

Importancia de los ácidos grasos omega-3 (EPA y DHA) en el TDAH.

Dra Esther Cardo Jalón (1) Natalia Mendez Guerrero (2)

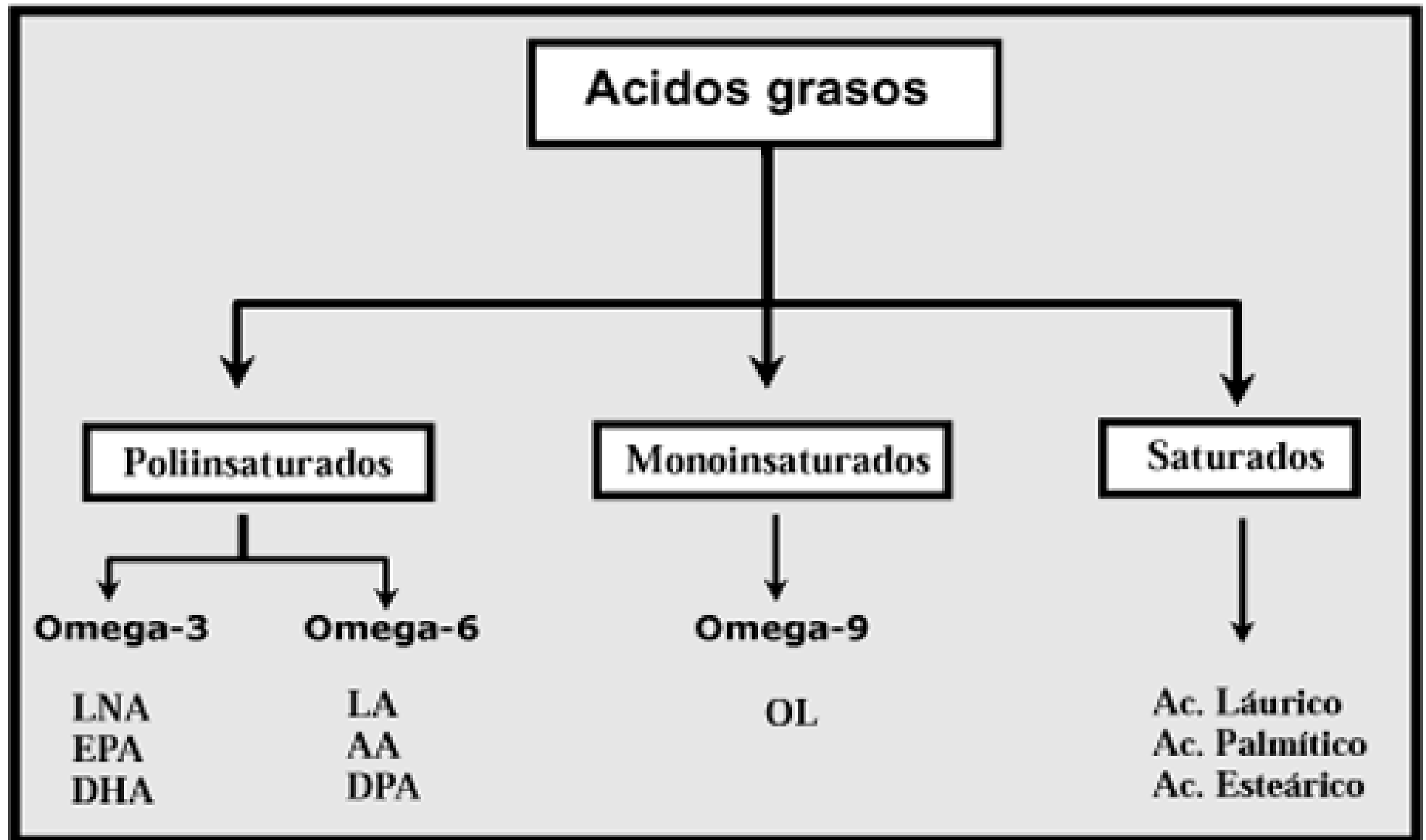
(1) Neuropediatra Hospital Son Llatzer/ Prof UIB/Investigador IdisPa

(2) Psicopedagoga Instituto Universitario de Investigación de Palma (IdisPa)



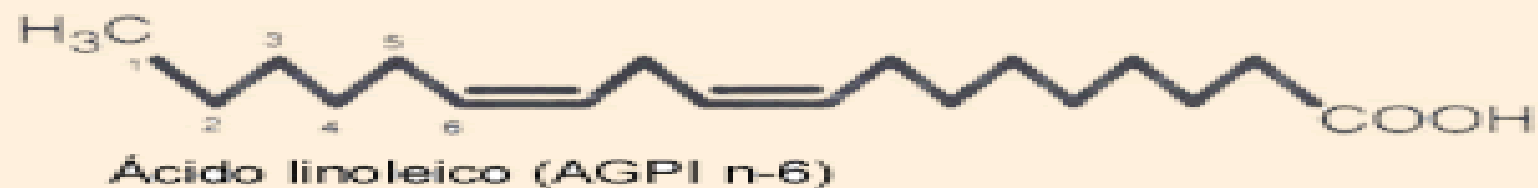
Universitat de les
Illes Balears

Ácidos Grasos omega 3, 6 y 9



Ácidos Grasos omega 3, 6 y 9

Estructura Química



Ácidos Grasos omega 3, 6 y 9

Componentes estructurales de las grasas

GRASAS

A.G Saturados



A.G Monoinsaturados

w9



A.G Poliinsaturados

w3/w6



Acido graso esencial omega 3

Acido α -linolenico (18:3 n-3)

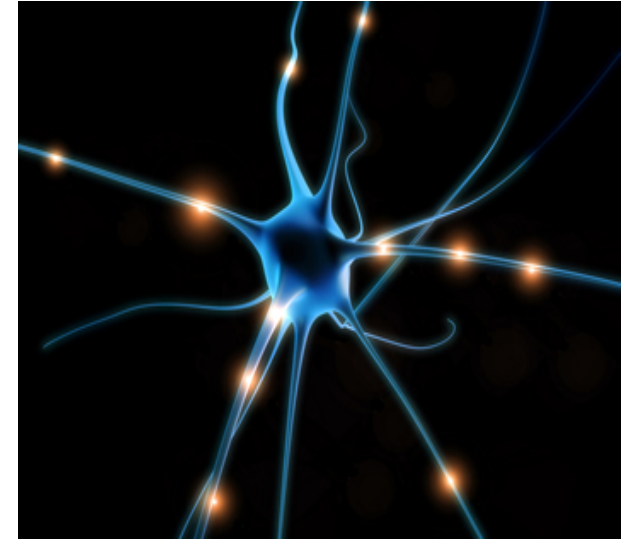
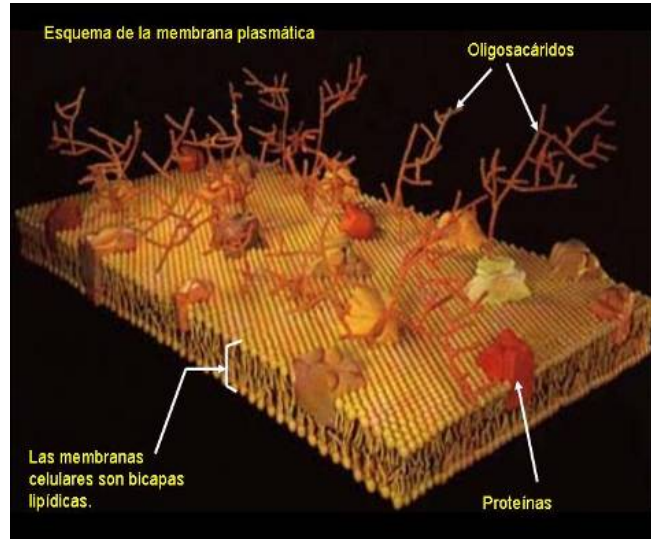
EPA (20:5 n-3)
Eicosapentaenoico

DHA (22:6 n-3)
Docosahexaenoico

Membranas celulares

Su deficiencia genera Alteraciones en S.N.C. y retina

Acido graso esencial omega 3



Funciones

Fundamental en el desarrollo del S.N.C en el niño

Mejora la función inmune

Disminuye la agregación plaquetaria

Mejora la dilatación de la arterias

Disminuye la respuesta inflamatoria

Disminuye niveles de triglicéridos en sangre

Acido graso esencial omega 3

Nutriente fundamental en la alimentación de niños, madres embarazadas y lactantes



- * Formación de la retina lo que garantiza mayor agudeza visual**
- * Desarrollo del sistema nervioso central**

Acido graso esencial omega 3

Alimentos fuentes de alfa- linolenico



Aceite de Linaza



Nueces



Maní



Almendras



Avellanas

Acido graso esencial omega 3

Alimentos fuentes de **EPA** (Eicosapentaenoico) y **DHA** (Docosahexaenoico)

Alimento	Contenido de EPA+DHA en 100grs.
Sardina en aceite	3,3
Salmón	1-1,4
Trucha arcoiris	1
Atún en agua	0,74
Atún fresco	0,25-1,3
Aceite de Hígado de bacalao	0,21

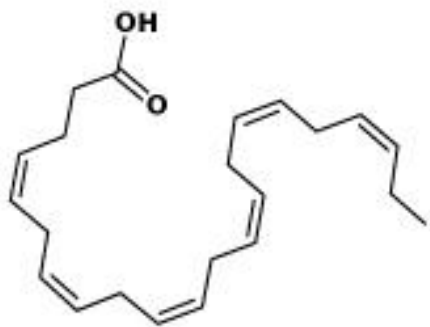


Krause food and nutrition therapy, 2008 p 55
Farmacología de los ácidos grasos omega-3, 2007

También está disponible en fuentes no animales, como suplementos de **spirulina y microalgas**. Las microalgas se están desarrollando como fuentes comerciales

DHA

- Es el AGPI-CL Omega-3 más abundante en el cerebro (representa el 95% de esta familia de lípidos).
- Se relaciona especialmente con la modificación de la estructura y función de los lípidos de las membranas celulares, pudiendo modificar por ejemplo su permeabilidad.



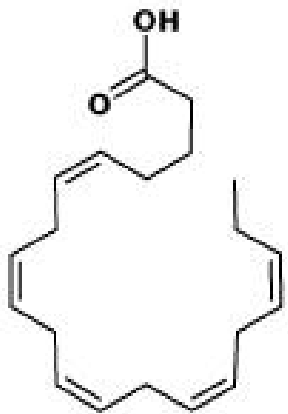
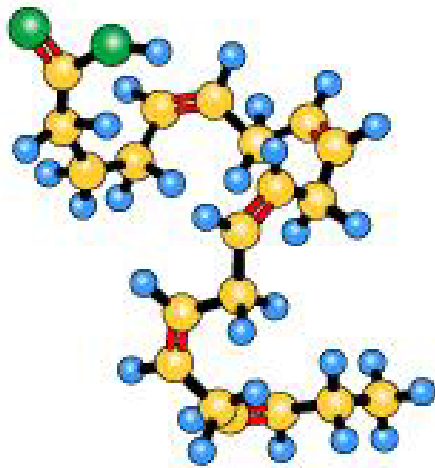
Docosahexaenoic acid
DHA (22:6n-3)

1 sardina

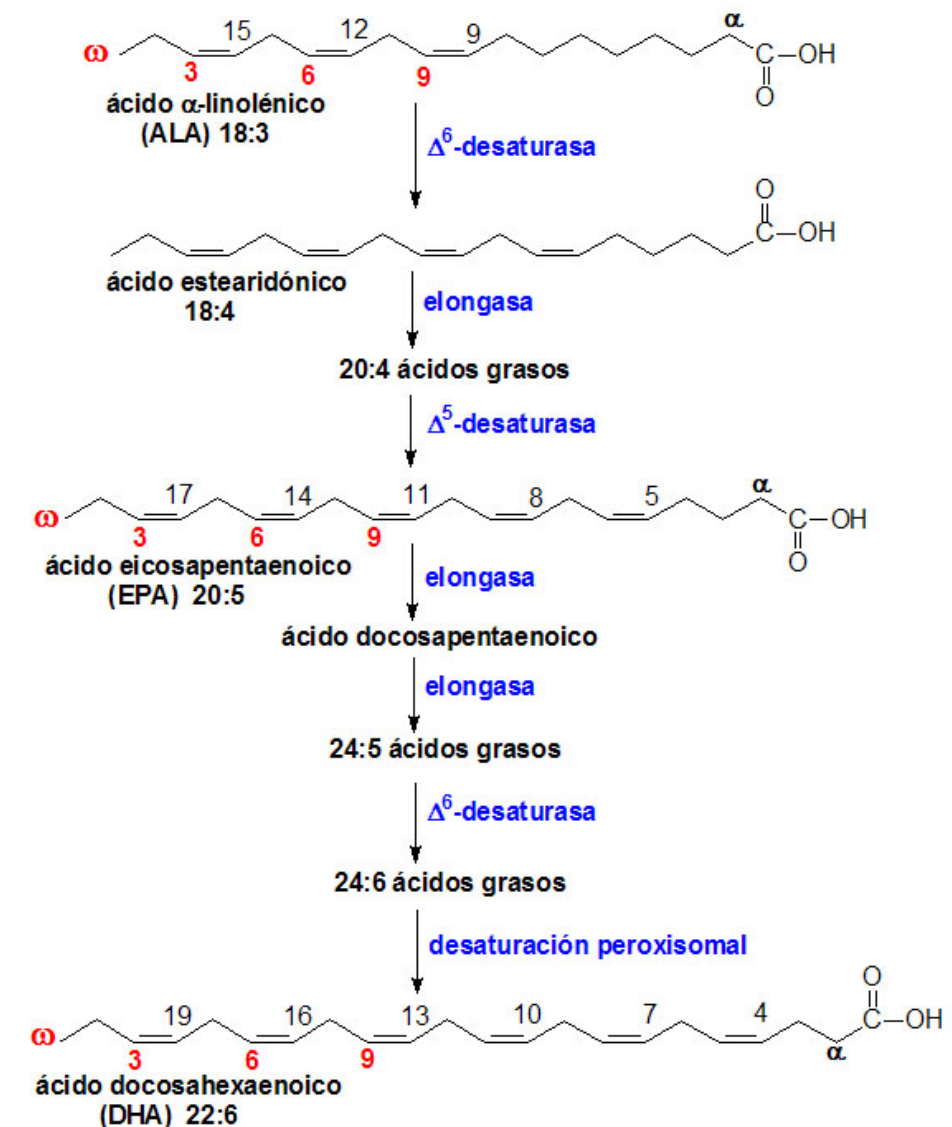


EPA

- Precursor del DHA (baja conversión).
- Presenta una funcionalidad más marcada de tipo antiinflamatorio.



Eicosapentaenoic acid
EPA (20:5n-3)



Recomendaciones de omega 3

Asociaciones medicas en el mundo	Recomendación
American Diabetes Association American Heart Association	En pacientes diabéticos, hipertrigliceridemicos o con sobrepeso, recomiendan consumir pescados ricos en Omega 3 mínimo 3 veces por semana
Sociedad Colombiana de Cardiología	Consumir alimentos ricos en ácidos grasos Omega 3
FDA	No recomienda dosis de Omega 3 mayores a 3 gramos por día
Sociedad Europea de cardiología	Pacientes con antecedentes de infarto de miocardio consumir 1 gr de Omega 3 por día
OMS	Pacientes sanos consumir 0.3 a 0.5 de Omega 3 por día
Sociedad Española de Nutrición	Recomienda en pacientes sanos el consumo de 1 a 2.2 de Omega 3 por día

Acido graso esencial Omega 6

Acido linoleico (18:2 n-6)



Araquidónico (20:4 n-6)



Membranas celulares

**1929 primeros
estudios- Borr y Col**

**1970 nutrición
parenteral**

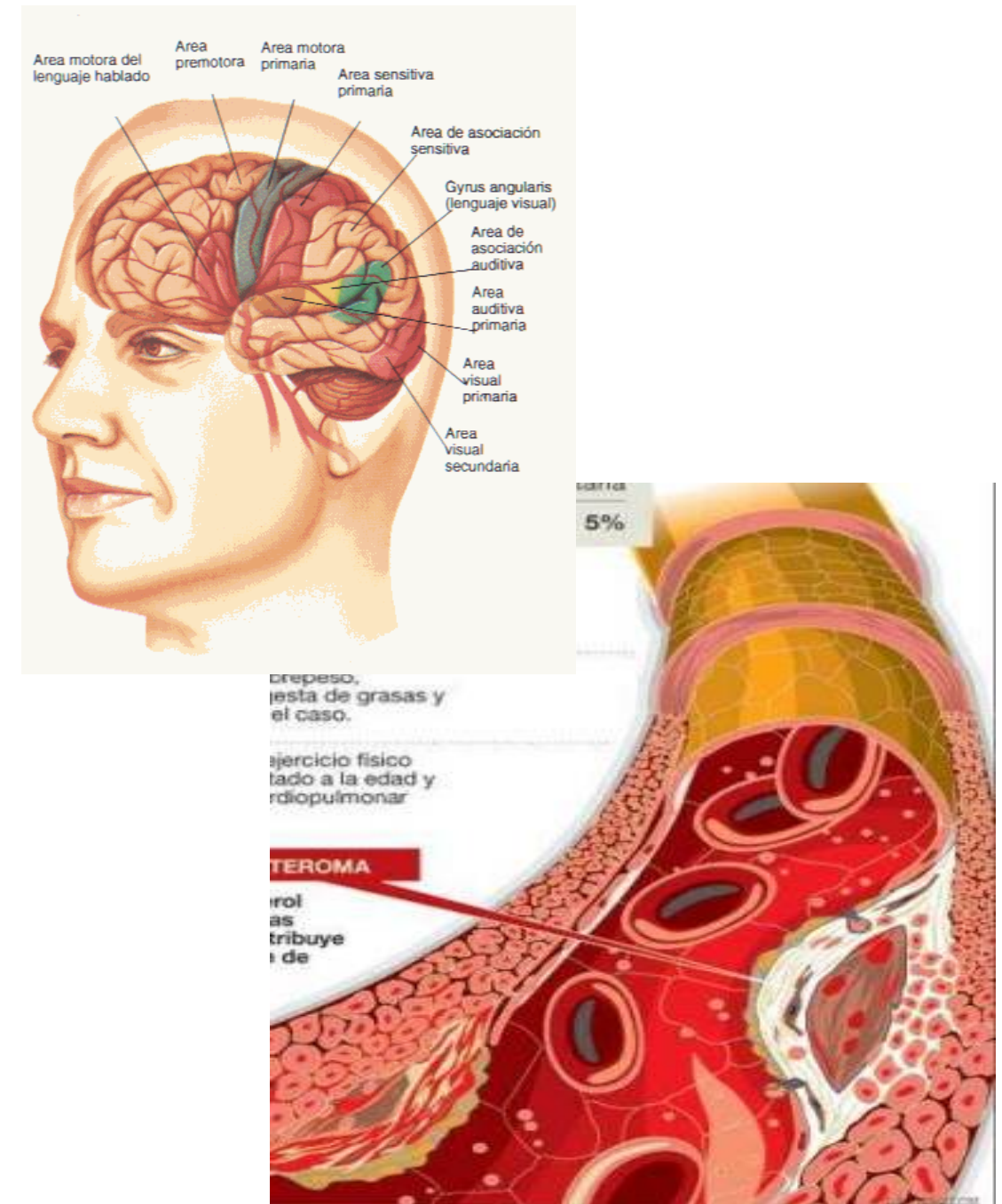
Acido graso esencial omega 6

Funciones

- Formación de membranas celulares
- Contribuye a disminuir los niveles de colesterol total y colesterol LDL
- Correcto funcionamiento del sistema inmunológico
- La correcta formación de la retina

Exceso:

- Producción de vasoconstricción, aumentan la formación de trombos



Acido graso esencial omega 6

Alimentos fuentes



Aceite de Girasol

Aceite de Canola

Aceite de Soya

Aceite de maiz



Pepitas de
uva



Germen de
trigo

Acido graso esencial omega 6

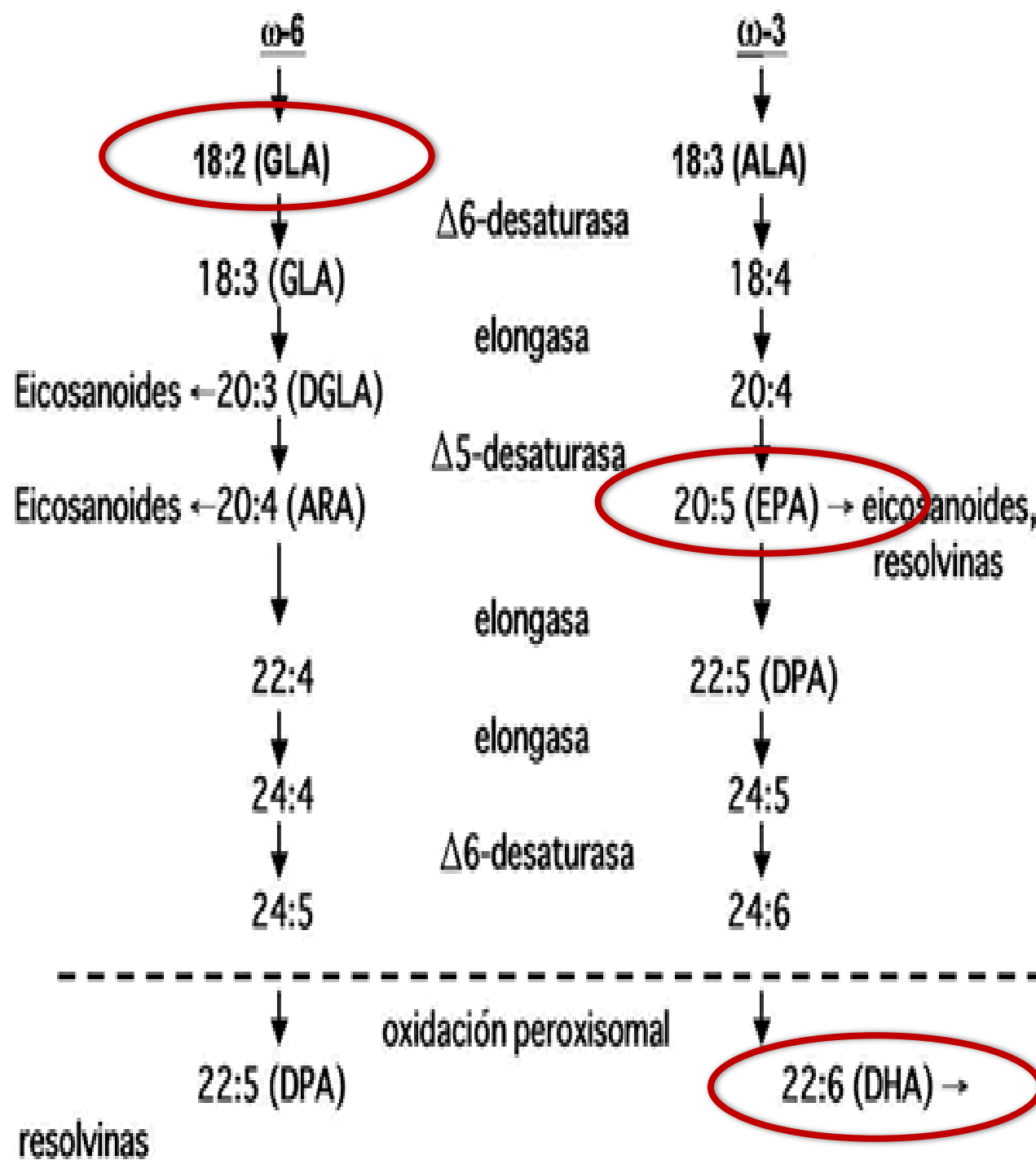


Importancia para la salud de la relación Omega 6 y Omega 3

IDEAL: 1: 1 Máximo 4:1

Actual: 20:1

Aceite de semillas
de borraja
(*Borago officinalis*)



Aceite de pescado
(sardinas y
anchoas)

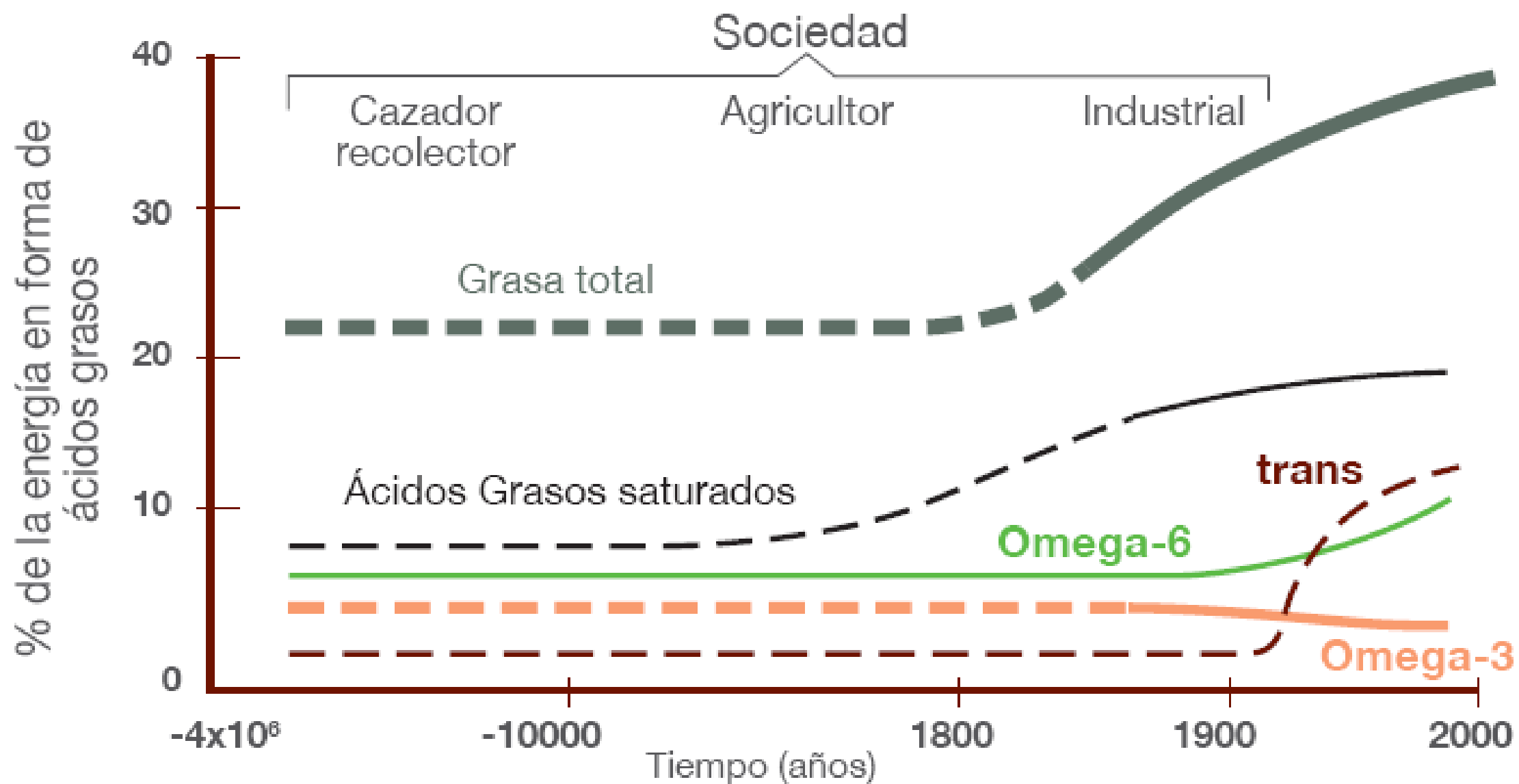


HABITOS DIETETICOS

- ¿Papel que juega la dieta en el desarrollo, evolución y tratamiento de los TDAH y trastornos del neurodesarrollo?
- Desde hace 150 años el equilibrio entre los AGPI-LC omega 6 y omega 3 se ha “roto”.
- DHA: presente en grandes cantidades únicamente en un número muy limitado de alimentos, cuyo consumo infantil (en gran parte del mundo) es bajo *
- España: 60% de los españoles no consumen suficiente pescado azul, la principal fuente de Omega3 DHA (**)

* Kuratko CN et al. *The relation of DHA with learning and behaviour in healthy children: a review. Nutrients. 2013.*

** Programa Corazones Contentos (Semergen).



Anteriormente relación
n-6/n-3 de 1:1



Actualmente la relación n-6/n-3 es de 25:1

(Simopoulos 1999)

Cambios en la dieta

- ◆ Consumimos pocos Omegas 3
- ◆ Aumentamos el ratio Omega 6 / Omega 3
 - ◆ Los ratios omega 6 / omega 3 han pasado de 3:1 a 25:1.
- ◆ Los omega 6 no son malos en si mismos (aunque no conviene abusar de los de origen animal, ARA),
- ◆ Los omega 3 son buenos, principalmente DHA y EPA.
- ◆ Lo que se suele valorar la ratio ARA / DHA-EPA.

¿Qué evidencias existen del papel de los AGPI-CL Omega 3?

Mantenimiento de la
función cognitiva



Efectos antialérgicos



Efectos antiinflamatorios



Prevención frente a
enfermedades
cardiovasculares



Tabla 1 Posibles efectos de los ácidos grasos n-3 sobre la salud

<i>Actuación de los ácidos grasos n-3</i>	<i>Efectos sobre la salud</i>
Crecimiento	Efecto positivo en pretérminos
Función visual	Mejora de la agudeza visual en neonatos
Función cognitiva	Mejora de funciones motoras y del aprendizaje
Perfil lipídico	Disminución de la hipertrigliceridemia
Tensión arterial	Disminución de la tensión arterial
Sistema inflamatorio	Efectos antiinflamatorios
Sistema inmune	Prevención de alergias y enfermedades autoinmunes

Recomendaciones



Desde 1994 a la actualidad diversas organizaciones internacionales han recomendado la inclusión de EPA y DHA en las fórmulas infantiles cuando la LM no sea a posible

Uauy R, Dangour AD. Fat and fatty acid requirements and recommendations for infants of 0–2 years and children of 2–18 years. Ann Nutr Metab. 2009;55:76–96

¿Qué evidencias existen del papel de los AGPI-CL a nivel cerebral?

SALUD



ENFERMEDAD

Trastornos
psiquiátricos



Depresión

Alzheimer



TDAH

Habilidades lectoras/ MT

- ◆ *Montgomery P. Low blood long chain Omega-3 fatty acids in UK children are associated with poor cognitive performance and behaviour: a cross-sectional analysis from the DOLAB study. Plos One. 2013 Jun).*
- ◆ Las bajas concentraciones sanguíneas de DHA en niños de la población escolar general se asocian (independientemente de la edad, sexo y el nivel socioeconómico) con habilidades lectoras y memoria de trabajo más pobres.

Habilidades lectoras/ MT

- ◆ *Richardson AJ DHA for reading, cognition and behavior in children aged 7-9 years: a randomized, controlled trial (the DOLAB study). Plos One 2012,*
- ◆ DOLAB (DHA Oxford Learning and Behaviour), diseñados para estudiar si la complementación con DHA puede mejorar el aprendizaje y/o la memoria en la población escolar general,
- ◆ las concentraciones sanguíneas promedio de EPA + DHA son muy bajas en relación a las recomendaciones en adultos
- ◆ 9 de cada 10 niños no cumplen con los criterios de las actuales guías de nutrición en cuanto al consumo de pescado.
- ◆ EC controlado randomizando N = 500 Edad 7 y 9 años
 - ◆ Énfasis en DHA más que el EPA. 600 mg de DHA/día
 - ◆ Mejoraron habilidades lectoras y MT en los niños que estaban por debajo del p20 en pruebas de lectura.

Habilidades lectoras/ MT

- ◆ *Dalton A et al A randomised control trial in schoolchildren showed improvement in cognitive function after consuming a bread spread, containing fish flour from a marine source. Prostaglandins Leukot Essent Fatty Acids 2009*
- ◆ las concentraciones sanguíneas de DHA menores se asocian significativamente con menor
 - ◆ Habilidad lectora
 - ◆ Menor rendimiento de la memoria de trabajo
 - ◆ Menor habilidad emocional
 - ◆ Más problemas de conducta señalados por sus padres (independientemente de la edad, sexo y el nivel socioeconómico)
- ◆ Cognitive function Hopkins verbal learning test / spelling test. Parecido al minimal test.

Dislexia/Coordinación motora

- ◆ Plantea que el problema es: poco omega-3, mayor ratio omega 6/omega 3.
 - ◆ Diversos estudios en los que se han utilizado DHA y EPA en niños con dislexia han evidenciado mejoría en las habilidades para la lectura y manipulación.
 - ◆ Algunos de ellos son estudios controlados, y demuestran que el consumo elevado de DHA / EPA puede ser eficaz en el tratamiento
-
- ◆ **Schuchardt JP et al Significance of PUFAs for the development and behaviour of children Eur J Pediatr 2010,**
 - ◆ ***Gow RV. Omega 3 fatty acids are inversely related to callous and unemotional traits in adolescent boys with ADHD. Prostaglandins Leukot Essent Fatty Acids 2013 Jun**

TDAH

◆ *Milte 2011/2012*

- ◆ Estudio con 90 niños.
 - ◆ Hay indicios de que los niños con TDAH con dificultades de aprendizaje, cuyas concentraciones eritrocíticas de DHA son menores a las de aquellos con TDAH sin dificultades, responden mejor a la complementación con AGPI-LC Omega-3
- ◆ Estudio con 100 niños
 - ◆ El incremento eritrocitario de DHA y EPA tras la complementación se ha relacionado con una mejora en la conducta, la atención y las habilidades de lectoescritura en estos niños.
 - ◆ Muy curioso, porque suplementarlo no mejora nada, pero los que tenían más DHA y más EPA eran mejores en varios parámetros.

METANÁLISIS

ARTICLE IN PRESS

NEW RESEARCH

Omega-3 Fatty Acid Supplementation for the Treatment of Children With Attention-Deficit/Hyperactivity Disorder Symptomatology: Systematic Review and Meta-Analysis

Michael H. Bloch, M.D., M.S., and Ahmad Qawasmi, M.D.

Objective: Several studies have demonstrated differences in omega-3 fatty acid composition in plasma and in erythrocyte membranes in patients with attention-deficit/hyperactivity disorder (ADHD) compared with unaffected controls. Omega-3 fatty acids have anti-inflammatory properties and can alter central nervous system cell membrane fluidity and phospholipid composition. Cell membrane fluidity can alter serotonin and dopamine neurotransmission. The goal of this meta-analysis was to examine the efficacy of omega-3 fatty acid supplementation in children with ADHD. **Method:** PubMed was searched for randomized placebo-controlled trials examining omega-3 fatty acid supplementation in children with ADHD symptomatology. The primary outcome measurement was standardized mean difference in rating scales of ADHD severity. Secondary analyses were conducted to determine the effects of dosing of different omega-3 fatty acids in supplements. **Results:** Ten trials involving 699 children were included in this meta-analysis. Omega-3 fatty acid supplementation demonstrated a small but significant effect in improving ADHD symptoms. Eicosapentaenoic acid dose within supplements was significantly correlated with supplement efficacy. No evidence of publication bias or heterogeneity between trials was found. **Conclusion:** Omega-3 fatty acid supplementation, particularly with higher doses of eicosapentaenoic acid, was modestly effective in the treatment of ADHD. The relative efficacy of omega-3 fatty acid supplementation was modest compared with currently available pharmacotherapies for ADHD such as psychostimulants, atomoxetine, or α_2 agonists. However, given its relatively benign side-effect profile and evidence of modest efficacy, it may be reasonable to use omega-3 fatty supplementation to augment traditional pharmacologic interventions or for families who decline other psychopharmacologic options. *J. Am. Acad. Child Adolesc. Psychiatry*, 2011;xx(x):xxx. **Key Words:** attention-deficit disorder with hyperactivity, polyunsaturated fatty acids, omega-3 fatty acids, eicosapentaenoic acid, meta-analysis

Attention-deficit/hyperactivity disorder (ADHD) is characterized by developmentally inappropriate and impairing inattention, impulsivity, and hyperactivity (DSM).¹ ADHD is one of the most common and impairing health conditions affecting school-age children.^{2,3} Several pharmacotherapies have demonstrated

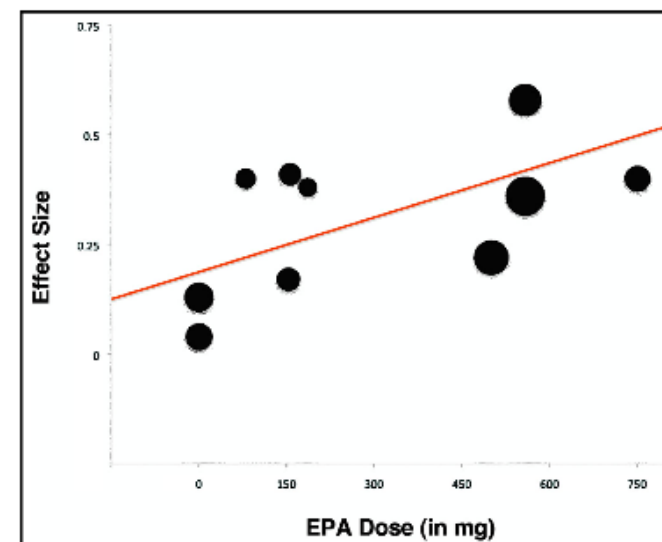
significant short-term efficacy for the treatment of ADHD. More than 70% of children with ADHD respond to psychostimulant medications (i.e., methylphenidate and dextroamphetamine derivatives).⁴ Other medications such as atomoxetine, α_2 agonists, and desipramine have also demonstrated efficacy in treating ADHD.⁵⁻⁷ However, many families elect not to use traditional pharmacotherapies to treat ADHD. This decision is often related to concerns over possible short-term side effects or doubts regarding long-term efficacy or effects of these medications on development.⁸⁻¹¹

This article is discussed in an editorial by Dr. J. Eugene Arnold on page xxx.

JOURNAL OF THE AMERICAN ACADEMY OF CHILD & ADOLESCENT PSYCHIATRY
VOLUME xx NUMBER x MONTH 2011

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Este meta-análisis del 2011 demuestra un **beneficio pequeño pero estadísticamente significativo** de la suplementación con ácidos grasos omega-3 en el tratamiento del TDAH.

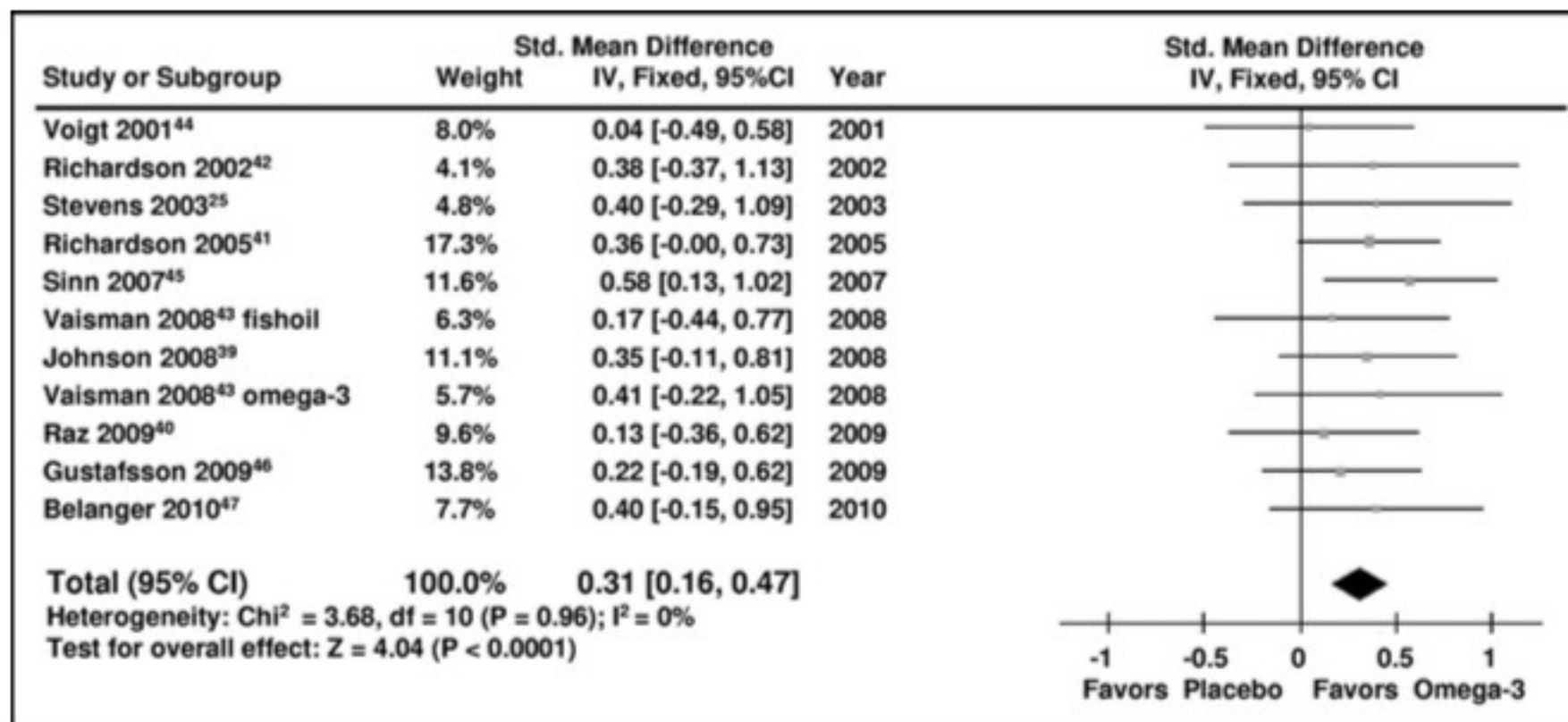


Los suplementos con las dosis más altas de EPA se asociaron significativamente con el aumento de la eficacia en el tratamiento de los síntomas del TDAH.

Dados sus relativamente benignos efectos secundarios y la evidencia de eficacia moderada, puede ser **razonable utilizar suplementos de grasos omega-3 para complementar las intervenciones farmacológicas tradicionales o para familias que rechazan tratamientos farmacológicos.**

Omega-3 Fatty Acid Supplementation for the Treatment of Children With Attention-Deficit/Hyperactivity Disorder Symptomatology: Systematic Review and Meta-Analysis. *J. Am. Acad. Child Adolesc. Psychiatry*, 2011.

FIGURE 2 Omega-3 fatty acid supplementation for attention-deficit/hyperactivity disorder (ADHD). Note: Forest plot depicts the efficacy of omega-3 fatty acid supplementation compared with placebo in the treatment of children with ADHD symptoms. Ten studies involving 699 participants contributed to this analysis. There was a significant benefit of omega-3 supplementation compared with placebo and no evidence of heterogeneity or publication bias. CI = confidence interval.



¿% ideal DHA / EPA?

¿Formulaciones?

- Bloch Estudio realizado a través de una revisión sistemática y metaanálisis
- El efecto positivo de la complementación con AGPI-LC Omega-3 en el TDAH también se observa de forma independiente y estadísticamente significativa en la desatención y en la hiperactividad.
- Opción en familias que rechazan el tratamiento farmacológico.
- Analiza el efecto de las dosis de EPA/DHA

TABLE 1 Characteristics of Included Trials

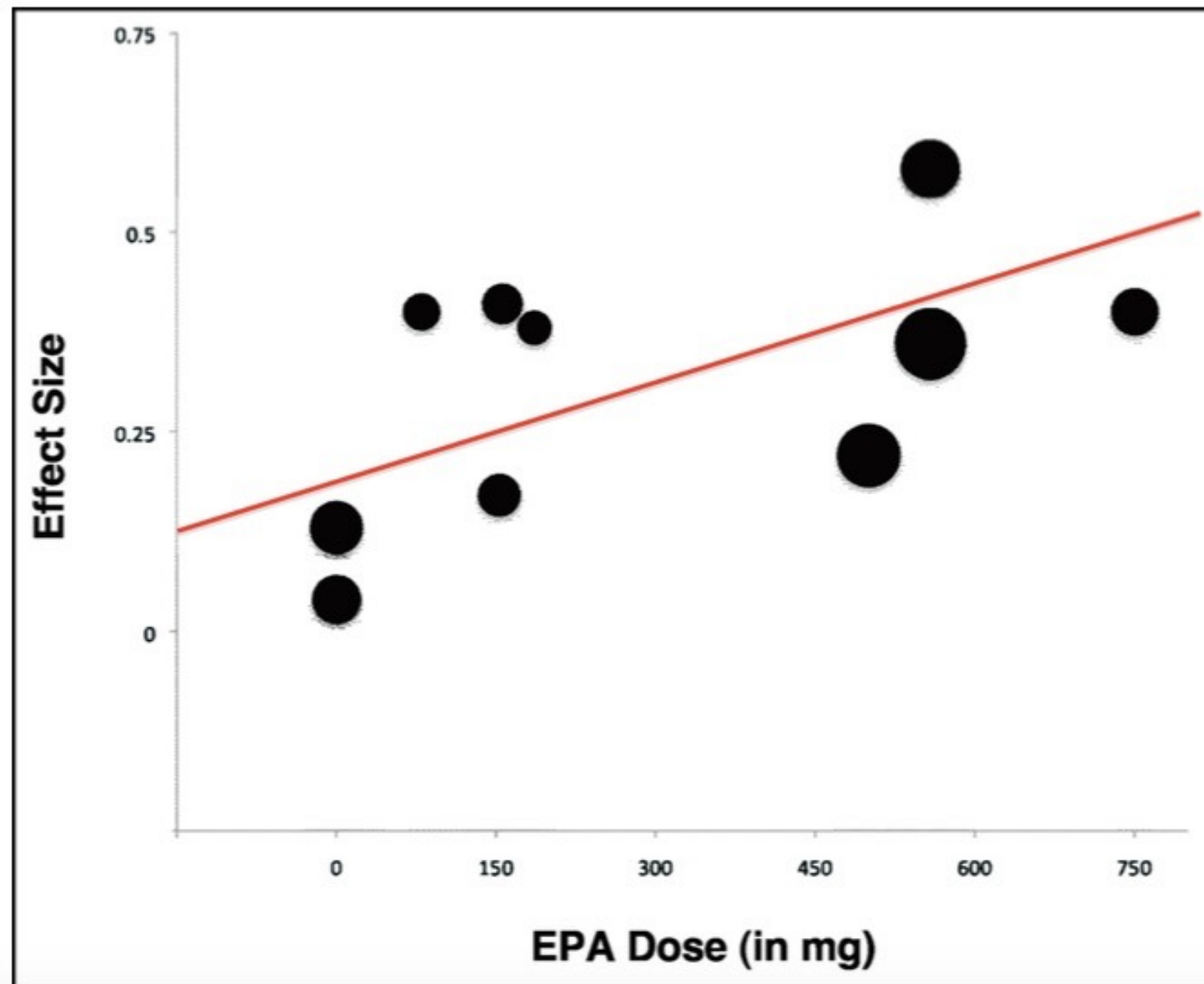
Study	Year	Design	Study Duration	Monotherapy vs. Augmentation	N	Mean Age	Gender (% Male)	Rating	Jadad Score	Analysis	EPA Dose (mg)	DHA Dose (mg)	ALA Dose (mg)	Placebo
Voigt et al. ⁴⁴	2001	parallel	4 mo	augmentation	63	9.3	78	CBCL Attention subscale	5	completer	0	345	0	—
Richardson et al. ⁴²	2002	parallel	12 wk	monotherapy	41	10.3	85	CPRS-L	4	completer	186	480	0	olive oil
Stevens et al. ²⁵	2003	parallel	4 mo	augmentation	47	9.8	87	ASQ (DBD–teacher) ^b	3	completer ^a	80	480	0	olive oil
Richardson et al. ⁴¹	2005	parallel	3 mo	monotherapy	117	8.8	67	CTRS-L	5	ITT	558	174	0	olive oil
Sinn and Bryan ⁴⁵	2007	parallel	15 wk	monotherapy	104	9.4	74	CPRS-L	2	completer	558	174	0	palm oil
Johnson et al. ³⁹	2009	parallel	3 mo	monotherapy	75	12.0	85	ADHD-RS	5	modified ITT	558	174	0	olive oil
Vaisman et al. ⁴³	2008	parallel	3 mo	monotherapy	55	9.2	77	CPRS-R-S	4	completer	156	95	1	canola oil
Vaisman et al. ⁴³	2008	parallel	3 mo	monotherapy	54	9.4	71	CPRS-R-S	4	completer	153	96	2	canola oil
Belanger et al. ⁴⁷	2009	crossover	16 wk	monotherapy	26	9.2	69	CPRS-L	3	completer	750	300	0	sunflower oil
Gustafsson et al. ⁴⁶	2010	parallel	15 wk	monotherapy	92	7–12	—	CTRS	5	modified ITT	500	2.7	0	canola oil
Raz et al. ⁴⁰	2009	parallel	7 wk	monotherapy	78	10.5	60	ADHD-RS	3	completer	0	0	120	vitamin C

Note: Twelve trials involving 735 children with attention-deficit/hyperactivity disorder (ADHD) were included in this meta-analysis. ADHD-RS = ADHD rating scale; ALA = α -linolenic acid; ASQ = Connors' Parental Abbreviated Symptom Questionnaire; CBCL = Connors' Behavioral Checklist; CPRS-L = Connors' Parents Rating Scale–Long Version; CPRS-R-S = Connors' Parents Rating Scale–Revised Short Version; CTRS-L = Connors' Teachers Rating Scale–Long Version; DBD = Disruptive Behavior Disorders Scale; DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid; ITT = intention-to-treat; N = number of individuals contributing data to meta-analysis from trial.

^aPresented data for completers analysis only but reported p values for ITT sample.

^bFor inattention and hyperactivity measurements, the DBD scale was used.

FIGURE 3 Eicosapentaenoic acid (EPA) dose and efficacy of omega-3 fatty acid supplementation for attention-deficit/hyperactivity disorder (ADHD). Note: Scatterplot displays the measured efficacy of omega-3 fatty acid supplementation in trials as a function of EPA dose used. Trials were weighted (size of circles) using the generic inverse variance method. Higher doses of EPA within essential fatty acid supplements were significantly associated with increased efficacy in treating ADHD symptoms ($\beta = 0.36$, 95% CI: 0.01–0.72, $t = 2.34$, $p = .04$, $R^2 = 0.38$). Two trials, by Johnson et al.³⁹ (effect size = 0.35, EPA dose = 558 mg, weight = 11.1%) and Richardson et al.⁴¹ (effect size = 0.36, EPA dose = 558 mg, weight = 17.3%), had overlapping point estimates on this figure. CI = confidence interval.



Nonpharmacological Interventions for ADHD: Systematic Review and Meta-Analyses of Randomized Controlled Trials of Dietary and Psychological Treatments

Edmund J.S. Sonuga-Barke, Ph.D. Chris Hollis, M.D.
 Daniel Brandeis, Ph.D. Eric Konofal, M.D., Ph.D.
 Samuele Cortese, M.D., Ph.D. Michel Lecendreux, M.D.
 David Daley, Ph.D. Ian C.K. Wong, Ph.D.
 Maite Ferrin, M.D., Ph.D. Joseph Sergeant, Ph.D.
 Martin Holtmann, M.D. European ADHD Guidelines Group
 Jim Stevenson, Ph.D.
 Marina Danckaerts, M.D., Ph.D.
 Saskia van der Oord, Ph.D.
 Manfred Döpfner, Ph.D.
 Ralf W. Dittmann, M.D., Ph.D.
 Emily Simonoff, M.D.
 Alessandro Zuddas, M.D.
 Tobias Banaschewski, M.D., Ph.D.
 Jan Buitelaar, M.D., Ph.D.
 David Coghill, M.D.

Objective: Nonpharmacological treatments are available for attention deficit hyperactivity disorder (ADHD), although their efficacy remains uncertain. The authors undertook meta-analyses of the efficacy of dietary (restricted elimination diets, artificial food color exclusions, and free fatty acid supplementation) and psychological (cognitive training, neurofeedback, and behavioral interventions) ADHD treatments.

Method: Using a common systematic search and a rigorous coding and data extraction strategy across domains, the authors searched electronic databases to identify published randomized controlled trials that involved individuals who were diagnosed with ADHD (or who met a validated cutoff on a recognized rating scale) and that included an ADHD outcome.

Results: Fifty-four of the 2,904 nonduplicate screened records were included in the analyses. Two different analyses were performed. When the outcome measure was based on ADHD assessments by raters closest to the therapeutic setting, all dietary (standardized mean differences=0.21–0.48) and psychological (standardized mean differences=0.40–0.64) treatments produced statistically significant effects. However, when the best probably blinded assessment was employed, effects remained significant for free fatty acid supplementation (standardized mean difference=0.16) and artificial food color exclusion (standardized mean difference=0.42) but were substantially attenuated to nonsignificant levels for other treatments.

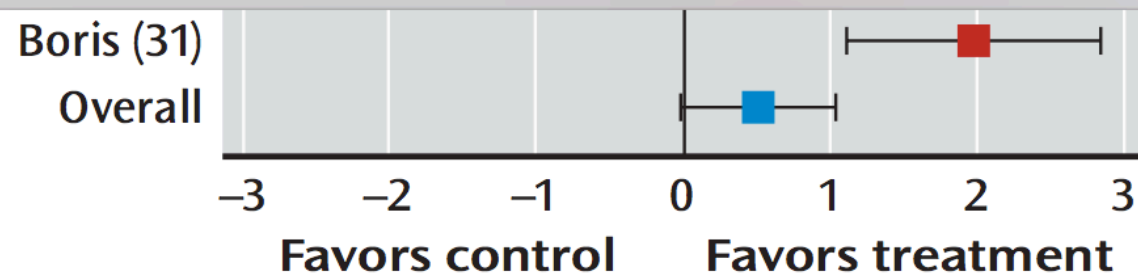
Conclusions: Free fatty acid supplementation produced small but significant reductions in ADHD symptoms even with probably blinded assessments, although the clinical significance of these effects remains to be determined. Artificial food color exclusion produced larger effects but often in individuals selected for food sensitivities. Better evidence for efficacy from blinded assessments is required for behavioral interventions, neurofeedback, cognitive training, and restricted elimination diets before they can be supported as treatments for core ADHD symptoms.

(*Am J Psychiatry* 2013; 170:275–289)

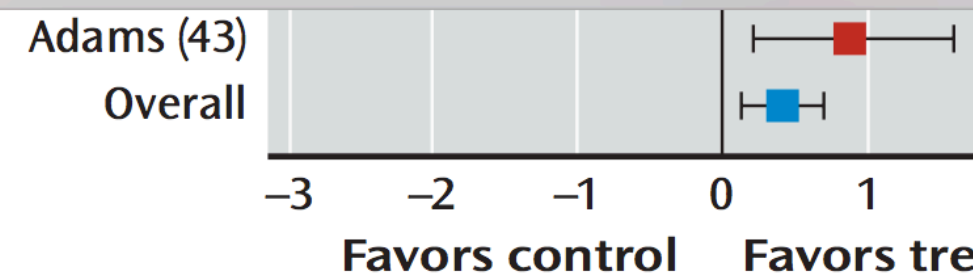
Attention deficit hyperactivity disorder (ADHD) is a common disorder that, although most frequently diagnosed during the school years, affects individuals across the lifespan (1). It is characterized by symptoms of inattention, overactivity, and/or impulsiveness that are age inappropriate, persistent, and pervasive (2). In the long term, ADHD is associated with a significant risk

of educational failure, interpersonal problems, mental illness, and delinquency (3), creating a substantial burden on families as well as on health, social care, and criminal justice systems (4). Multimodal approaches are recommended for the treatment for ADHD (5), which normally begins during the school years. Pharmacological treatments are efficacious (6) and are widely used but may

This article is featured in this month's AJP [Audio](#), is discussed in an [Editorial](#) by Dr. Galanter (p. 241) and is an article that provides [Clinical Guidance](#) (p. 289)

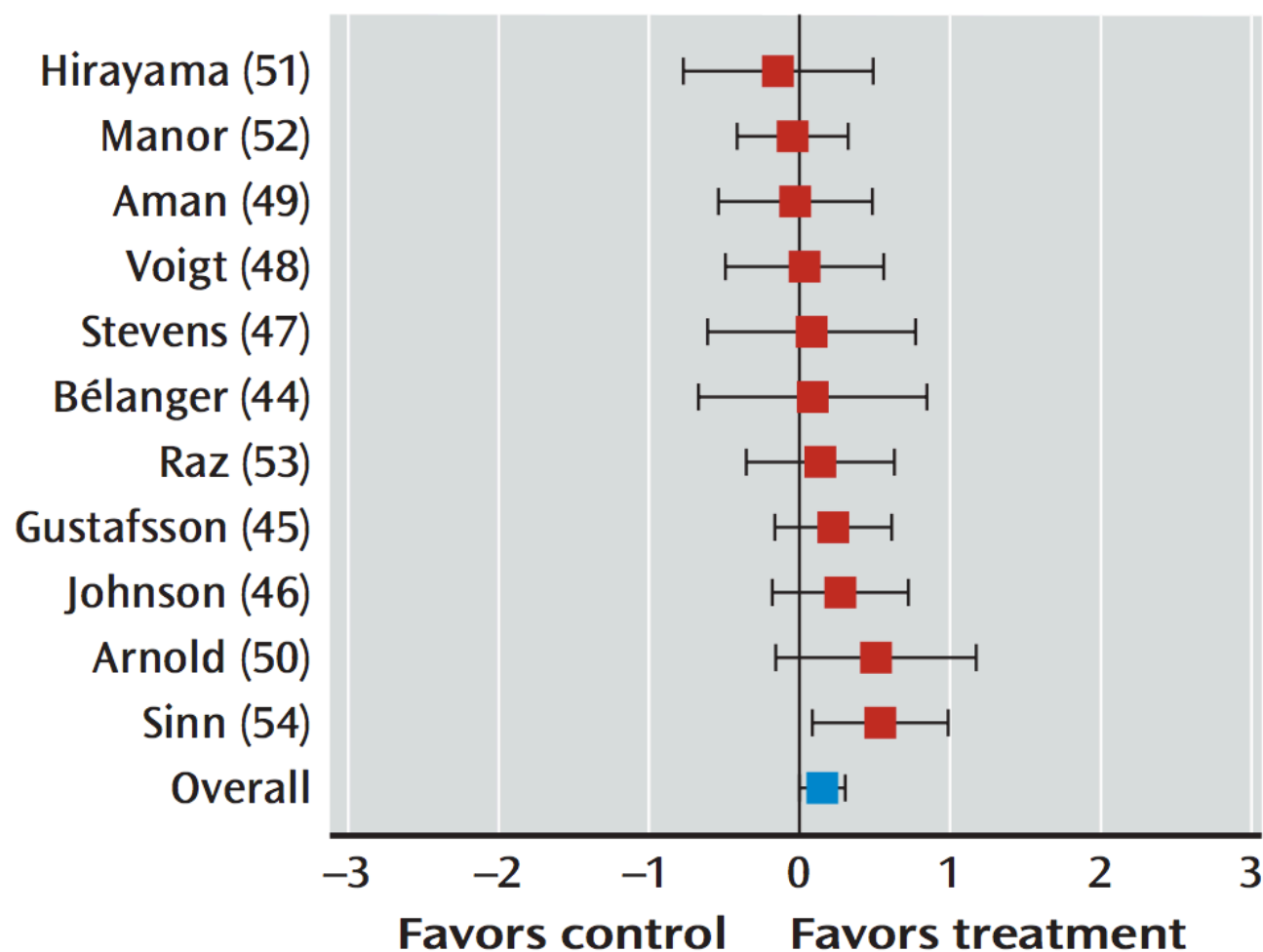


Overall SMD=0.51, 95% CI=–0.02, 1.04
 Test for overall effect: $Z=1.90$, $p=0.06$
 Heterogeneity: $\chi^2=17.68$, $df=5$, $p<0.003$, $I^2=72\%$



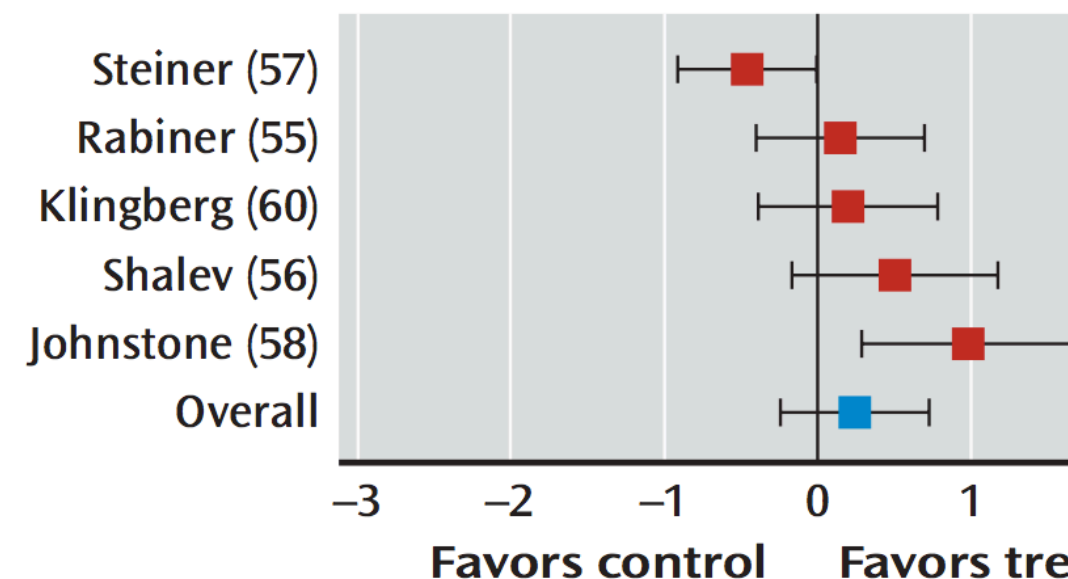
Overall SMD=0.42, 95% CI=0.13, 0.71
 Test for overall effect: $Z=2.86$, $p=0.004$
 Heterogeneity: $\chi^2=8.02$, $df=7$, $p=0.31$, $I^2=53\%$

C. Supplementation With Free Fatty Acids



Overall SMD=0.16, 95% CI=0.01, 0.31
 Test for overall effect: $Z=2.05$, $p=0.04$
 Heterogeneity: $\chi^2=6.95$, $df=10$, $p=0.73$, $I^2=0\%$

D. Cognitive Training



Overall SMD=0.24, 95% CI=–0.2, 0.68
 Test for overall effect: $Z=0.96$, $p=0.33$
 Heterogeneity: $\chi^2=13.78$, $df=4$, $p=0.008$, $I^2=73\%$

F. Behavioral Interventions

Free fatty acid supplementation ■

- 11 free fatty acid supplementation trials met inclusion criteria.
 - 5 involved omega-3 supplements. 2 involved omega-6 supplements, and the remainder used both omega-3 and omega-6 supplements.
 - All had probably blinded assessments and scored 3 or more on the Jadad scale.
 - Treatment effects were significant for both analyses
 - The probably blinded assessment effects remained significant when the analysis was limited to the nine trials with no/low medication (standardized mean difference=0.17; 95% CI=0.01, 0.34).
- The effects for free fatty acid supplementation were also significant but small. 0.21

Edmund J.S. Sonuga-Barke,
Nonpharmacological Interventions for ADHD: Systematic Review
and Meta-Analyses of Randomized Controlled Trials of Dietary
and Psychological Treatments 2013

- **CONCLUSIONES**
- Free fatty acid supplementation and artificial food color exclusions appear to have beneficial effects on ADHD symptoms,
- Although the effect of the former are small and those of the latter may be limited to ADHD patients with food sensitivities.



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Effect of supplementation with long-chain ω -3 polyunsaturated fatty acids on behavior and cognition in children with attention deficit/hyperactivity disorder (ADHD): A randomized placebo-controlled intervention trial[☆]

Katharina Widenhorn-Müller^{a,b,*}, Simone Schwanda^c, Elke Scholz^a,
Manfred Spitzer^{a,b}, Harald Bode^c

^a Transfer Center for Neuroscience and Learning, University Hospital, Ulm, Germany

^b Department of Psychiatry, University Hospital, Ulm, Germany

^c SPZ, University Children's Hospital, Division of Social Pediatrics and Child Neurology, Ulm, Germany

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ABSTRACT

Objective: To determine whether supplementation with the long-chain omega-3 polyunsaturated fatty acids eicosapentaenoic (EPA) and docosahexaenoic acid (DHA) affects behavioral symptoms and cognitive impairments in children 6–12 years of age diagnosed with attention-deficit/hyperactivity disorder (ADHD).

Study design: The randomized, double-blind placebo-controlled 16 weeks trial was conducted with 95 children diagnosed with ADHD according to DSM-IV criteria. Behavior was assessed by parents, teachers and investigators using standardized rating scales and questionnaires. Further outcome variables were working memory, speed of information processing and various measures of attention. For a subgroup of 81 participants, erythrocyte membrane fatty acid composition was analyzed before and after the intervention.

Results: Supplementation with the omega-3 fatty acid mix increased EPA and DHA concentrations in erythrocyte membranes and improved working memory function, but had no effect on other cognitive measures and parent- and teacher-rated behavior in the study population. Improved working memory correlated significantly with increased EPA, DHA and decreased AA (arachidonic acid).

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1. Introduction

Attention-deficit/hyperactivity (ADHD) disorder is one of the most prevalent developmental childhood disorders with a worldwide prevalence rate of 5.29% [1]. It is characterized by the inability to concentrate over a long period of time, to pay attention to tasks and to control impulsive and hyperactive behavior [2,3].

Despite convincing evidence for the efficacy of pharmacologic interventions such as methylphenidate (MPH) on ADHD symptom

reduction, there is substantial interest in other evidence-based treatment procedures [4].

Not all children experience symptom reduction by pharmacologic treatment with methylphenidate. Although the responder rate to MPH is high (65–70%), supplementation with omega-3 polyunsaturated fatty acids might be an option for non-responders or treatment-resistant children [5]. In addition omega-3 fatty acids could be an alternative for families concerned about adverse effects caused by stimulant medication such as loss of appetite, stunted growth and increased blood pressure and heart rate [6].

During the last years the effect of nutrition on behavior and learning problems in children has attracted the attention of parents, educators and therapists. In this context, research has focussed on long-chain polyunsaturated fatty acids (LC-PUFAs), especially the n-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), as a possible treatment option for ADHD [7–9].

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The authors take full responsibility for the study.

Trial Registration: ClinicalTrials.gov: NCT 01055119 <http://clinicaltrials.gov>.

* Corresponding author at: Department of Psychiatry, Leimgrubenweg 12–14, D-89075 Ulm, Germany. Tel.: +49 73150061538; fax: +49 73150061542.

E-mail address: katharina.widenhorn-mueller@uni-ulm.de (K. Widenhorn-Müller).

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A B S T R A C T

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Conclusiones 1

1) Los AG omega 3 pueden ser beneficiosos sobre el sistema cognitivo y visual, así como presentar propiedades antiinflamatorias y sobre el sistema inmune con una función en la prevención de alergias y control de enfermedades autoinmunes.

2) En la infancia existen suficientes evidencias científicas de que los ácidos grasos omega-3 juegan un papel importante en relación con un funcionalismo neurológico “normal”, con potencial terapéutico sobre TDAH y otros trastornos del neurodesarrollo. Aunque el tamaño del efecto es pequeño.

Conclusiones II

3) Es importante la proporción entre omega 6/3 y su eficacia es más clara en situaciones de bajas concentraciones o de Riesgo ejemplos la prematuridad, enfermedades crónicas como fibrosis quística y otras metabolopatías.

4) Importancia de los períodos ventana: embarazo, LM... hasta que los niños puedan incluir alimentos ricos en n-3 en la alimentación complementaria, o cuando sospechemos un déficit carencial.

Cuestiones sin resolver

1. Necesitamos más **estudios a largo plazo** con **más pacientes** con características clínicas bien definidas.
2. ¿**Composición óptima y dosis** (EPA, DHA, AA)?
3. ¿**Duración** del tratamiento para corregir los desbalances?
4. ¿**Efectivo “en general”** o solo en pacientes con deficiencias o desbalances?

Cuestiones sin resolver

4. ¿Su **administración profiláctica** disminuiría el riesgo de trastornos del neurodesarrollo?
5. ¿**Primera línea de tratamiento** para el TDAH en pacientes que rechazan F?.
6. Necesitamos definir la **correlación** entre niveles bajos de omega 3 eritrocitarios y cambios comportamentales en pacientes TDAH.

“¿Que es la nutraceutica?”

genética □□

ambiente □□

nutrición □□

“¿Qué día es?” preguntó Pooh.

“Es hoy.” dijo Piglet.

“Mi día favorito.”

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Muchas
Gracias