The Hoffman Centre for Integrative Medicine

ASU Study of Nutritional and Metabolic Status of Children with Autism

Autism Handout

Description

- A new study published in the journal *Nutrition and Metabolism* evaluates the nutritional and metabolic status of 55 children with autism spectrum disorders compared to 44 neurotypical children of similar age and gender.
- Compared to the neurotypical children, children with autism had significantly worse nutritional and metabolic status, as detailed below.

Highlights of the study

- The findings of low levels of ATP (a major fuel for the body and the brain) suggest that children with autism have impaired mitochondrial function (decreased energy production).
- The findings of lower levels of biotin and other vitamins, and biomarkers indicating increased need for vitamins, strongly suggests that vitamin/mineral supplementation would be helpful for most children with autism.
- The findings of low levels of reduced glutathione, and increased levels of oxidized glutathione, are consistent with several studies by James et. al. Glutathione is a major anti-oxidant, and a major defense against toxic metals/chemicals.
- The findings of low levels of NADPH at least partially explains the increased oxidation of glutathione, because NADPH is the co-factor required to convert oxidized glutathione to reduced (active) glutathione.
- The finding of low levels of SAMe is consistent with several studies by James et al. SAMe is the primary methyl donor in the body, and is important for methylation (activation/deactivation/modification) of DNA, RNA, proteins, phospholipids, and neurotransmitters.
- Uridine, a biomarker of methylation status, was also significantly elevated, which confirms a significant impairment in methylation. ATP is the co-factor needed to convert methionine to SAMe, so low levels of ATP likely contributes to the decreased level of SAM.
- The finding of very low levels of sulfate replicates several studies by Waring et al. Sulfate is the third most abundant mineral in the body, and sulfation is one of the major ways in which the liver detoxifies chemicals.
- It appears that children with autism cannot recycle sulfate in their kidneys (partly due to lower levels of ATP), resulting in increased loss of sulfate in the urine, and decreased levels in the body. It appears that most children with autism need substantial sulfate therapy (MSM supplements or Epsom salt baths).
- The finding of low levels of ATP, NADH, and NADPH is interesting because all are formed from ribose, and a recent study (Freedenfeld et al) found that ribose therapy and NADH therapy were each able to improve levels of ATP, NADH, NADPH, SAM, and/or ribose.

- The findings of low levels of tryptophan, an essential amino acid, suggests that children with autism would have low levels of serotonin (an important neurotransmitter) and melatonin (the hormone that induces sleep), since tryptophan is converted into serotonin and then melatonin. This suggests that tryptophan supplementation may be helpful.

- The findings of low level of lithium confirms an earlier study by Adams et al, which found lower levels of lithium in young children with autism and their mothers. Lithium is possibly an essential mineral, and low levels of lithium are associated with a wide range of psychiatric disorders, including schizophrenia and aggressive behavior. This suggests that low levels of lithium supplementation may be helpful.

- The lead author of the study, Prof. James Adams of Arizona State University, states that "This extensive study revealed many nutritional and metabolic abnormalities in children with autism. The good news is that they should all be easily treatable with appropriate nutritional supplementation." This paper is the first of several papers on a large study conducted by Arizona State University to evaluate and treat nutritional and metabolic problems in children with autism by the use of a customized vitamin/mineral supplement. The supplement used in that study has now been commercialized, and is available from www.yasooproducts.com/syndion [1]

Background [2]

- The relationship between relative metabolic disturbances and developmental disorders is an emerging research focus. This study compares the nutritional and metabolic status of children with autism with that of neurotypical children and investigates the possible association of autism severity with biomarkers.

Method

- Participants were children ages 5-16 years in Arizona with Autistic Spectrum Disorder (n=55) compared with non-sibling, neurotypical controls (n=44) of similar age, gender and geographical distribution. Neither group had taken any vitamin/mineral supplements in the two months prior to sample collection. Autism severity was assessed using the Pervasive Development Disorder Behavior Inventory (PDD-BI), Autism Treatment Evaluation Checklist (ATEC), and Severity of Autism Scale (SAS).

Study measurements included:

- Vitamins, biomarkers of vitamin status, minerals, plasma amino acids, plasma glutathione, and biomarkers of oxidative stress, methylation, sulfation and energy production.

Results

- Biomarkers of children with autism compared to those of controls using a t-test or Wilcoxon test found the following statistically significant differences ($p<0.001$): Low levels of biotin, plasma glutathione, RBC SAM, plasma uridine, plasma ATP, RBC NADH, RBC NADPH, plasma sulfate (free and total), and plasma tryptophan; also high

1 James B. Adams Presidents Professor and Program Chair School of Mechanical, Aerospace, Chemical, and Materials Engineering Arizona State

2 Nutritional and Metabolic Status of Children with Autism vs. Neurotypical Children, and the Association with Autism Severity.http://www.ncbi.nlm.nih.gov/pubmed/21651783 Adams JB, Audhya T, McDonough-Means S, Rubin RA, Quig D, Geis E, Gehn E, Loresto M, Mitchell J, Atwood S, Barnhouse S, Lee W. Nutr Metab (Lond). 2011 Jun 8;8(1):34. http://tinyurl.com/3jpv7ho

levels of oxidative stress markers and plasma glutamate. Levels of biomarkers for the neurotypical controls were in good agreement with accessed published reference ranges. In the Autism group, mean levels of vitamins, minerals, and most amino acids commonly measured in clinical care were within published reference ranges. A stepwise, multiple linear regression analysis demonstrated significant associations between several groups of biomarkers with all three autism severity scales, including vitamins (adjusted R2 of 0.25-0.57), minerals (adj. R2 of 0.22-0.38), and plasma amino acids (adj. R2 of 0.22-0.39).

Conclusion

- The autism group had many statistically significant differences in their nutritional and metabolic status, including biomarkers indicative of vitamin insufficiency, increased oxidative stress, reduced capacity for energy transport, sulfation and detoxification. Several of the biomarker groups were significantly associated with variations in the severity of autism.
- These nutritional and metabolic differences are generally in agreement with other published results and are likely amenable to nutritional supplementation. Research investigating treatment and its relationship to the co-morbidities and etiology of autism is warranted.

Reference

- Defeat Autism Now Network – June 10, 2011