

Omega-3 Fats and Autism

Overview

Autism is a complex developmental disability that typically appears during the first three years of life. The result of a neurological disorder that affects the functioning of the brain, autism impacts the normal development of the brain in the areas of social interaction and communication skills. Children and adults with autism typically have difficulties in verbal and non-verbal communication, social interactions, and leisure or play activities. Autism affects an estimated 2 to 6 per 1,000 individuals (Centers for Disease Control and Prevention, 2001), meaning that as many as 1.5 million Americans today are believed to have some form of autism. The overall incidence of autism is consistent around the globe, but is four times more prevalent in boys than girls. For more information on autism, visit the Autism Society of America (<http://www.autism-society.org/>).

Summary

Although there are many anecdotal reports of omega-3 fatty acids improving the symptoms of autistic children, no clinical trials of its efficacy have yet been published. At present, although omega-3 polyunsaturated fatty acids are considered to be a promising therapeutic for autistic children (Kidd, 2002; Richardson and Ross, 2000), the best evidence currently available to support this claim comes from research showing that autistic children have lower DHA levels in blood than children with mental retardation (Vancassel, et al 2001; Bell, et al 2000). Additional support comes from evidence that low plasma omega-3 levels in boys were associated with behavior problems, temper tantrums, and sleep disorders (Stevens, et al 1996).

References

Bell JG, Sargent JR, Tocher DR, Dick JR. Red blood cell fatty acid compositions in a patient with autistic spectrum disorder: a characteristic abnormality in neurodevelopmental disorders? *Prostaglandins Leukot Essent Fatty Acids*. 2000 Jul-Aug;63(1-2):21-5.

The fatty acid compositions of red blood cell (RBC) phospholipids from a patient with autistic spectrum disorder (ASD) had reduced percentages of highly unsaturated fatty acids (HUFA) compared to control samples. The percentage of HUFA in the RBC from the autistic patient was dramatically reduced (up to 70%) when the sample was stored for 6 weeks at -20 degrees C. However, only minor HUFA reductions were recorded in control samples stored similarly, or when the autistic sample was stored at -80 degrees C. A similar instability in RBC HUFA compositions upon storage at -20 degrees C has been recorded in schizophrenic patients. In a number of other neurodevelopmental conditions, including attention deficit hyperactivity disorder (ADHD) and dyslexia, reduced concentrations of RBC HUFA have been recorded. The extent and nature of these aberrations require further assessment to determine a possible common biochemical origin of neurodevelopmental disorders in general. To facilitate this, a large scale assessment of RBC fatty acid compositions in patients with ASD, and related disorders, should be performed as a matter of urgency. Supplementing cells in culture with the tryptophan metabolite indole acrylic acid (IAA) affected the levels of cellular HUFA and prostaglandin production. Indole acryloyl glycine (IAG), a metabolite of IAA excreted in urine, is found in high concentrations in patients with neurodevelopmental disorders including ASD, ADHD, dyslexia, Asperger's syndrome and obsessive compulsive disorder. Copyright 2000 Harcourt Publishers Ltd.

Kidd PM. Autism, an extreme challenge to integrative medicine. Part 2: medical management. *Altern Med Rev*. 2002 Dec;7(6):472-99.

Autism and allied autistic spectrum disorders (ASD) present myriad behavioral, clinical, and biochemical abnormalities. Parental participation, advanced testing protocols, and eclectic treatment strategies have driven progress toward cure. Behavioral modification and structured education are beneficial but insufficient. Dietary restrictions, including removal of milk and other casein dairy products, wheat and other gluten sources, sugar, chocolate, preservatives, and food coloring are beneficial and prerequisite to benefit from other interventions. Individualized IgG or IgE testing can identify other troublesome foods but not non-immune mediated food sensitivities. Gastrointestinal improvement rests on controlling *Candida* and other parasites, and using probiotic bacteria and nutrients to correct dysbiosis and decrease gut permeability. Detoxification

of mercury and other heavy metals by DMSA/DMPS chelation can have marked benefit. Documented sulfoxidation-sulfation inadequacies call for sulfur-sulfhydryl repletion and other liver p450 support. Many nutrient supplements are beneficial and well tolerated, including dimethylglycine (DMG) and a combination of pyridoxine (vitamin B6) and magnesium, both of which benefit roughly half of ASD cases. Vitamins A, B3, C, and folic acid; the minerals calcium and zinc; cod liver oil; and digestive enzymes, all offer benefit. Secretin, a triggering factor for digestion, is presently under investigation. Immune therapies (pentoxifyllin, intravenous immunoglobulin, transfer factor, and colostrum) benefit selected cases. Long-chain omega-3 fatty acids offer great promise. Current pharmaceuticals fail to benefit the primary symptoms and can have marked adverse effects. Individualized, in-depth clinical and laboratory assessments and integrative parent-physician-scientist cooperation are the keys to successful ASD management. Richardson AJ, Ross MA. Fatty acid metabolism in neurodevelopmental disorder: a new perspective on associations between attention-deficit/hyperactivity disorder, dyslexia, dyspraxia and the autistic spectrum. *Prostaglandins Leukot Essent Fatty Acids*. 2000 Jul-Aug;63(1-2):1-9. There is increasing evidence that abnormalities of fatty acid and membrane phospholipid metabolism play a part in a wide range of neurodevelopmental and psychiatric disorders. This proposal is discussed here in relation to attention-deficit/hyperactivity disorder (ADHD), dyslexia, developmental coordination disorder (dyspraxia) and the autistic spectrum. These are among the most common neurodevelopmental disorders of childhood, with significant implications for society as well as for those directly affected. However, controversy still surrounds both the identification and management of these conditions, and while their aetiology is recognized as being complex and multifactorial, little progress has yet been made in elucidating predisposing factors at the biological level. An overview is provided here of the contents of this Special Issue, which contains a selection of reports from a unique multidisciplinary workshop involving both researchers and clinicians. Its purpose was to explore the possibility that ADHD, dyslexia, dyspraxia and autism fall within a phospholipid spectrum of disorders. This proposal could explain the high degree of co-morbidity between these conditions, their aggregation within families and relation to other psychiatric disorders, and a range of associated features that are already well known at a clinical level. The existing evidence for fatty acid abnormalities in these disorders is summarized, and new approaches are outlined that have the potential to improve both the identification and the management of these and related neurodevelopmental and psychiatric conditions.

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Stevens LJ, Zentall SS, Abate ML, Kuczek T, Burgess JR. Omega-3 fatty acids in boys with behavior, learning, and health problems. *Physiol Behav*. 1996 Apr-May;59(4-5):915-20. The purpose of the study reported here was to compare behavior, learning, and health problems in boys ages 6 to 12 with lower plasma phospholipid total omega-3 or total omega-6 fatty acid levels with those boys with higher levels of these fatty acids. A greater frequency of symptoms indicative of essential fatty acid deficiency was reported by the parents of subjects with lower plasma omega-3 or omega-6 fatty acid concentrations than those with higher levels. A greater number of behavior problems, assessed by the Conners' Rating Scale, temper tantrums, and sleep problems were reported in subjects with lower total omega-3 fatty acid concentrations. Additionally, more learning and health problems were found in subjects with lower total omega-3 fatty acid concentrations. (Only more colds and more antibiotic use were reported by those subjects with lower total omega-6 fatty acids). These findings are discussed in relation to recent findings for omega-3 experimentally deprived animals.

Vancassel S, Durand G, Barthelemy C, Lejeune B, Martineau J, Guilloteau D, Andres C, Chalon S. Plasma fatty acid levels in autistic children. *Prostaglandins Leukot Essent Fatty Acids*. 2001 Jul;65(1):1-7.

Phospholipid fatty acids are major structural components of neuronal cell membranes, which modulate membrane fluidity and hence function. Evidence from clinical and biochemical sources have indicated changes in the metabolism of fatty acids in several psychiatric disorders. We examined the phospholipid fatty acids in the plasma of a population of autistic subjects compared

to mentally retarded controls. Our results showed a marked reduction in the levels of 22:6n-3 (23%) in the autistic subjects, resulting in significantly lower levels of total (n-3) polyunsaturated fatty acids (PUFA) (20%), without significant reduction in the (n-6) PUFA series, and consequently a significant increase in the (n-6)/(n-3) ratio (25%). These variations are discussed in terms of potential differences in PUFA dietary intake, metabolism, or incorporation into cellular membranes between the two groups of subjects. These results open up interesting perspectives for the investigation of new biological indices in autism. Moreover, this might have new therapeutic implications in terms of child nutrition.

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