

Bringing ADHD into Focus:

The ADHD-Omega Fatty Acid Connection

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Introduction to Neurodevelopmental Conditions & Neurodiversity

Neurodiversity

ADHD is included among a larger “umbrella” grouping of neurodevelopmental conditions.

Others include:

Autism

Dyslexia

Dyspraxia

Dyscalculia

Dysgraphia

Tourette syndrome



Neurodiversity

The intersection of the medical model and the social model of disability—between pathologizing and marginalizing

- + 18th-century educational paradigm: 1 in 5 were defined by what they *could not* do, rather than what they *could* do.
- + The neurodiversity paradigm *does not deny impairment* but instead counters the deficit concept of intelligence, ability, and employability.
- + “**Strength-based approach**”:
 - + Challenges limiting stigma or learned helplessness

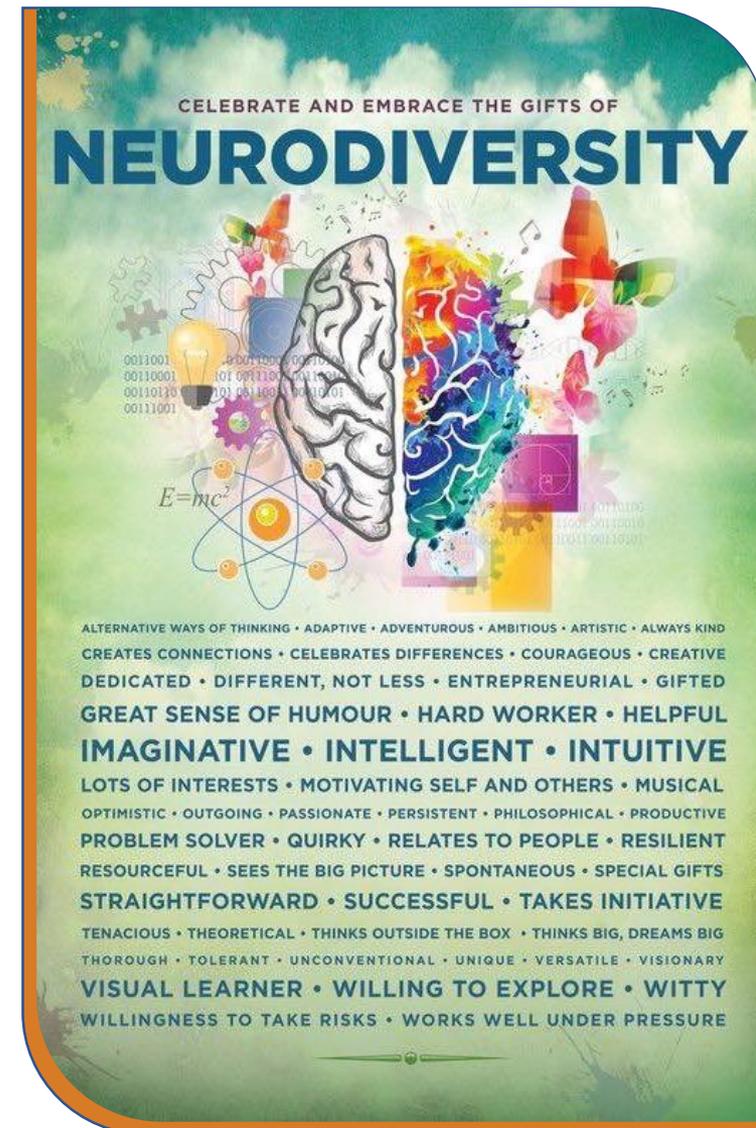


*They told me I was
different...
Best compliment they could
have given me.*

*Think differently.
- Steve Jobs*

Changing Times...

- + We are no longer ransomed by our educational qualifications.
- + We are less disabled by context:
 - + 21st-century culture
 - + Technology
 - + Employment trends
- + Increased access to knowledge and information accommodate diversity of learning, working, and connecting.



ADHD: Strengths and Challenges

Strengths:

- + Creative thinking
- + Information processing
- + Identifying visual patterns and designs
- + Drive, passion, and enthusiasm for what interests them
- + Heightened senses
- + Social and communication skills

Challenges:

- + Social and communication directness
- + Executive functioning skills
- + Rigid rules and regulations
- + Working memory and cognitive overload
- + Heightened sensory responses
- + Emotional regulation, frustration, and intolerance
- + Motivation and task initiation



Executive Functioning

May be impaired, to varying degrees, for those who have learning differences



- + Emotion and impulse control
- + Mind wandering
- + Setting goals and planning:
 - + Prioritizing
 - + Organizing
 - + Shifting/flexibility
- + Self-monitoring
- + Working memory:
 - + Holding/manipulating information
 - + Hindsight and foresight
- + Difficulty storing information long-term

As essential as biodiversity

There is an indisputable necessity to conserve diversity within the human species.

- + Neurodiversity is about **more** than inclusion...
- + It is about recognizing that human nature—human intelligence—thrives on difference, because that is the universal design of health.
- + Rebel Minds: Disruptors



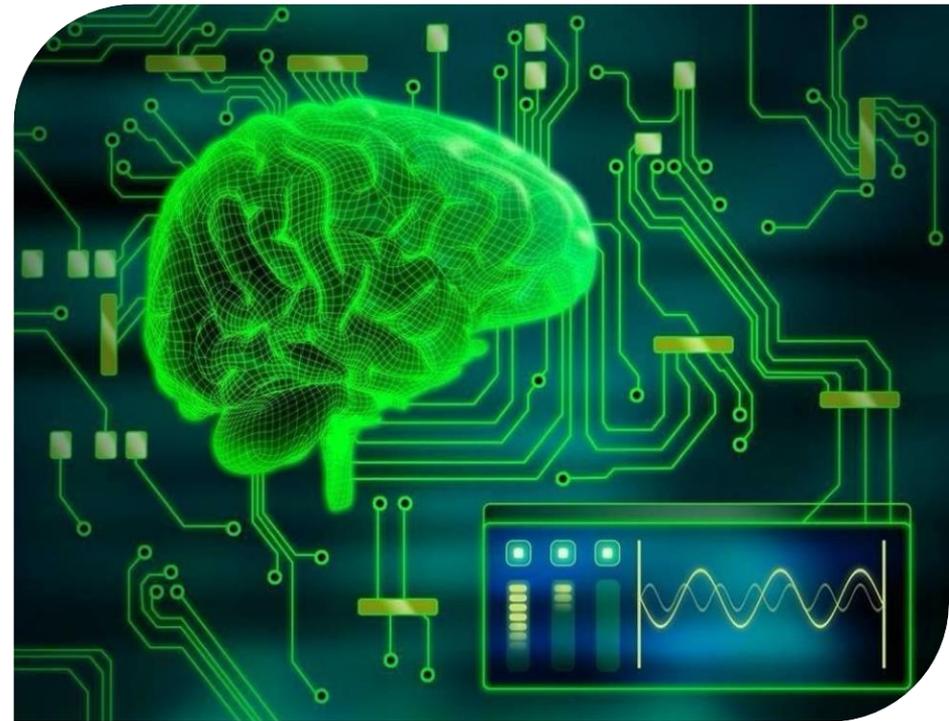
Workforce Diversity

Major growth industries—especially technology, robotics, bioscience, and media—actively recruit a diverse workforce.

Examples: Microsoft, Apple, Google, Sony, Twist Bioscience, even the UK Secret Service and GCHQ, now actively recruit neurodiverse employees.

Why?

- + Inclusion, equality, and diversity agendas
- + A competitive edge
- + Innovation
- + Creativity
- + Enterprise



What do you think? How do you think?

Is the 1 in 5 who is an entrepreneur...

...Disordered?

...Disabled?

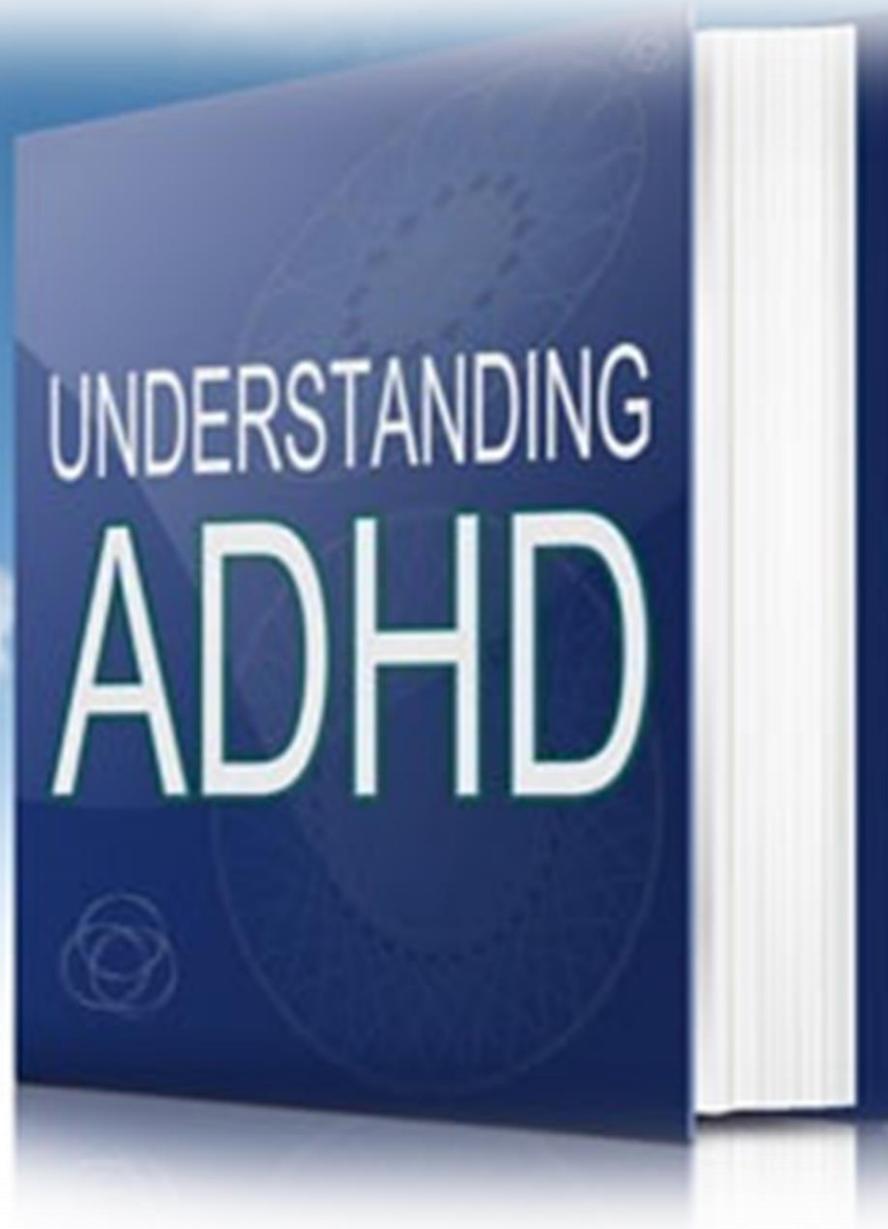
- 35% of entrepreneurs are dyslexic or have ADHD.
- In a survey of 69,000 millionaires, 40% were dyslexic.

Entrepreneurs are commonly characterized as:

- Individuals with lots of energy
- Risk takers
- Creative thinkers
- Resilient in their pursuit of goals

Any number of these individuals might be described as having “underachieved in school.” Is this the reason why so many become self-employed entrepreneurs?





ADHD

DSM 5: 3 Core Characteristics

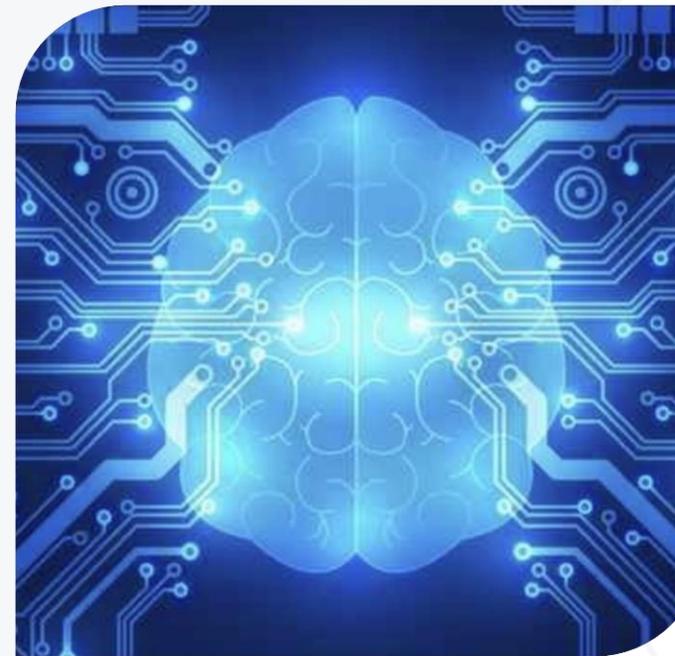
- + **Inattention:** poor concentration, poor working memory, and distractibility
- + **Impulsivity** of thought, action, words, and emotions
- + **Hyperactivity:** compulsions to move and fidget, as well as a hyperactive mind

Secondary Characteristics

- + Neurological developmental delay of approximately 2 to 3 years in children
- + Poor executive functioning skills
- + Low emotional resilience
- + Overlapping symptoms with other neurodevelopmental conditions as well as characteristics commonly associated with autism, such as sensory integration difficulties, which may be a subthreshold for secondary diagnosis

ADHD Described

- + Quantitative measure of a trait—ranging from mild to moderate or severe.
- + Occurs in all human beings but, for some, in *a more extreme form*.
- + All children can be hyperactive, impulsive, and inattentive—as such, traits must reach a certain threshold for the application of an ADHD diagnosis.
- + The 72% heritability remains from childhood to adulthood.



The Neurobiology of ADHD

Investigations into structural, functional, and chemical factors in ADHD have contributed to neurobiological hypotheses of the disorder.

Structural ^{1,2}	Functional ³⁻⁵	Chemical ⁶⁻⁸
Structural abnormalities in the ADHD brain	Specific brain networks are implicated in ADHD	Reduced catecholamine signaling in the ADHD brain
		Dysregulated dopaminergic and noradrenergic synthesis
Serotonin dysregulation is not a core feature but may modulate the severity of ADHD symptoms and comorbidities, especially anxiety, depression, OCD, aggression, and mood disorders.		

1. Proal E, et al. 2011. 2. Makris N, et al. 2007. 3. Cortese S, et al. 2012. 4. Morein-Zamir S, et al, 2014. 5. Karch S, et al. 2014. 6. Arnsten AFT. 2009. 7. Volkow N, et al. 2007. 8. Volkow ND, et al. 2009.

ADHD–Incidence and Prevalence

- + Global prevalence: 5.26% (WHO)
- + Global adult prevalence: 2.8%
- + USA: 11% in children aged 4 to 17 years; 6.1 million children
- + USA: 50% of cases persist into adulthood
- + Adult ADHD diagnoses growing 4x faster than child diagnoses in the United States
- + 26.4% increase among children compared to 123.3% among adults



ADHD—Polygenetic Aspects

- + A polygenic disorder involving multiple gene variants
- + 72% heritability of genetic variants
- + An estimated 50% of comorbidities are also attributed to genetic factors
- + Approximately 20% of individuals have ADHD “caused” by brain injury (TBI), including:
 - + Trauma caused by preterm birth
 - + Perinatal trauma
 - + Epilepsy
- + Severe sleep deprivation and breathing disorders in early childhood may present similarly to ADHD but in fact are not ADHD—rather, they are more closely linked to anxiety



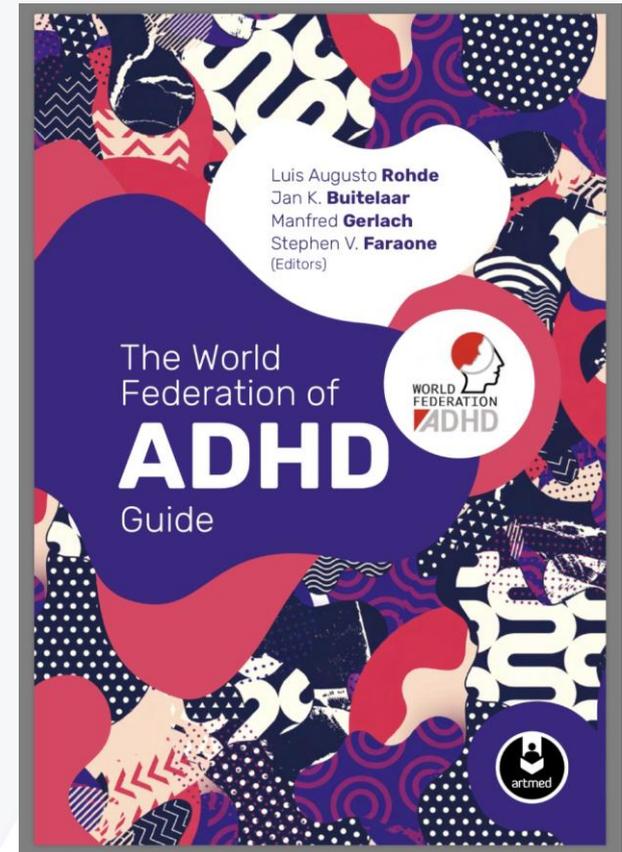
ADHD–Polygenetic Aspects

- + “There can be no doubt now that people with ADHD carry DNA variants that operate via unknown mechanisms to cause inattention, hyperactivity, and impulsivity.

Most of these variants are fairly common, such that everyone carries some genetic risk for ADHD.

This creates a polygenic genetic architecture and supports the idea that the risk for ADHD, and its expression in symptoms, is a continuously varying trait in the population. For clinicians, this means that people who come to clinic with subthreshold symptoms may carry some biological risk for ADHD even though they don't meet full diagnostic criteria for the disorder.¹

- + ADHD is inherited, and many DNA risk variants are needed before it becomes evident. The combination of DNA variants with environmental factors determines presentation.



¹Rohde LA, et al. *The World Federation of ADHD Guide*. World Federation of ADHD; 2019. <https://www.adhdfoundation.org.uk/wp-content/uploads/2019/06/The-World-Federation-of-ADHD-Guide-2019.pdf>. Accessed November 2020.

ADHD–Comorbidity

Comorbidity is the rule rather than the exception for those with ADHD:

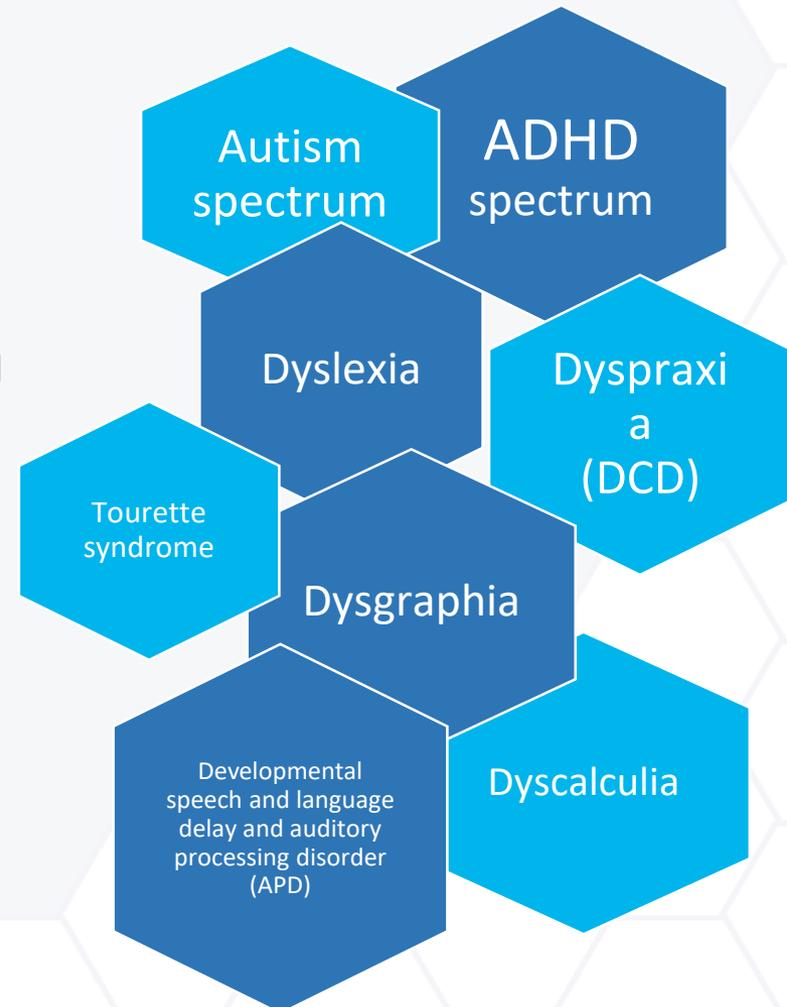
- + 13.7% have been diagnosed with ASD, with some research estimating this could be as high as 26%.
- + 1.2% have Tourette syndrome.
- + An estimated 45% have another neurodevelopmental learning difficulty.

Neurological comorbidities include:

- + Anxiety disorder, depression, conduct disorder, oppositional defiant disorder (ODD), bipolar disorder, obsessive compulsive disorder (OCD), and addiction.

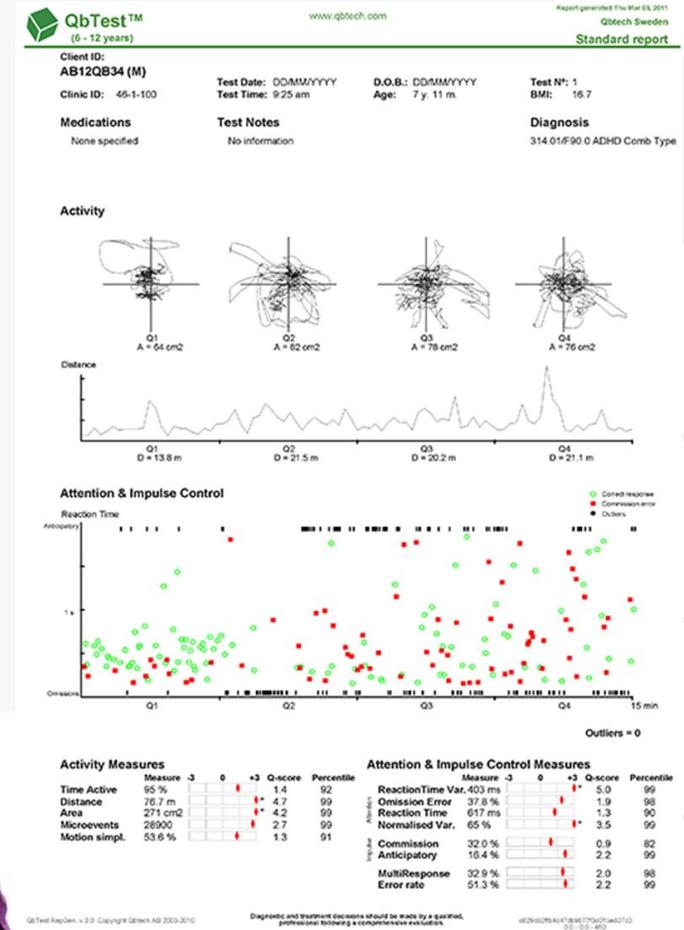
Physiological comorbidities include:

- + Migraines, hypertension, and allergies.



ADHD–Diagnosis

- + ADHD subjective observational and self-reporting rating scales
- + Computerized cognitive functioning tests, such as QB Test
- + Screening for coexisting learning difficulties, such as dyslexia
- + Family history inventory
- + Clinical interview



ADHD–Treatment in U.S.

About 75% of children with ADHD in the U.S. undergo some type of ADHD treatment.¹

31.7% of children with ADHD receive ADHD medication and behavioral treatment

- + 30.3% take ADHD medication only
- + 14.9% undergo behavioral treatment only

ADHD Medication

62% of children with ADHD are currently taking ADHD medication¹

- + 18.2% of 2- to 5-year olds with ADHD
- + 68.6% of 6- to 11-year olds with ADHD
- + 62.1% of 12- to 17-year olds with ADHD

Behavioral Health

46.7% of children with ADHD receive behavioral treatment¹

- + 59.5% of 2- to 5-year olds with ADHD
- + 51.4% of 6- to 11-year olds with ADHD
- + 41.7% of 12- to 17-year olds with ADHD

¹ADHD Statistics: New ADD Facts and Research. ADDitude.com. <https://www.additudemag.com/statistics-of-adhd/#footnote1>. Updated April 6, 2020. Accessed November 2020.

Lifestyle & Nutritional Influences

Lifestyle Influences

- + Nutritional support, especially correcting deficiencies in omega fatty acids, vitamin D, iron, and zinc
- + Attaining healthy weight
- + Daily exercise
- + Adequate sleep
- + Stress-reduction strategies

All support positive ADHD-related dopaminergic and noradrenergic functioning.



General Notice & Disclaimer: This information is for general informational purposes only and should not replace the advice of a healthcare practitioner. The information provided herein is based on a review of current existing research; SFI®Health does not accept responsibility for the accuracy of the information itself or the consequences from the use or misuse of the information.

Nutritional Support

- + A balanced diet with proportionate levels of protein to ensure the sustained release of energy is recommended.
- + Reduce blood sugar swings by including protein in each meal and snack.
- + Avoid added sugars, especially in processed foods.
- + Omega-3 and omega-6 fatty acids, commonly found in fish oil and certain plant-based sources, respectively, have been proven to be effective in helping to support brain development and are often used in conjunction with ADHD medications.



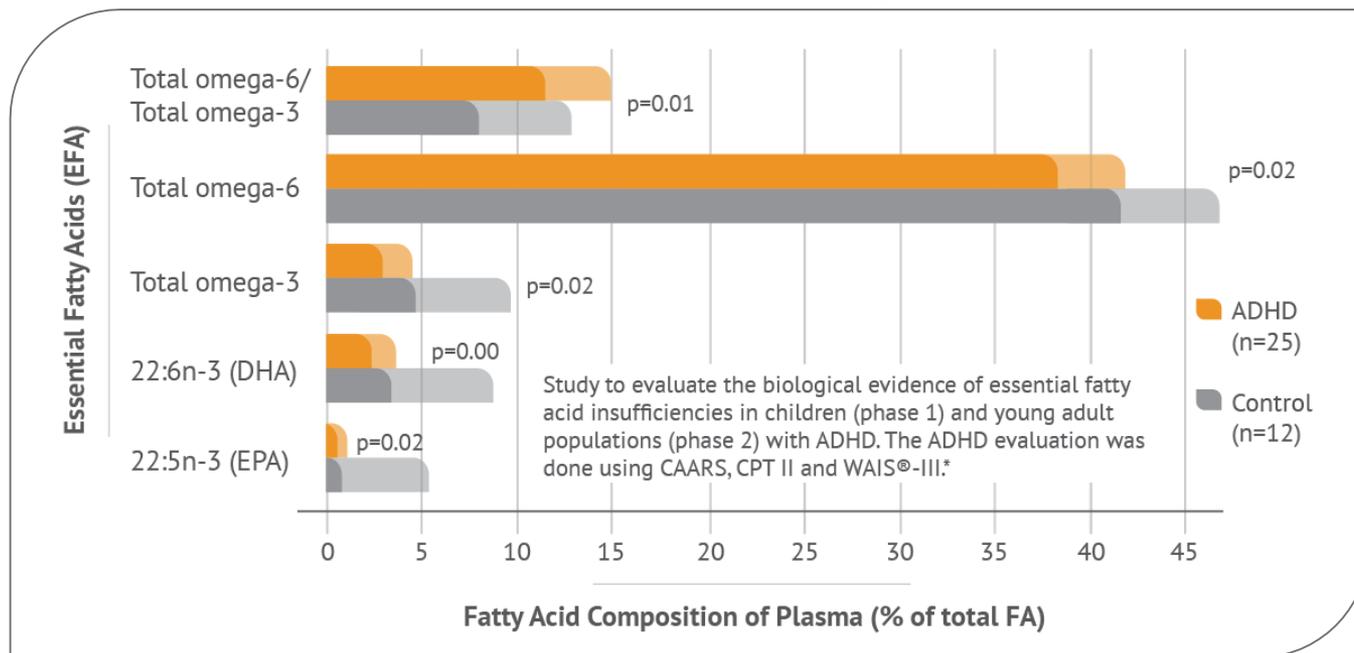
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Addressing Genetic Differences

The ADHD-Omega Fatty Acid Connection

ADHD is associated with impaired omega fatty acid balance.

Lighter color demarcates standard deviation



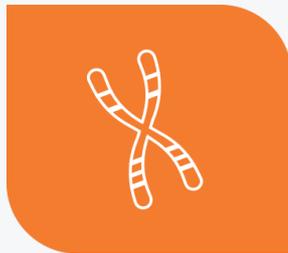
*CAARS: Conners' Adult ADHD Rating Scales; CPT II: Conners' Continuous Performance Test; WAIS®-III: Wechsler Adult Intelligence Scale®

On average, children with attention-deficit/hyperactivity disorders had:

- + Significantly smaller fractions of omega-3 and omega-6 in the blood
- + Significantly higher omega-6/omega-3 ratios

How does this occur?

The answer lies in the genes. Specific inborn genetic differences found in many individuals with ADHD can reduce the functional efficiency of enzymes that serve as rate-limiting steps for fatty acid metabolism.



FADS-1 and FADS-2 genes are found in a genetically “hot” region for ADHD (on the 11th chromosome).



These genes code for desaturase enzymes (delta-5 and delta-6) that convert essential fatty acids to long-chain polyunsaturated fatty acids.



In ADHD, different alleles can result in different forms of these enzymes, which may be less efficient at processing omega fatty acids.

EPA:DHA:GLA

in the ratio of 9:3:1 to support healthy fatty acid metabolism

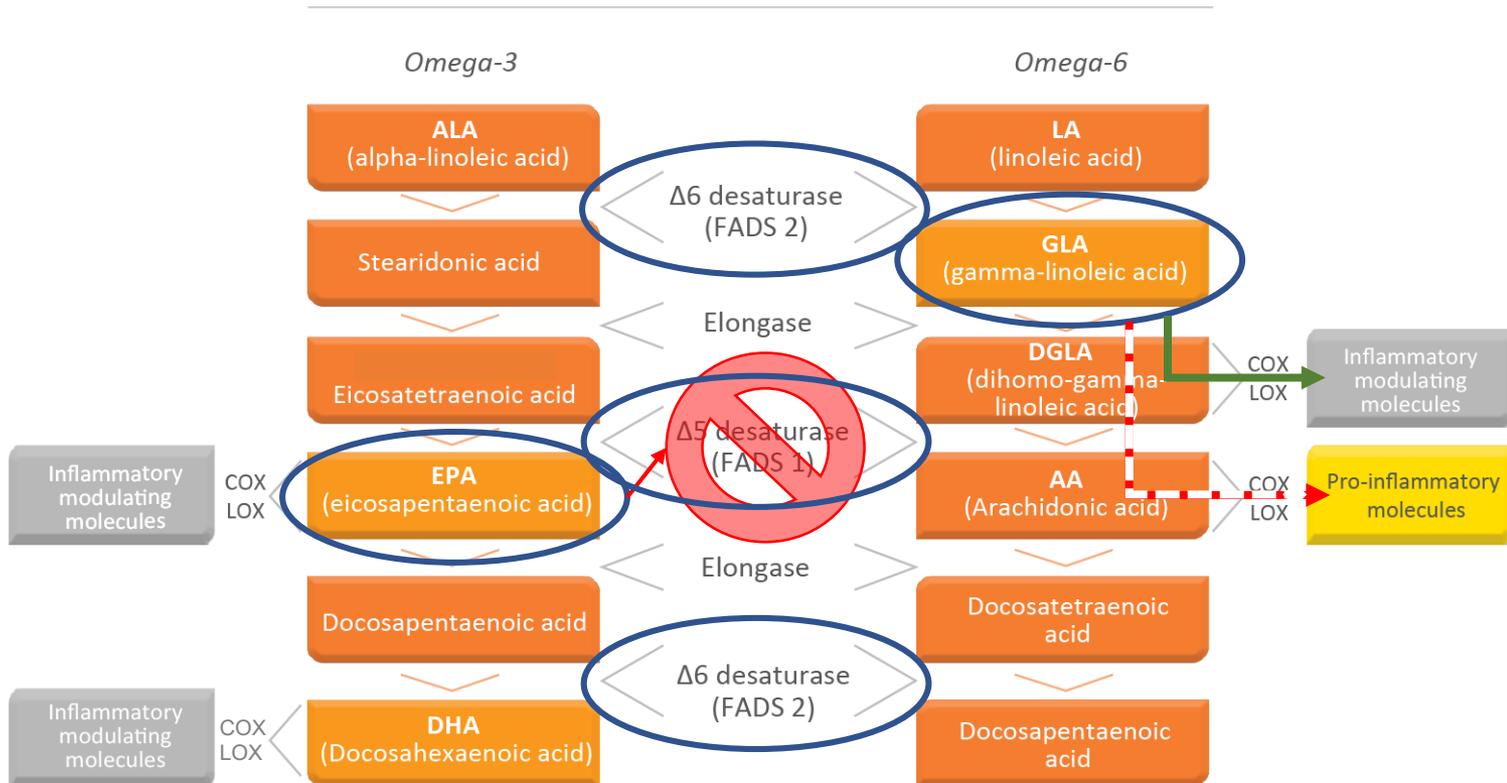


Figure 1. The metabolism of omega-3 and omega-6 fatty acids, including the genes that code for associated enzymes in parentheses.

Adapted from Roke K. *Appl Physiol Nutr Me.* 2017;42:10.1139/apnm-2016-0700.

Providing EPA:DHA:GLA

in the ratio of 9:3:1 to help rebalance omega fatty acid levels and support healthy fatty acid metabolism



Combining higher amounts of EPA with DHA and an optimal balance of GLA has been shown to support a proper inflammatory response by balancing the production of metabolites that come from AA (arachidonic acid) and maintaining the supportive capabilities of EPA, DHA, and GLA. This is important because long-chain omega fatty acid deficiencies are thought to negatively affect key brain functions.

INTRODUCING EQUAZEN[®] PRO

†EQUAZEN[®] PRO is a medical food designed to address metabolic differences in children and adolescents with ADHD who have been determined by medical evaluation to require nutritional management of polyunsaturated fatty acid deficiencies that cannot be achieved by modification of normal diet alone.

Patient Outcomes

Supported by over 15 years of research and 19 clinical studies in the areas of learning, attention and focus, brain development.



Supports children’s attention control, vocabulary, and immediate memory recall†

Improves inattentive behavior†

Supports balanced mood†

Improves academic performance†

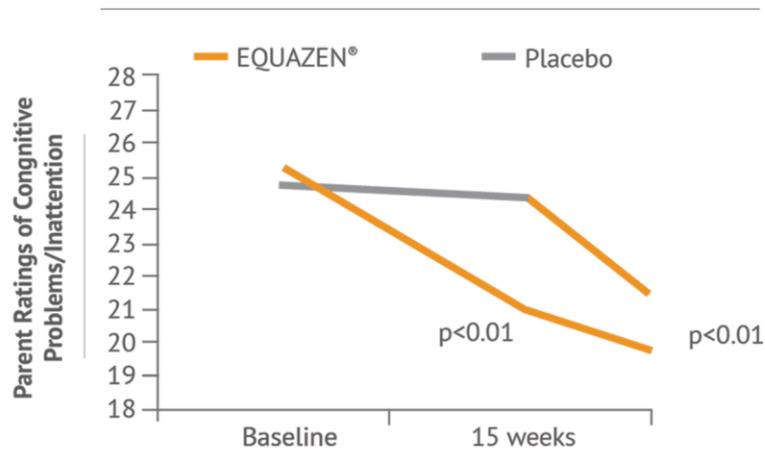


NOTICE: EQUAZEN[®] PRO IS A MEDICAL FOOD TO BE USED UNDER THE SUPERVISION OF A PHYSICIAN OR OTHER LICENSED HEALTHCARE PRACTITIONER. IT IS NOT A REPLACEMENT FOR ANY MEDICATION

The Evidence

On average, significant improvements in key ADHD indices

Cognitive Challenges/Inattention



ADHD Index

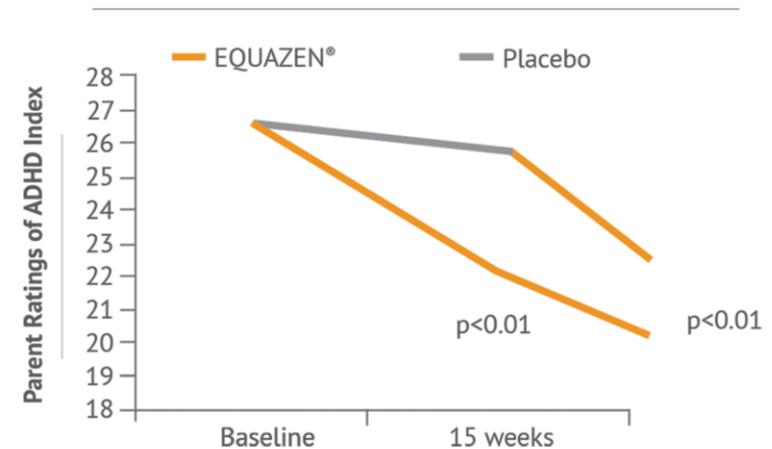


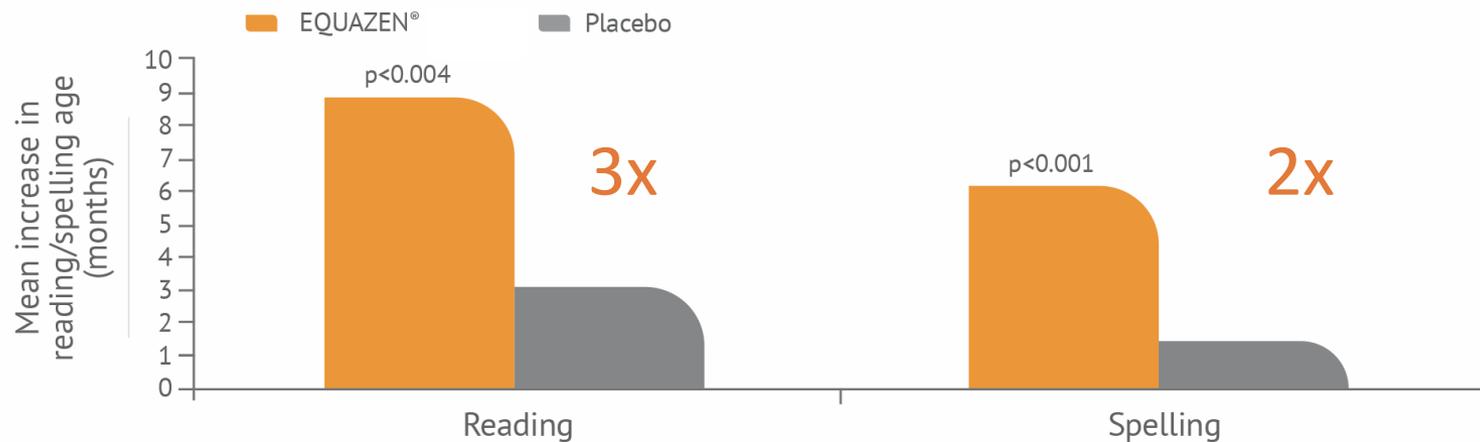
Figure 2. Randomized, placebo-controlled trial in 132 children (aged 7-12 years) with learning and behavioral problems associated with ADHD. Subjects were randomized to treatment with either EQUAZEN®, EQUAZEN® + a multivitamin/mineral product, or placebo for 15 weeks. From week 16 to 30, all participants were switched to EQUAZEN® + a multivitamin/mineral. Children were evaluated using the Conners' Parent Rating Scale (CPRS) and the Conners' Teacher Rating Scale (CTRS). Supplementation with the multivitamin/mineral product offered no additional benefits over EQUAZEN®

Sinn N, Bryan J, Wilson C. *Prostaglandins Leukot Essent Fatty Acids*. 2008;78(4-5):311-326.
<https://pubmed.ncbi.nlm.nih.gov/18514501/>

The Evidence

On average, significant improvements in reading and spelling age

Literacy following 3 months of supplementation



Randomized, double-blind, placebo-controlled trial in 117 children (aged 5 to 12 years) who met criteria for Developmental Coordination Disorder (DCD).# Subjects were randomized to receive either EQUAZEN® or placebo for 12 weeks and were assessed for reading and spelling ability (Wechsler Objective Reading Dimensions [WORD]) and for ADHD symptoms (Conners' Teacher Rating Scale–Revised: Long Form [CTRS-R:L]).

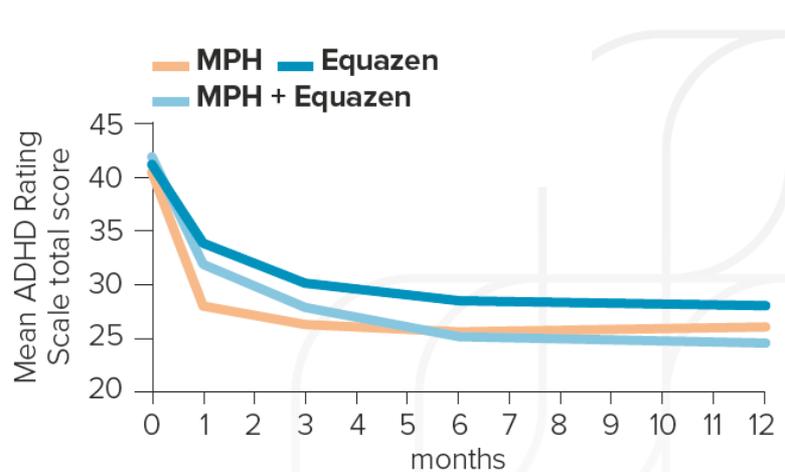
#DCD is characterized by specific impairments of motor function and shows substantial overlap with ADHD in terms of difficulties with organizational skills and attention.

Richardson AJ, Montgomery P. *Paediatrics*. 2005;115:1360-1366. <https://pubmed.ncbi.nlm.nih.gov/15867048/>

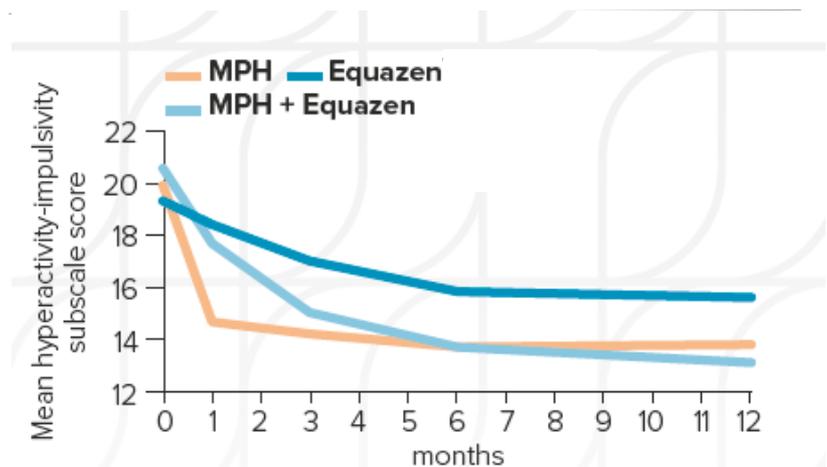
The Evidence

On average, significant improvements in ADHD symptoms when combined with methylphenidate (MPH)

ADHD Rating Scale Total score



Hyperactivity-Impulsivity subscale score



Randomized, double-blind, placebo-controlled trial in 90 children (aged 6 to 12 years) newly diagnosed with ADHD. Subjects were randomized to receive either EQUAZEN®, EQUAZEN® + with methylphenidate (MPH), or MPH for 12 months and were assessed for reading and spelling ability (Wechsler Objective Reading Dimensions [WORD]) and for ADHD symptoms (DuPaul, 1998 and the Clinical Global Impressions-Severity [CGI-S] scale). Improved tolerability, adherence, and reduced dosing were observed in the EQUAZEN + MPH group.

Note: Children in the MPH arm received an initial daily dose of 0.3 mg/kg/day, increased to 0.5 mg/kg/day after the first 2 weeks. The dose was subsequently increased to a maximum of 1 mg/kg/day depending on response and tolerability. **Children receiving EQUAZEN + MPH were able to better manage and reduce their ADHD symptoms while reducing their dose of (0.8mg/kg/day versus 1.0mg/kg/day), over a period of 12 months. (20% reduction)**

Note: The original research was conducted on Equazen® eye q™ which is equivalent to the active ingredients in Equazen® Pro

Testimonials

Dr. Tony Lloyd shares his 20 years of professional experience utilizing EQUAZEN® in his ADHD patient protocols.



Summary: Focus on ADHD

- + Prevalence is 5.26% globally and 11% in the U.S.
- + A polygenic disorder of self-regulation that is genetic in origin.
- + Highly heritable at 72% (increased risk according to intergenerational social and economic deprivation).
- + Approximately 20% of cases caused by brain injury, epilepsy, severe neglect, or trauma in early infancy.
- + Increased risk from preterm birth (9% to 17%) and biological assaults in utero.
- + An extreme presentation of traits that exist in all human beings.
- + Stable (genetic) and dynamic (environmental) factors determine the “expression” of ADHD.
- + Shares genetic risk factors with autism.
- + Deficiencies in neurotransmission of norepinephrine, which derives from dopamine.
- + Impacts on frontal cortex, limbic system, basal ganglia, reticular activating system, and cingulate gyrus.
- + Treatment should be “multi-modal,” including nutrition; habitual, daily physical exercise and stress-reduction strategies; scaffolding of strategies to support executive functioning skills; cognitive behavioral therapy and coaching; and, in those for whom it is necessary, medication.
- + EQUAZEN® PRO is a clinically tested omega fatty acid formulation, supported by over 15 years of ongoing research and 19 clinical studies in the areas of learning, attention and focus, and brain development.



The ADHD Foundation Neurodiversity Charity is an integrated health and education service offering a unique lifespan - strength based service, for the 1 in 5 people who live with ADHD, Autism, Dyslexia, Dyspraxia, Dyscalculia and Tourette's syndrome.



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ADHD Foundation



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