changes the frequency of brain waves, and increases our attention), production of myelin (the nerve insulating substance which ensures accurate and efficient message transmission). Anti-myelin antibodies are frequently found in children with autism and the levels of these anti-myelin antibodies correlate with their levels of anti-measles antibodies, raising speculation that a chronic measles infection of the nervous system may be one cause of autism [1]. A person with impairments in methylation is likely to be more susceptible to viral infection and to adverse reactions to live viral vaccines.

Methylation is involved in the proper functioning of the neurotransmitters and the production of melatonin. A person who is less able to methylate may present with inflammatory conditions (eczema, colitis, asthma, arthritis) as the production of glutathione, our body’s primary antioxidant, requires methylation. Furthermore, chronic inflammation and the associated tissue damage may lead to an autoimmune disease. One of the effects of partially digested gluten and casein is damage to the process of methylation.

**IT ALL STARTS IN THE GASTROINTESTINAL TRACT**

The majority of autistic children have digestive tract problems: malabsorption, maldigestion, gut pathogen overgrowth (fungal, bacterial, and viral), alternating diarrhea and constipation, abnormal intestinal permeability as well as abnormal amounts of gas, belching, and foul smelling stools.

During the first two years of life, a genetically predisposed child is exposed to environmental toxins, initial vaccinations, heavy metals, antibiotics all of which contribute to the damage of the digestive tract and its flora. Gut flora is a respectable medical term for the different species of bacteria and a few fungi that inhabit our digestive tract. In fact, there are 500 or so different kinds of germs inhabiting the mouth, esophagus, stomach, and small and
large intestine. The gut flora can be viewed as very much a body organ, with their own complex metabolism and their own capacity for health and disorder, just like our tissues. Scientific reports attest to the complex interaction between this flora and our immune system, hormone balance and nutritional status [16].

As the intestinal tract represents an important barrier between external pathogens and our internal organs, nature has incorporated a number of immune mechanisms into the epithelium, the Gut Associated Lymph Tissue (GALT). It is this gastrointestinal-immunological system that is then affected, followed by increased gut permeability and absorption of food-derived peptides and antigens that enter the blood.

Anomalous live virus exposure through the MMR vaccine with persistence of the measles vaccine virus in GALT and the central nervous system (CNS) are followed by gastrointestinal and immunological, and CNS signs and symptoms all of which are indications of inflammation and disorder.

In light of the known-gut-brain connection as established in other diseases (such as celiac disease and hepatic encephalopathy), it is possible that the neurological effect could be secondary to a widespread immune activation that started in the gut combined with an injury from neurotoxic compounds derived from food substances and abnormal bowel flora. In his book *The Second Brain*, Michael Gershon, MD, states, “If you are seeking the cause of harm to the brain or other tissues of the body, you need not necessarily find a harmful substance in the brain or other tissues. It is sufficient that a substance harms the gut, which by its nerve-connection to the rest of the body can evoke harm elsewhere”. With this in mind, it is not surprising that the therapy of autistic children starts with the treatment of the gastrointestinal tract, which has a direct effect on the brain.
Diet alone is not enough for autistic children as they have specific, elevated needs. To achieve a therapeutic effect from nutrition, relatively high levels of specific nutrients are required. These high levels are generally not attainable just from the daily diet.

Detoxification embraces all of the ways by which a person is exposed to, recognizes, processes, and eliminates noxious substances [16]. The detoxification capacity of the autistic child is severely compromised. The combination of the detoxification nutrients required by each individual child differs and is dependant on the symptoms exhibited. Laboratory evaluations, such as the urinary organic acid test, assist in determining specific nutrients required in each case that may not be determined due to lack of symptoms. The defective immune system in autism can be supported with many nutrients.

The immune system is intimately related to the gastrointestinal tract. Removing foods that are toxic to the child is a priority and providing essential nutrients to counteract the deficiencies follows. Anything that enhances the immune system also combats yeast overgrowth.

**Nutritional deficiencies identified in autistic children:** According to a Defeat Autism Now! study on the nutritional status of autistic children, most autistic children demonstrate the following abnormalities [17, 18]:

- Low vitamin B6 levels and poor B6-binding combined with low or low-normal amounts of intracellular magnesium
- Low intracellular zinc
- Low blood levels of vitamin A and D
- Low biotin, vitamin B1, vitamin B3, and vitamin B5 function (according to microbiological assays)
- Low urinary vitamin C
- Low red blood cell membrane levels of eicosapentaenoic acid (EPA)
- Elevated red blood cell membrane levels of arachidonic acid (one cause of inflammation)
- Low levels of taurine (vital to nerve cells)
- Elevated casomorphine and gliadomorphine levels (opioid peptides)
- Elevated urinary yeast metabolites
- Elevated IgG antibodies to milk
- Imbalance of the bacterial flora of the gut

In addition many autistic children demonstrate:

- Low serum selenium (50% of subjects)
- Low folate and vitamin B12 on microbiological assay
- Elevated red blood cell membrane trans fatty acid levels
- IgG antibodies to grains
- Elevated urinary bacterial metabolites (50% of subjects)
- Overly acidic stools

Other studies have revealed that a large number of autistic children are deficient in zinc, vitamin B6, and GLA, as well as low methionine levels.

*The use of specific nutrients:* The individuality of each child determines the nutrients required to aid in the healing process. However, there are certain nutrients that are beneficial to all children with autism. These nutrients are: probiotics, enzymes, vitamin B12, vitamin B6 and magnesium, vitamin C, vitamin E, vitamin A, vitamin D, zinc, omega-3 fatty acids (EPA and DHA), gamma linolenic acid (GLA), dimethyl-glycine (DMG), and folinic acid. The damaged metabolism of the autistic child fails to convert certain nutrients to their useful forms. As a result, the forms of the nutrient to be used are, in many cases, specific.

*Probiotics:* For most autistic children with intestinal challenges, probiotics are important in bringing the diseased gut back to health. An extremely large amount of probiotics are
required to crowd out the yeasts and bacteria, especially Clostridia. Probiotics are effective in reducing allergic symptoms, regulating bowel function, and enhancing the immune system. Probiotics directly interact with the immune system to help immunological defenses: down-regulate pro-inflammatory cytokines and up-regulate anti-inflammatory cytokines, modulate gut-associated lymphoid tissue endogenous flora, enhance IgA production, and positively influence the gut immunological barrier. There is also scientific support regarding the ability of probiotics to detoxify methyl mercury by sequestering it and propelling it along the gastrointestinal tract toward elimination [19].

**Enzymes:** The most frequent enzyme problems are: (1) deficiency of the DPP-IV enzyme, which breaks down gluten and casein; (2) deficiency of lipase enzymes, which break down fat; (3) deficiency of carbohydrate-digesting enzymes, which break down complex dietary sugars. Incomplete breakdown of gluten and casein, fatty acids, and complex carbohydrates can result in partially digested molecules including neurotoxic peptides. These peptides can then trigger neurological decline and behavioral disorders. Enzymes play a decisive role in food absorption from the gut to the bloodstream and are essential in the transport of nutrients. Enzymes, taken with food, act as digestive enzymes that assist in the proper breakdown of protein, carbohydrates and fat. When taken between meals, enzymes assist with immune imbalances, heavy metal toxicity and inflammatory conditions having the ability to act on proteins that are foreign to the body, including viruses.

**Vitamin B12:** The complexity of vitamin B12’s absorption from the digestive tract together with the inability to convert this vitamin to its useful form, calls for this vitamin to be given in the form of injectable methyl-B12 or methylcobalamin. In this form, it is critically important for achieving detoxification from heavy metals by enhancing the process of methylation and reduced glutathione formation. The primary way that methyl-B12 helps methylation is by enabling homocysteine to be recycled to methionine. Enhanced
methylation also improves cell membrane function, neurotransmitter and hormone metabolism, and neuronal healing. It is important to note that methyl-B12 is not administered to treat a deficiency, but to bypass metabolic blocks, and to jump-start metabolic processes and neuronal healing.

*Vitamin B6:* Pyridoxal 5-phosphate (P5P) is the active form of vitamin B6. Clinical studies have shown beneficial effect for autistics with large doses of vitamin B6. Among the therapeutic effects of vitamin B6 are: (1) improvement in methionine metabolism (an important factor for methylation); (2) relief from seizures, particularly those triggered in part by an excess of the amino acid glutamate, or by a deficiency of the neurotransmitter GABA; and (3) remediation of a deficiency of the enzyme decarboxylase, which is involved in a syndrome characterized by poor eating during infancy, irritability, sleep disturbances, developmental delays, poor muscle tone, and rolling of the eyes.

*Magnesium:* For autism, magnesium is best used in conjunction with vitamin B6. When used alone, neither is as effective as are both when used together. Magnesium is important in methylation and sulfation, the processes that corrects heavy metal overload, because it helps to activate certain key enzymes. This magnesium-assisted process of methylation is also important in neurotransmitter and hormone metabolism. Magnesium is also one of the best minerals for restoring sulfation, which is commonly impaired in autistics.

*Vitamin C:* Vitamin C has many beneficial effects in autistic children: (1) neutralizes harmful oxidants and it can regenerate vitamin E; (2) when ascorbate participates in oxidant-quenching reactions, the resulting forms of ascorbate (ascorbate radicals) are relatively harmless because they are neither strongly oxidizing nor reducing – oxidized ascorbate is easily recycled back to active ascorbate by enzyme systems; (3) is a helper or promoter for the enzyme that changes dopamine into norepinephrine (noradrenaline), a very necessary step in adrenal catecholamine metabolism, which precedes methylation steps that balance
catecholamine levels; (4) is a helper or promoter for the enzyme in tyrosine metabolism that helps balance the phenylalanine-tyrosine-catecholamine system; (5) is required for efficient formation of L-carnitine (an inside-the-cell carrier of fatty acids needed for normal utilization of fats for energy); (6) assists the enzyme involved in the balancing chemistry of the peptide-hormones oxytocin, vasopressin, and cholecystokinin; (7) assists in the conversion of folic acid to folinic acid; (8) helps modulate immunity; and (9) helps decrease and prevent constipation.

*Vitamin E:* Vitamin E is an important antioxidant that: (1) potentiates the effect of methyl-B12; (2) boosts sulfation, the biochemical partner of methylation, by helping preserve cysteine, glutathione, and several enzymes; (3) helps prevent essential fatty acids from being oxidized; (4) helps restore damaged cells in the liver, especially in people with low cysteine and glutathione; (5) helps protect against the damage done by saturated and oxidized fats, which can damage brain cells and blood vessels, and can impair gastrointestinal function; (6) reduces susceptibility of children to neuromuscular diseases; and (7) helps boost immunity.

*Vitamin A:* Vitamin A is an antioxidant and an important immune booster, specific against measles. The deficiency of vitamin A accounts for some of the vision problems that are common in autistic children. The deficiency affects the cones and rods of the eyes, and contributes to the tendency of autistic children to rely upon their peripheral vision. This reliance – the classic autistic sideways gaze – often results in poor eye contact.

*Vitamin D:* Vitamin D appears to have the ability not only to increase immune activity, but to modulate it, and keep it within a proper range of activity. This helps to avoid autoimmune assaults upon the body. This vitamin also helps to avoid inappropriate immune reactions such as those involved in allergy.

*Zinc:* Zinc is vital for proper cognitive function, but it is typically deficient among autistics. Zinc deficiency affects a range of functions including growth, immunity, and brain
development. It impairs digestion, methylation, and the immune response. In addition, it can contribute to excessive levels of copper, which can be neurotoxic. Zinc deficiency often occurs because of gastrointestinal dysfunction, which is then exacerbated by low zinc, in a destructive cycle. This cycle is common in autistics.

**Omega-3 fatty acids:** The two long-chain omega-3 fatty acids EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) are linked with many aspects of neuronal function, including neurotransmitter function (particularly dopamine), membrane fluidity, ion channel and enzyme regulation, and gene expression. DHA is the predominant omega-3 fatty acid in the brain, linked to development of both visual and auditory processing systems. EPA modulates the activity of the immune system through modification of the production of cytokines; it is known to shift the balance of the immune system response from pro-inflammatory to anti-inflammatory. Omega-3 fatty acids decrease damage from oxidative stress, possibly by speeding up the repair of the injured phospholipid membranes.

**Gamma linolenic acid (GLA):** GLA is an essential fatty acid. Many autistic children have defects in fatty acid metabolism, therefore they are unable to metabolize linoleic acid to form GLA, thus compromising the body’s anti-inflammatory capacity.

**Dimethyl-glycine (DMG):** DMG is an amino acid that has extraordinary effects in detoxifying the body of heavy metals, because it is intimately involved in the methylation process. DMG is used to increase methylation ultimately enhancing the production of glutathione, which can facilitate the removal of toxins through urine. Until this conjugation occurs, many toxins – including mercury and other heavy metals – cannot be excreted, and remain in the system, unable to be removed. Eye contact and speech are the first most noticeable initial improvements that DMG offers. DMG works synergistically with folinic acid and methyl-B12.
Folinic acid: Folinic acid is the useful form of folic acid and is an important nutrient for methylation. Sometimes, folic acid blood levels of autistic children appear to be normal, but are actually low in the specific constituents that aid in methylation. The important contribution that folinic acid makes in the methylation process is to help produce methylcobalamin by attaching methyl to cobalamin. Because it is only one element of methylation, though, it needs to be taken with other nutrients that prompt methylation, including methyl-B12 and DMG.

Calcium: Calcium is necessary not only for bones and teeth, but also for cell signaling processes and hormonal messenger activities. The low levels of calcium found in autistic children are due to malabsorption due to gastrointestinal problems and low dietary intake. A casein free diet also puts the autistic child in risk for calcium deficiency.

Taurine: Taurine was one of the first nutrients to be used in autism. Taurine has several important functions: (1) it increases the effects of magnesium; (2) it is part of the metabolic process of essential fatty acid assimilation, as well as assimilation of fat-soluble vitamins, such as vitamins A, D, and E; (3) it is a powerful antioxidant; (4) it is a component of the methylation process, and may work synergistically with DMG and methyl-B12; and (5) it contains sulfur and may therefore help children with impaired sulfation.

Glutathione (GSH): Glutathione is the most valuable antioxidant of the body: it conjugates and detoxifies not just heavy metals, but also chemical toxicants; it is a very powerful antioxidant, and stops free radical damage; it protects proteins from oxidation; it helps preserve mitochondrial integrity, and protects the mitochondria from toxic free-radical damage; it promotes the production of energy units that are formed by the mitochondria called ATP; it protects the epithelial lining of the gut, and thereby helps prevents toxins from entering the system, due to leaky gut syndrome; it promotes normal T-cell function, and prevents the destruction of T-cells through the process of programmed cell death; it helps
prevent the oxidation of antioxidants, such as vitamins C and E, thereby preserving their antioxidant activity; and it activates an important enzyme in the methylation process that results in the formation of SAMe. Glutathione is low in most autistic children. Low glutathione can create disastrous consequences: reduced ability to detoxify; altered cell membrane function; poor nerve conduction; vulnerability to toxins in the brain; absorption of neurotoxic proteins; increased autoimmunity and allergy; and reduced methylation. As oral glutathione may contribute to intestinal yeast overgrowth, the transdermal form is preferred.

Coenzyme Q10: Coenzymes Q10 is a natural molecule that the body produces. It is also present in foods. It is in every cell in the body because it is needed by the energy-producing area of the cell, the mitochondria. The mitochondria, turn fuel into energy, and strongly influence how people feel and function. In autism, coenzyme Q10 is used to improve mitochondrial and energy metabolism dysfunctions. Elevated lactate and pyruvate are markers for mitochondrial dysfunction. Supplementation with coenzyme Q10 can lower these markers and result in clinical improvement.

Selenium: Selenium is valuable for autistic children because it plays an important role in the metabolism of glutathione, which is vital in the methylation process. The metabolism of glutathione appears to be subnormal among autistics, partly because mercury interferes with the ability of selenium to help promote the metabolism of glutathione. Selenium is also an important component in the immune response. It also protects cell membranes from oxidant damage, helps to spare vitamin E, and is critical for pancreatic enzyme function. Children with a low-protein diet or abnormalities in protein metabolism can become selenium-deficient.

L-Glutamine: L-glutamine is the preferred respiratory fuel for enterocytes and colonocytes. Maintaining the bioenergetics of these cells is fundamental to maintaining the integrity of the intestine. In addition, L-glutamine helps maintain secretory IgA, which function primarily by
preventing the attachment of bacteria to mucosal cells. L-glutamine may inhibit translocation of Gram-negative bacteria from the intestine into the body. Metabolic stress goes hand in hand with oxidative stress. L-glutamine can help in ameliorating oxidative stress by serving as a precursor to glutathione.

*Milk Thistle:* The active components of milk thistle are from the seed of the plant. Silymarin has hepatoprotective activity. Silymarin seems to inhibit the entrance of toxins and blocks toxin-binding sites through alteration of the liver cell’s outer membrane [20, 21]. Silymarin increases glutathione production by the liver, intestines and stomach. Silymarin is thought to exert an anti-inflammatory response via inhibition of leukotriene production.

*Grapefruit seed extract:* Grapefruit seed extracts main advantage is it's extraordinary ability to perform both (internally and externally) against a wide variety of known or unknown infections caused by viruses, bacteria, fungi and parasites.

*Oregano oil:* Carvacal, the primary component of oregano oil, can be effective against bacteria, fungi, and parasites.

*Capryllic acid:* This fatty acid has been shown to be effective against viruses and bacteria. It is also believed to be effective against yeast overgrowth.

*Olive leaf extract:* Olive leaf extract is effective against a range of infectious conditions that are caused by viruses and bacteria. It has the unique ability to stop viral replication. It can also be helpful for allergies.

*Garlic extract:* The active ingredient in garlic, allicin, is effective against infections due to bacteria, viruses, parasites, and fungi. It is also an antioxidant. Due to its sulphhydryl groups, it even has some ability to act as a natural detoxifying agent, and helps flush heavy metals from the body.

*Lauricidin:* This medicinal oil, derived from coconut, is believed to help eradicate bacteria, viruses, fungi, and parasites.
**DIETARY INTERVENTION FOR THE TREATMENT OF AUTISM**

Virtually all children must make significant changes to the diet in order to optimize physical and neurological health, and rebalance the metabolism. It is perhaps the most important element in treating autism. Changes in diet usually come before anything else. As a rule, the various restriction diets are implemented one at a time, however, other foods may need to be removed depending on the food reactions they may cause to any individual child.

Implementing these diets is not easy, as autistic children seem to be addicted to exactly the foods they need to stay away from. To complicate things further, as yeast, or candida overgrowth, is commonly diagnosed in autistic children, it is required to further restrict foods that contain yeast (such as bread) and foods that stimulate the growth of yeast (such as sugar), or that contain other forms of mold or fungus (such as cheese or mushrooms), whatever nutritional protocol is followed.

*Gluten free/casein free/soy free diet:* Scientific studies are pointing to inflammation in the gut being caused by gluten, casein, soy and other foods. Clinical experience of many Defeat Autism Now! physicians has identified the gluten free/casein free/soy free diet as the single most effective action a parent can take to begin to help their autistic child. After the successful implementation of this diet, many parents have reported that their children’s chronic diarrhea stopped and the appearance of formed stools began. They also report that their children are better able to mentally focus and show improvement in their capacity to learn as a result of the diet. Many parents report seeing physical, emotional or even cognitive improvements a few days after dairy and gluten is removed from their child’s diet.

   Gluten is present in wheat, rye, barley and oats. It is a protein and it has a sticky, gluey texture that helps give wheat products the ability to bake properly. Unfortunately, gluten is hidden in many products and ingredients. Hidden sources of gluten will not be
immediately recognizable by just reading the label of foods. For instance, many labels may state “natural and artificial flavors, food starch, malt, and vinegar”. Those are only a few ingredients that can be derived from wheat.

Foods that contain gluten are: baked beans, baking powder, barley, barley malt, barley sugar, bleached all-purpose flour, bouillon cubes/powder, bran (except rice bran), bulgur wheat, cereal, chicken nuggets, couscous, crackers, croutons, curry powder, durum wheat, enriched flour, flour tortillas, graham flour, ice-cream cones, ice-cream syrup, kamut, malt, malt extract, malt flavoring, malt syrup, malt vinegar, marzipan, mincemeat, muesli, mustard powder, noodles, oat flour, oatmeal, oats, pasta, pearl barley, pita bread, pretzels, rice malt, rye, rye flour, rye semolina, sausages, semolina, soy sauce, spelt, stuffing mixes, teriyaki sauce, vinegar, waffles, wheat, wheat bran, wheat flour, wheat germ, wheat malt.

Foods that contain casein are: Bavarian cream, butter, butterfat, buttermilk, butterscotch, caseinate, cheese, cheese powder, cheese slices, cheese spread, chocolate, condensed milk, cooking chocolate, cottage cheese, cream, cream cheese, curd cheese, curds, dried milk, evaporated milk, fudge, goat’s milk, ice cream, lactalbumin, lactalbumin phosphate, lactate acid, lactoglobulin, lemon curd, margarine, mayonnaise, milk, milk chocolate, milk powder, milk solids, mousses, nonfat milk, rennet casein, shortening, skimmed milk, sodium caseinate, sour cream, sour cream solids, toffee, whey, whey protein, whey sodium caseinate, whey sugar, whey syrup, whipped cream, yogurt.

Foods that contain both gluten and casein are: artificial cream, artificial sweeteners, baby foods, bagels, biscuits, bread, bread crumbs, bread rolls, cakes, coffee creamer, cookies, croissants, custards, doughnuts, dry roasted peanuts, gravy, hot chocolate, hot dogs, luncheon meat, malted milk, milkshakes, muffins, pancakes, pastry, pates, pies, pizza, puddings, sandwich spreads, soups: canned/packed, spam, vegetarian cheese.
Children on a gluten free/casein free/soy free diet should avoid all the foods that contain gluten, casein, or soy. Unfortunately, before things get better, they often get worse. Things can get worse immediately after the restriction begins, due to classic symptoms of withdrawal, which can be very much like those experienced by a person withdrawing from an addiction to drugs or alcohol. Immediate symptoms are: insomnia, anger and anxiety, fatigue, night sweats and day sweats, hyperactive behavior, constipation or diarrhea, clinging and whining, upset stomach, cognitive dysfunction, return or amplification of autistic behaviors. These symptoms tend to diminish gradually. For many children, the withdrawal period is a difficult time, however, it is not a good idea for parents to allow their children to deviate from their program and it would prolong the process and reawaken cravings. Even tiny amounts can cause reactions, particularly after the body has already eliminated gluten and casein.

Low Oxalate Diet: Oxalate is present in varying amounts in plants, but it is especially high in nuts and seeds and certain vegetables and fruits. This simple compound is made of carbon and oxygen and is very reactive. It likes to bind positively charged ions, especially calcium, but it also forms highly insoluble complexes with lead and mercury [1].

Whenever oxalate is present in excess, it tends to find and bind to injured tissues where it may cause pain and inflict oxidative damage, causing lipid peroxidation in the membrane, depleting the cell of glutathione, and turning on inflammatory factors. Oxalate has also been found to impair key processes in the energy metabolism in the mitochondrion of cells. People with gut inflammation absorb about seven times as much oxalate as does someone with a healthy gut. Gut inflammation and a leaky gut are common in autistic children resulting in an excess absorption of oxalate. The physiological and neurological improvements of children on a low oxalate diet has led to the hypothesis that oxalates might cross the blood-brain barrier and affect the brain. Children on a low oxalate diet show
significant improvements in areas of gross and fine motor skills, motor planning, expressive speech, cognition, and executive function.

Oxalobacter formigenes, a microbe in the gut, is responsible for the excretion of body’s excess oxalates as it uses oxalate as food so that it is not absorbed. Commonly used antibiotics easily kill this microbe. Once gone, it is very hard to populate the gut again. Food, however, is not the only source of oxalate in the body. Microbes, including candida, may actually make oxalate or its immediate precursor out of substances as ordinary as sugar (arabinose).

The goal of a low oxalate diet is to limit consumption of oxalate from foods and beverages to around 40 to 60 milligrams per day [22]. To estimate the amounts of oxalate consumed daily, foods and beverages have been divided into low, medium, and high groups based on the oxalate content of each food per serving.

Low oxalate foods contain less than 2 mg of oxalate per serving: apple cider, apple juice, apricot nectar, buttermilk, cherry juice, grapefruit juice, green tea, lemonade, lemon juice, milk, pineapple juice, cheese, milk, buttermilk, butter, margarine, mayonnaise, salad dressing, vegetable oil, avocados, bananas, cherries, grapefruit, grapes, huckleberries, mangoes, melons, nectarines, papaya, passion fruit, canned peaches, canned pears, green and yellow plums, raisins (1/4 cup), bacon, beef, fish (except sardines), ham, lamb, lean meats, pork, poultry, shellfish, barley, cereals (corn or rice), chicken noodle soup, egg noodles, English muffin, graham crackers, macaroni, pasta (plain), white rice, wild rice, cabbage, cauliflower, chives, cucumber, endive, mushrooms, peas, radishes, water chestnut, basil, cinnamon, corn syrup, Dijon mustard, dill, honey, imitation vanilla extract, jelly made from low oxalate fruits, maple syrup, nutmeg, oregano, peppermint, sage, sugar, vinegar, white pepper, gelatin (unflavored), lemon balm, lemon juice, lime juice.
Moderate-oxalate foods contain 2 to 10 mg of oxalate per serving: carrot juice, cranberry juice, grape juice, orange juice, tomato juice, yogurt, flaxseed, sunflower seeds, apples, applesauce, apricots, coconut, cranberries, mandarin orange, orange, fresh peaches, fresh pear, pineapples, purple and Damson plums, prunes, fresh strawberries, liver, sardines, bagels, brown rice, cornmeal, corn starch, corn tortilla, fig cookie, oatmeal, ravioli (no sauce), spaghetti in red sauce, sponge cake, white bread, artichoke, asparagus, broccoli, Brussels sprouts, carrots (canned), corn, fennel, lettuce, lima beans, mustard greens, onions, parsnip, canned peas, tomato, tomato soup, turnips, vegetable soup, watercress, ginger, malt, potato chips (less than 3.5 oz), strawberry jam/preserves, thyme.

High-oxalate foods contain more than 10 mg of oxalate per serving: black tea, chocolate milk, cocoa, hot chocolate, juice made from high oxalate fruits, soy drinks, chocolate milk, soy cheese, soy milk, soy yogurt, nuts, nut butters, sesame seeds, tahini, soy nuts, amaranth, buckwheat, cereal (bran or high-fiber), crisp bread (rye or wheat), fruit cake, pretzels, wheat bran, wheat germ, whole wheat bread, whole wheat flour, blackberries, blueberries, concord grapes, currents, dewberries, elderberries, figs, fruit cocktail, gooseberry kiwis, lemon peel, lime peel, orange peel, raspberries, rhubarb, canned strawberries, tangerines, beans (baked, green, dried, kidney), beets, beet greens, beef root, carrots, celery, chicory, collards, dandelion greens, eggplant, escarole, kale, leeks, okra, olives, parsley, peppers (chili and green), potatoes (baked, boiled, fried), spinach, sweet potato, Swiss chard, zucchini, black pepper (more than 1 tsp), marmalade, soy sauce, chocolate.

**Specific Carbohydrate Diet (SCD):** This diet is based upon further, stricter restriction of carbohydrates. The reasoning is the malabsorption of carbohydrates resulting in disaccharides, which consist of two sugar molecules, due to enzyme deficiencies. The undigested sugars that remain in the intestines cause a reversal of the normal nutritional process. Instead of nutrients flowing from the intestinal space into the bloodstream, water is
drawn into the intestinal lumen [23]. This water directs nutrients to be excreted via abnormal intestinal function (diarrhea) depriving the body’s cells of energy, minerals, and vitamins. Most seriously, the sugars remaining in the intestinal lumen provide energy for further fermentation and growth of intestinal microbes [23], further contributing to the inflammation of the gut.

The implementation of the Specific Carbohydrate Diet usually creates uncomfortable healing reactions as the body eliminates toxic materials and rebalances itself. These reactions occur upon initial implementation, and at two to three months, at five months, and at nine months. The adverse reactions may last for up to two weeks during which many of the unpleasant autistic traits may be seen.

Carbohydrates to be eliminated include: canned vegetables, potatoes, yams, soybeans, garbanzo beans, wheat, Bulgur, corn, oats, rye, quinoa, tapioca, virtually all grains (including some that do not contain gluten such as rice, buckwheat, and millet), canned fruits, dried fruits, jams, jellies, ketchup, roasted nuts, peanuts in salted mixtures, glazed nuts, cow’s milk, goat’s milk, soy milk, rice milk, canned coconut milk, tea, and soft drinks. Processed cheese and all processed meats should also be eliminated (hot dogs, bologna, spiced ham, breaded fish, canned meat).

CONCLUSION

Individual biochemistry dictates for various protocols to be implemented on autistic children. A child must be placed on a nutritional protocol before the biochemical abnormalities and the toxic conditions become a part of their cellular functioning. This does not mean that an older child will not benefit from such a protocol. Actually, they may show remarkable improvement even though biomedical improvement seems to take longer and may not be as
The continuous reports from parents of autistic children give hope that autism is now treatable!

References


