C M B M

Webinar Series

This webinar is hosted by Kathie Madonna Swift, MS, RDN, LDN, Food As Medicine Education Director for the Center for Mind-Body Medicine, present by Mark Pettus, MD and made possible by a grant from the Scheidel Foundation.

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Built on the Love of Family and Community

# Overfed and Undernourished

## Common Micronutrient Deficiencies

A Mind, Mood and Food Webinar


**Mark Pettus MD**

**December 13, 2017**

Director Medical Education, Wellness and Population Health
Berkshire Health Systems
Associate Dean of Medical Education
University of Massachusetts Medical School


The Center for Mind-Body Medicine

# Disclosures

- Chief Medical Officer of Functional Formularies
- Chief of Clinical Innovation at Novolux Lighting Technologies

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# Learning Objectives

- Review the prevalence and importance of micronutrient deficiencies essential to brain health, mind and mood.
- Review the contributing factors to the growing prevalence of important micronutrient deficiencies.
- Examine the importance of the MTHFR SNP and its clinical implications for personalized micronutrient-nutritional intervention.
- Review recent studies supporting nutritional intervention and supplementation for addressing common nutrient deficient states in individuals with “brain disruption”.

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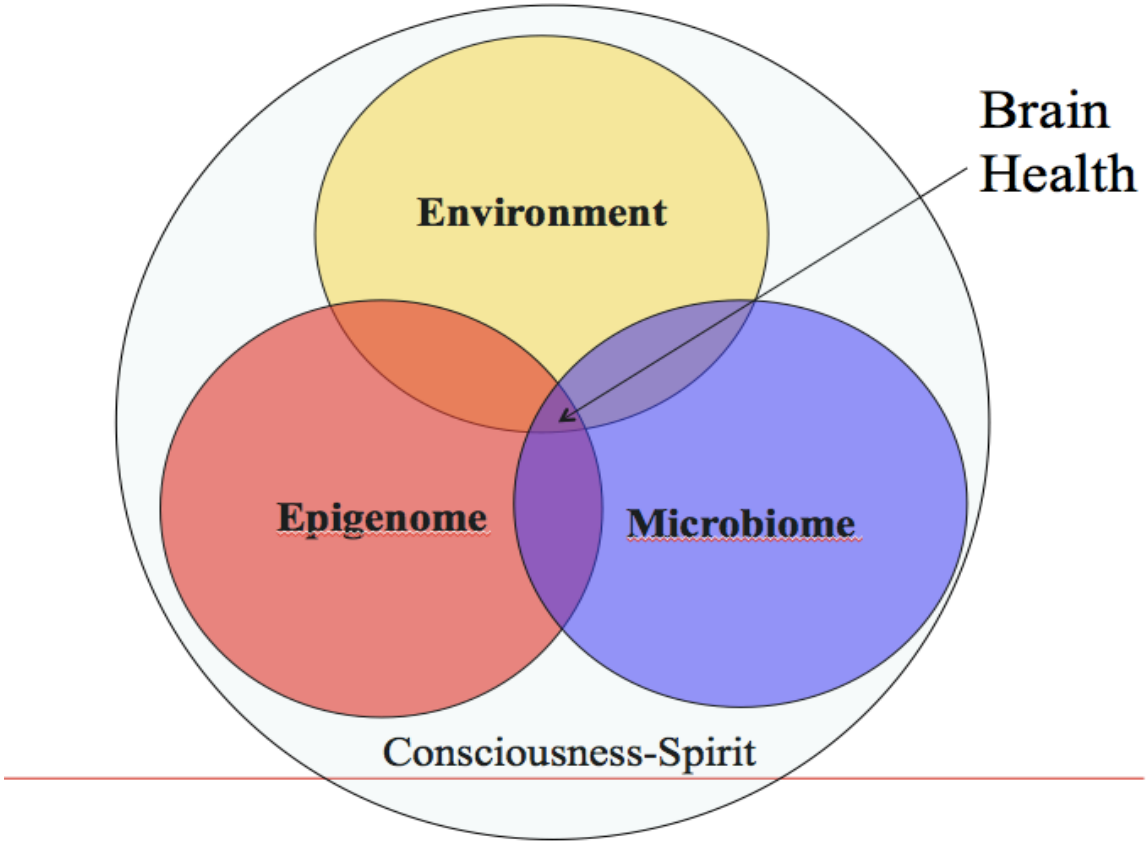
Nutr Neurosci. 2017 May 29:1-12. doi: 10.1080/1028415X.2017.1331524. [Epub ahead of print]

# Epigenetics, nutrition and mental health. Is there a relationship?

Stevens AJ[1], Rucklidge JJ[2], Kennedy MA[1].

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*Theoretical/Methodological/Review Article*

aps ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

Clinical Psychological Science
1–17

DOI: 10.1177/2167702614555413
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# The Emerging Field of Nutritional Mental Health: Inflammation, the Microbiome, Oxidative Stress, and Mitochondrial Function

**Bonnie J. Kaplan[1], Julia J. Rucklidge[2], Amy Romijn[2], and Kevin McLeod[3]**

[1]Department of Pediatrics, Department of Community Health Sciences, Alberta Children's Hospital Research Institute, University of Calgary; [2]Department of Psychology, University of Canterbury; and [3]Faculty of Medicine, University of Calgary

"There is now a wealth of research that has demonstrated the importance of inflammation, gut dysbiosis, oxidative stress, and mitochondrial dysfunction for mental health. The nutritional research reviewed herein justifies treating patients through either improved diet or supplementation (or both), given that such treatments could well have beneficial effects on all of these variables."

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# Nutritional medicine as mainstream in psychiatry

*Jerome Sarris, Alan C Logan, Tasnime N Akbaraly, G Paul Amminger, Vicent Balanzá-Martínez, Marlene P Freeman, Joseph Hibbeln, Yutaka Matsuoka, David Mischoulon, Tetsuya Mizoue, Akiko Nanri, Daisuke Nishi, Drew Ramsey, Julia J Rucklidge, Almudena Sanchez-Villegas, Andrew Scholey, Kuan-Pin Su, Felice N Jacka, on behalf of The International Society for Nutritional Psychiatry Research*

**Psychiatry is at an important juncture, with the current pharmacologically focused model having achieved modest benefits in addressing the burden of poor mental health worldwide. Although the determinants of mental health are complex, the emerging and compelling evidence for nutrition as a crucial factor in the high prevalence and incidence of mental disorders suggests that diet is as important to psychiatry as it is to cardiology, endocrinology, and gastroenterology. Evidence is steadily growing for the relation between dietary quality (and potential nutritional deficiencies) and mental health, and for the select use of nutrient-based supplements to address deficiencies, or as monotherapies or augmentation therapies. We present a viewpoint from an international collaboration of academics (members of the International Society for Nutritional Psychiatry Research), in which we provide a context and overview of the current evidence in this emerging field of research, and discuss the future direction. We advocate recognition of diet and nutrition as central determinants of both physical and mental health.**

*Lancet Psychiatry* 2015; 2: 271–74

Published Online January 26, 2015 http://dx.doi.org/10.1016/S2215-0366(14)00051-0

The Melbourne Clinic (J Sarris PhD), and Royal Melbourne Hospital (F N Jacka PhD), Department of Psychiatry, The University of Melbourne, Richmond

Growing recognition of nutrition as central determinants of both physical and mental health.

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# Essential Micronutrients

- Biotin
- Folic acid
- Niacin
- Pantothenate
- Riboflavin
- Thiamine
- Vit A
- Vit B6
- Vit B12
- Vit C
- Vit D
- Vit E
- Vit K

- Calcium
- Chloride
- Chromium
- Cobalt
- Copper
- Iodide
- Iron
- Magnesium
- Manganese
- Molybdenum
- Phosphorous
- Potassium
- Selenium
- Sodium
- Zinc

- Linolenic Acid (EPA/DHA)
- Linoleic acid
- Choline
- Isoleucine
- Leucine
- Lysine
- Methionine
- Phenylalanine
- Threonine
- Tryptophan
- Valine
- Histidine

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# What Americans Eat: Top 10 sources of calories in the U.S. diet

1. Grain-based desserts (cakes, cookies, donuts, pies, crisps, cobblers, and granola bars)
2. Yeast breads
3. Chicken and chicken-mixed dishes
4. Soda, energy drinks, and sports drinks
5. Pizza
6. Alcoholic beverages
7. Pasta and pasta dishes
8. Mexican mixed dishes
9. Beef and beef-mixed dishes
10. Dairy desserts

*Source: Report of the 2010 Dietary Guidelines Advisory Committee*

Carbohydrate-dense and high GI

- Loss of nutrient density
- Glucose-insulin
- Dysbiosis
- Fermentable Fiber deficient
- Pro-inflammatory
- Increased oxidative stress

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# Optimal Lifestyle Metrics

| Habit | Definition and criteria | Do you comply with it? | |
|---|---|---|---|
| | | No | Yes |
| **Smoking** | Absence of regular tobacco consumption | **0** | **1** |
| **Physical activity** | Amount of moderate and vigorous physical activity (more than 10 minutes/activity) that spans more than 150 minutes per week (the amount of time dedicated to vigorous physical activity accounts for double) | **0** | **1** |
| **Healthy diet** | Daily consumption of at least 5 pieces of fruit and vegetables | **0** | **1** |
| **Alcohol consumption** | Consumption of less than 2 alcoholic beverages a day for men and 1 in the case of women | **0** | **1** |

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## Make an educated guess:

Of the 2 million people managed by HealthPartners, what **percentage** follows all four (4) conditions of the OLM?


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# The "OLM" Universe

| Diet OLM Flag | Tobacco OLM Flag | Alcohol OLM Flag | Physical Activity OLM Flag | Number (%) |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1288 (0.26%) |
| 0 | 0 | 0 | 1 | 2363 (0.47%) |
| 0 | 0 | 1 | 0 | 20667 (4.13%) |
| 0 | 0 | 1 | 1 | 39918 (7.98%) |
| 0 | 1 | 0 | 0 | 2073 (0.41%) |
| 0 | 1 | 0 | 1 | 5783 (1.16%) |
| 0 | 1 | 1 | 0 | 90656 (18.1%) |
| 0 | 1 | 1 | 1 | 255344 (51.0%) |
| 1 | 0 | 0 | 0 | 40 (0.01%) |
| 1 | 0 | 0 | 1 | 205 (0.04%) |
| 1 | 0 | 1 | 0 | 661 (0.13%) |
| 1 | 0 | 1 | 1 | 4071 (0.81%) |
| 1 | 1 | 0 | 0 | 189 (0.04%) |
| 1 | 1 | 0 | 1 | 1386 (0.28%) |
| 1 | 1 | 1 | 0 | 10674 (2.13%) |
| 1 | 1 | 1 | 1 | 65026 (13.0%) |

- <0.5% meet **zero** OLM component
- 5% meets **one** OLM component
- 27.5% meets **two** OLM components
- 54% meets **three** OLM components
- 13% meets **four** OLM components

- 83.6% does **not** meet the diet OLM component (5 F&V daily)

**N = 500,344**

**Data based on self-reported health assessment questions**

Sources: Pronk, et al. Am J Prev Med 2004; 27(2S):25-33 and Pronk NP. ACSM's Health & Fitness Journal 2012;16(3):39-43.

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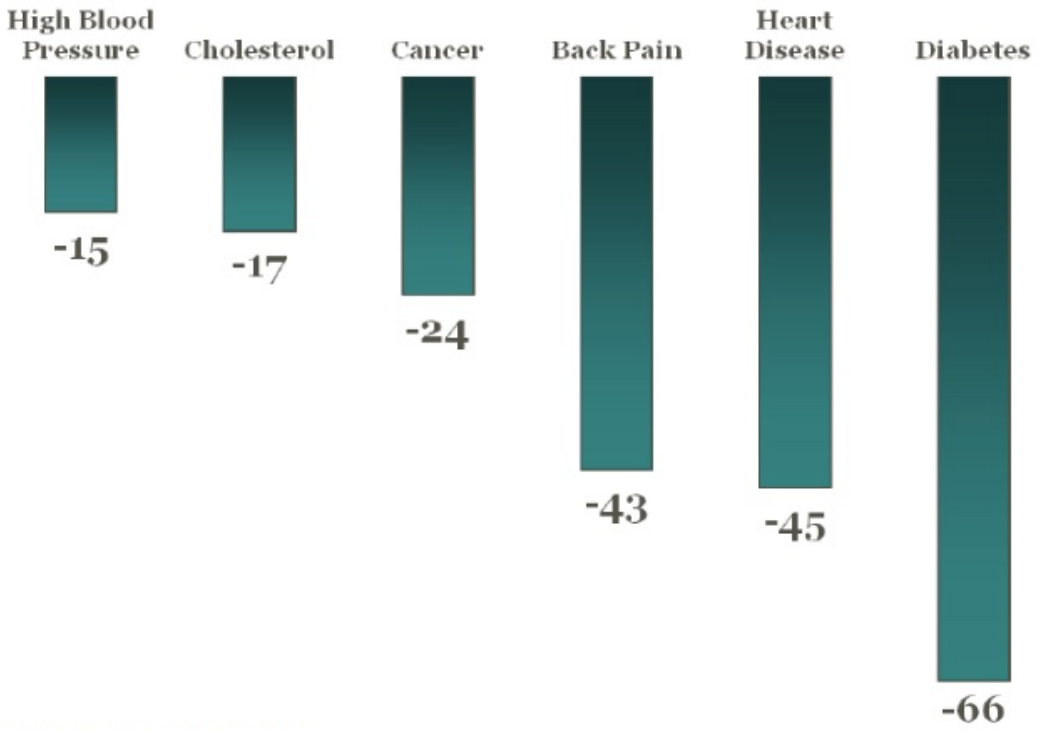
# Adherence to OLM and New Disease

*Difference in* **2-year incidence of new disease** *between people who adhere to OLM 0 or 1 and OLM 3 or 4 (%)*




Source: Pronk NP, et al. Pop Health Manage 2010;13:289-295.

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SUSTAINABILITY

# Dirt Poor: Have Fruits and Vegetables Become Less Nutritious?

Because of soil depletion, crops grown decades ago were much richer in vitamins and minerals than the varieties most of us get today

**Short-Term Effects**

- Micronutrient Intake almost non-existent
- Ex. Scurvy

**Long-Term Effects**

- Micronutrient Intake below RDA
- Ex. Cancer and aging-associated diseases

**Healthy**

- Micronutrient intake adequate
- Ex. Super-agers

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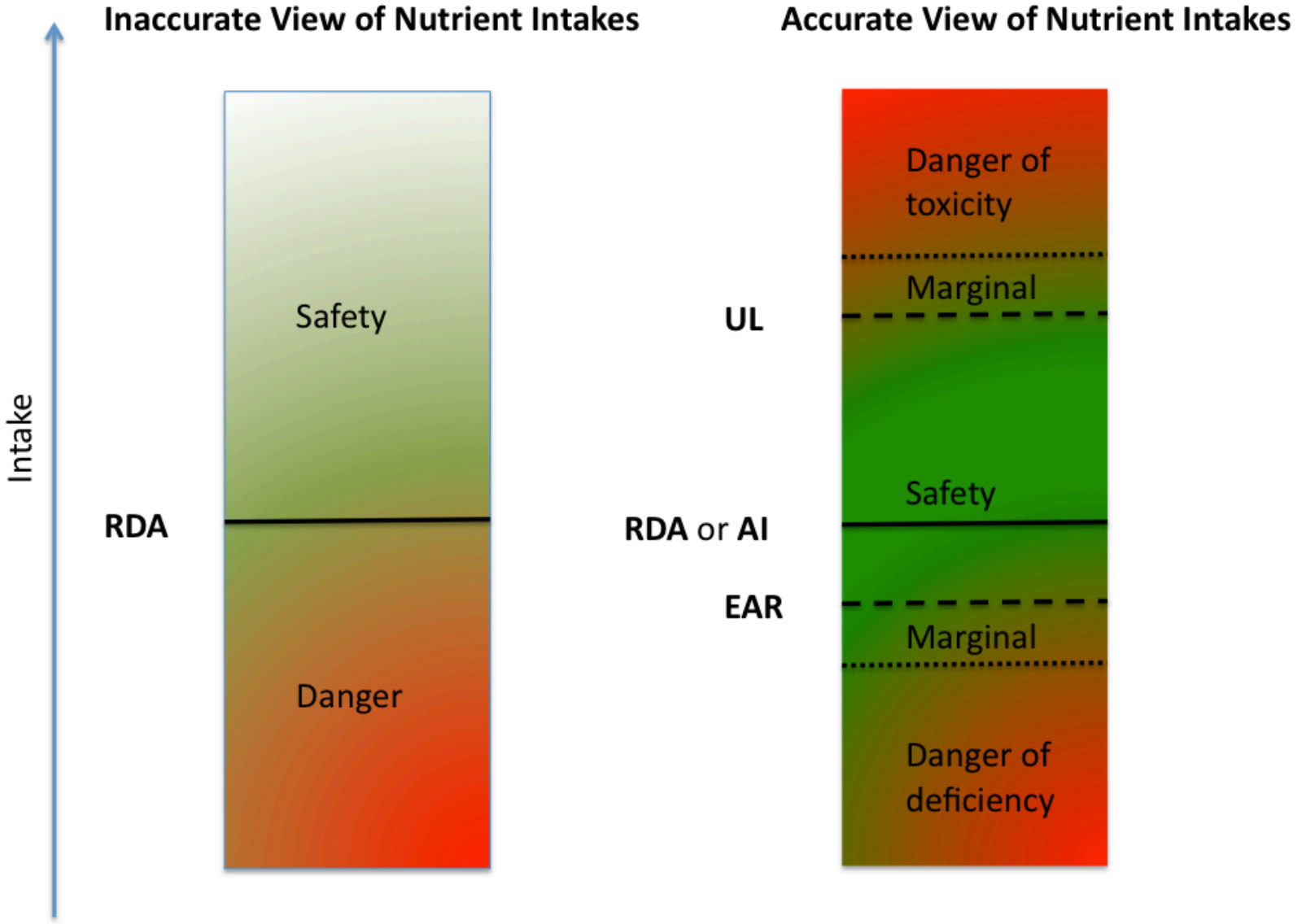


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# We need a broad spectrum of micronutrients for optimal function

- Biochemical individualization
- Compressed morbidity
- Goal to assist optimal biologic function e.g. identify “relative deficiencies”.
- Our needs change over time…a very dynamic metabolic landscape e.g. *triage theory and conditionally essential nutrients*
- Moving beyond vitamins and minerals e.g. *sufficient fermentable fiber and phytonutrients*

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J Am Coll Nutr. 2015;34(2):126-34. doi: 10.1080/07315724.2014.901196. Epub 2015 Jan 7.

# Comparison of prevalence of inadequate nutrient intake based on body weight status of adults in the United States: an analysis of NHANES 2001-2008.

Agarwal S[1], Reider C, Brooks JR, Fulgoni VL 3rd.

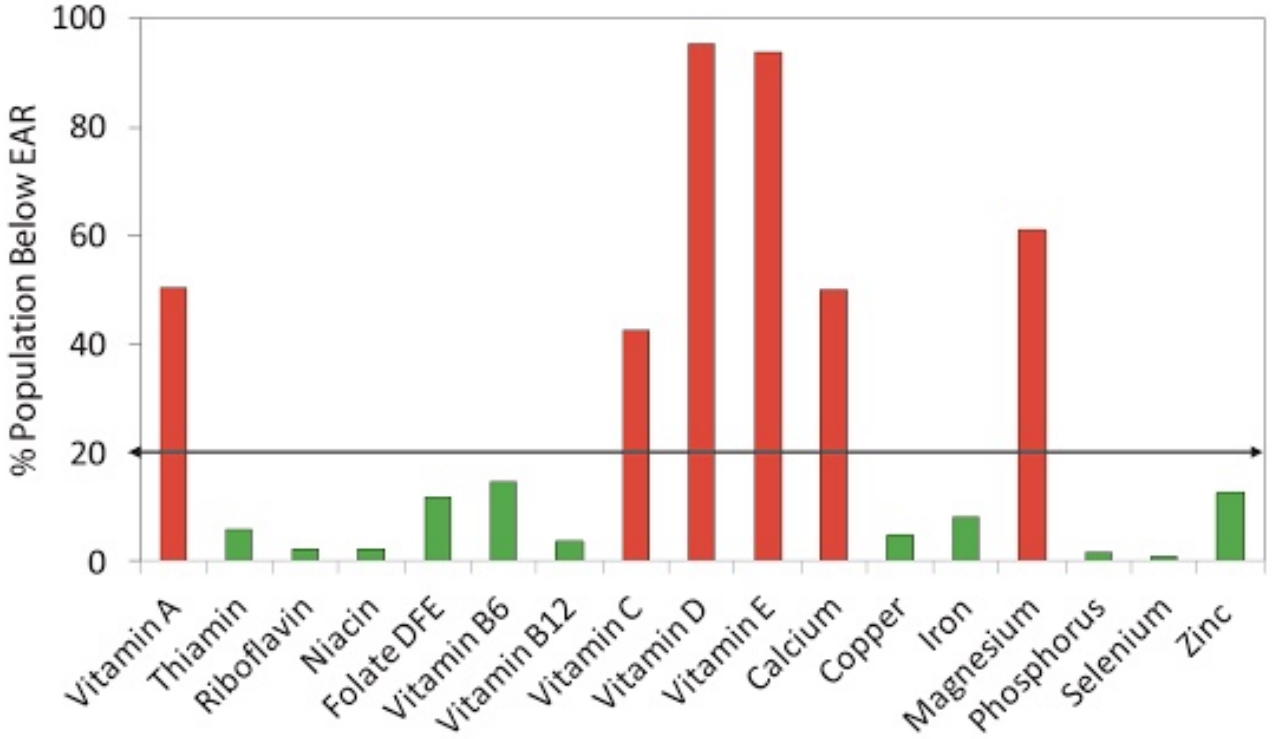


Figure 1: Percentage of the adult population (aged 19 years) with vitamin and mineral intakes below the EAR for individuals (data from NHANES 2001–2008). Usual intakes from foods were estimated by using the National Cancer Institute (NCI) method (Agarwal. 2014).

J Am Coll Nutr. 2015;34(2):126-34. doi: 10.1080/07315724.2014.901196. Epub 2015 Jan 7.

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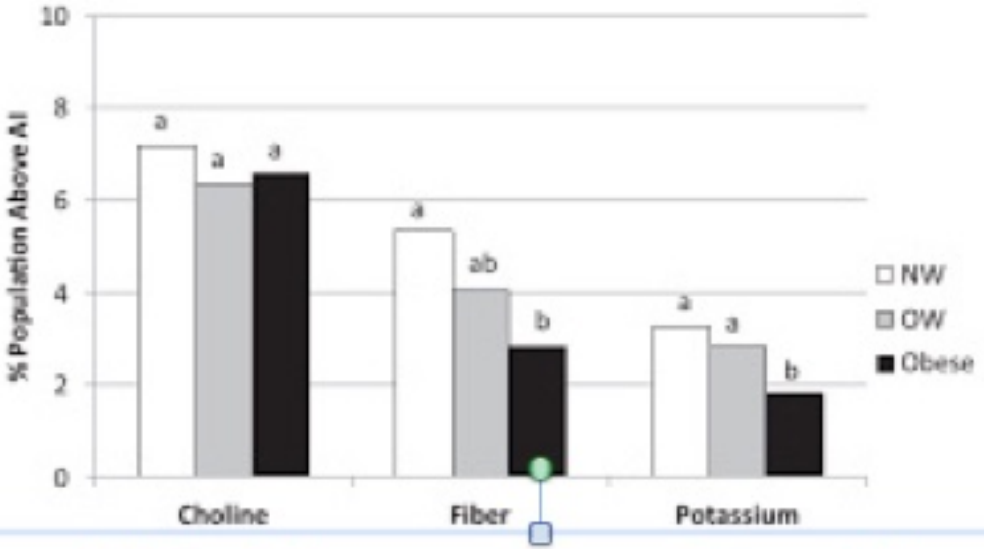


No RDA for choline, fiber and potassium. It is estimated that 93% Americans are deficient in choline, 95% fiber, and 97% Potassium!

estimated by using the National Cancer Institute method.
a, b,cBars with different letters are significantly different at $p < 0.05$ (Agarwal. 2014).

Medicine

# **Center for Disease Control** (testing blood and urine)

- *90 million* Americans deficient in vitamin D
- *30 million* Americans deficient in vitamin B 6
- *18 million* Americans deficient in vitamin B12 (using MMA)
- *16 million* Americans deficient in vitamin C
- *8 million* Americans deficient in iron; *Latinos 12%; blacks 16%; children ages <5 years of age 7-10%*
- Many women ages 25-39 with "borderline" low iodine levels

CDC
Centers for Disease Control and Prevention

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# Common Signs of Nutrient Deficiency

- Poor night vision-Vit A
- Chelitis – B2, B12, Fe, Zn
- Glossitis – B2, B3, Folic acid
- Spooning, spotted or ridged nails – Zn, Fe
- Easy bruising – Vit K
- Muscle weakness – Vit D
- Muscle cramps- Potassium, Magnesium, Riboflavin B2, B6-Pyridoxine
- RLS/Neuropathy – Fe, B12, Folate
- Loss of smell/taste - zinc
- Skin- Vitamin A (bumps on back of arms); Dermatitis- B2, B3, Biotin
- Hair loss- B2, B5, Biotin, D, zinc

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# Drug-Nutrient Interactions

- Alcohol- zinc, magnesium, phosphorous, B1, B2, B6 and Folate
- Antibiotics – Vitamin K
- Diuretics – potassium, magnesium, zinc, B6
- Metformin – B12
- Trimethoprim - Folate

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# Drug-Nutrient Interactions


- Proton pump inhibitors not only block the release of stomach acid but also something else called “intrinsic factor,” making it impossible to absorb vitamin B12.
- It’s well known that calcium is best absorbed in the presence of acid.
- Proton pump inhibitors are thought to inhibit active transport of magnesium in the intestine, leading to deficiencies and potentially serious health outcomes.

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- Your absorption of folic acid is inhibited, disrupting the production of new cells, which helps your body grow and repair itself.
- The absorption of zinc is impaired, which is needed for many enzyme reactions in the body.
- The inhibition of dietary iron can contribute to anemia over a long period of time

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## Seasonal Affirmations

- May you be safe
- May you be happy
- May you be at peace

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# Special Dietary-Nutrient Considerations

| TYPE OF DIET | RESTRICTED FOODS | NUTRIENTS OF CONCERN |
|---|---|---|
| Vegetarian (lacto-ovo) | Meat, poultry, fish/seafood | Iron, Zinc, Omega 3 fatty acids, Protein |
| Lacto-vegetarian | Meat, poultry, fish/seafood, eggs | Iron, Zinc, Omega 3 fatty acids, Protein |
| Ovo-vegetarian | Meat, poultry, fish/seafood, dairy products | Calcium, Iron, Zinc, Vitamin B12, Vitamin D, Omega 3 fatty acids, Protein |
| Vegan | All animal products including meat, poultry, fish/seafood, eggs, and dairy products | Calcium, Iron, Zinc, Vitamin B12, Vitamin D, Omega 3 fatty acids, Protein |
| Gluten-free | Wheat, rye, barley and their derivatives. Oats unless certified gluten-free. | B vitamins, Iron, Fiber |

# Labs for consideration

- 25 hydroxy-vitamin D
- B12 and Methylmalonic acid
- Folate
- Iron, TIBC, Ferritin
- Homocysteine
- MTHFR
- RBC magnesium and zinc
- RBC Omega 3/6 Index (want 8+ %)
- Urinary Organic Acids-Metabolic Profile

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*The FASEB Journal* • Review

# Vitamin D and the omega-3 fatty acids control serotonin synthesis and action, part 2: relevance for ADHD, bipolar disorder, schizophrenia, and impulsive behavior

**Rhonda P. Patrick**[1] **and Bruce N. Ames**[1]

Nutrition and Metabolism Center, Children's Hospital Oakland Research Institute, Oakland, California, USA

ABSTRACT **Serotonin regulates a wide variety of brain functions and behaviors. Here, we synthesize previous findings that serotonin regulates executive function, sensory gating, and social behavior and that attention deficit hyperactivity disorder, bipolar disorder, schizophrenia, and impulsive behavior all share in common defects in these functions. It has remained unclear why supplementation with omega-3 fatty acids and vitamin D improve cognitive function and behavior in these brain disorders. Here, we propose mechanisms by which serotonin synthesis, release, and function in the brain are modulated by vitamin D and the 2 marine omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Brain serotonin is synthesized from tryptophan by tryptophan hydroxylase 2, which is transcriptionally activated by vitamin D hormone. Inadequate levels of vitamin D (<70%**

*"The rapid progress true science now makes, occasions my regretting sometimes that I was born too soon. It is impossible to imagine the height to which may be carried, in a thousand years, the power of man over matter. We may, perhaps, deprive large masses of their gravity, and give them absolute levity, for the sake of easy transport. Agriculture may diminish its labor and double its produce: all diseases may by sure means be prevented or cured, (not excepting even that of old age,) and our lives lengthened at pleasure, even beyond the antediluvian standard. Oh that moral science were in as fair a way of improvement, that men would cease to be wolves to one another, and that human beings would at length learn what they now improperly call humanity."*

*– Benjamin Franklin, letter to Joseph Priestley, 1780*

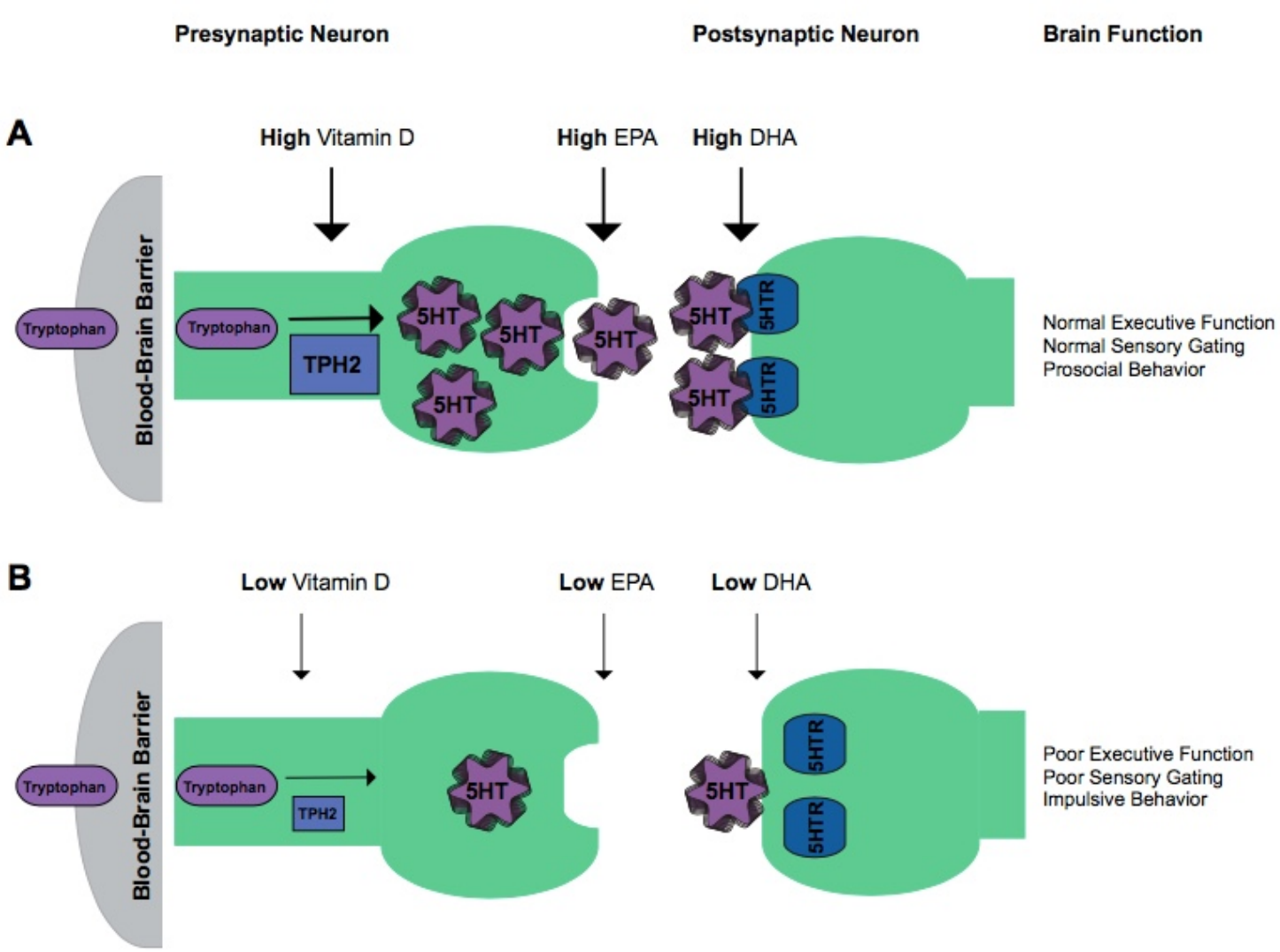
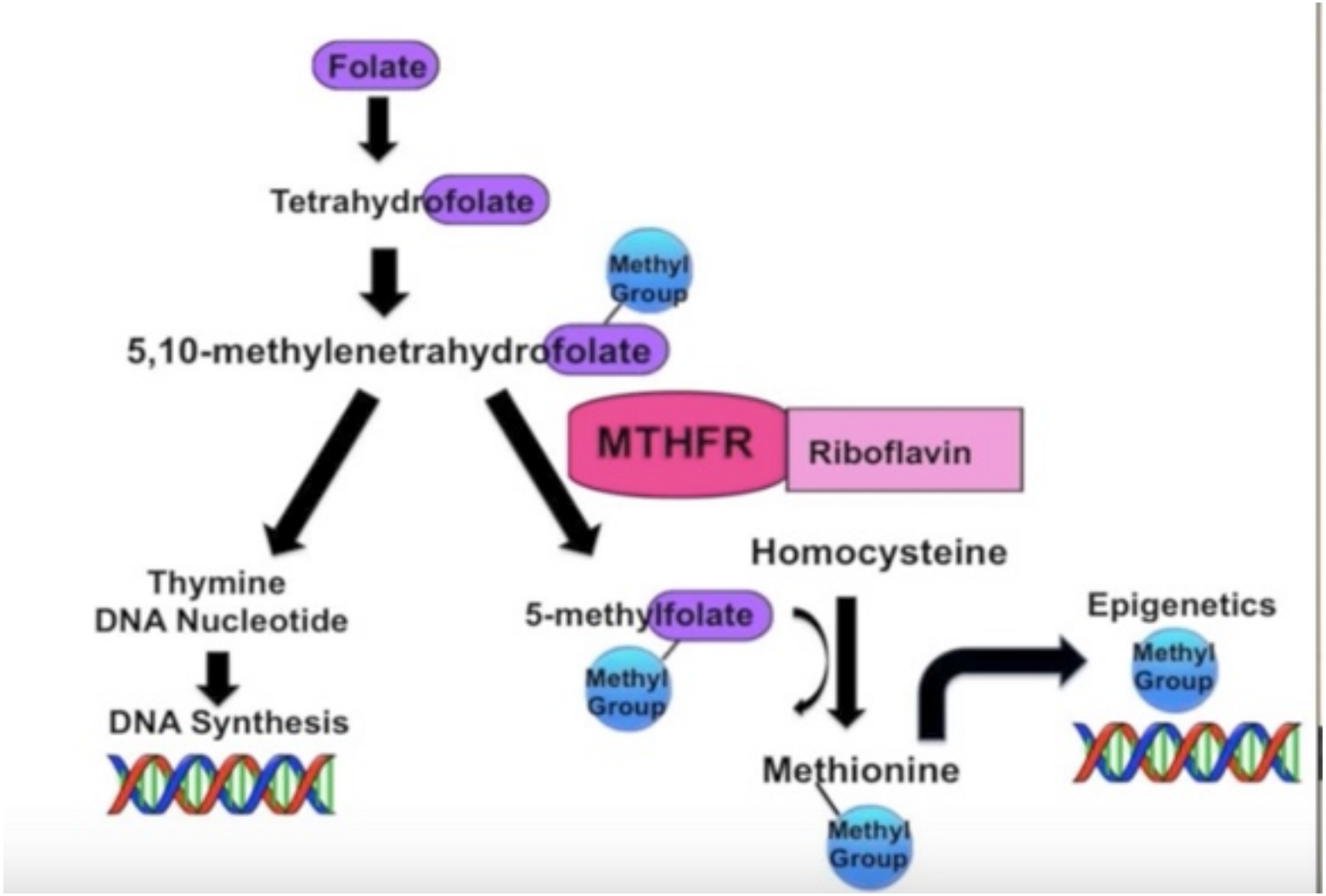



**Figure 2.** Micronutrient regulation of the serotonin pathway. *A*) Tryptophan is transported across the blood-brain barrier, and vitamin D sufficiency allows normal tryptophan metabolism by increasing expression of tryptophan hydroxylase 2 (TPH2) to produce serotonin (5HT). Sufficient levels of eicosapentaenoic acid (EPA) allow 5HT to be released by the presynaptic neuron. Sufficient levels of docosahexaenoic acid (DHA) allow for the binding of 5HT to the serotonin receptor (5HTR) in the postsynaptic neuron. This allows for normal serotonin neurotransmission and executive function, sensory gating, and prosocial behavior. *B*) When vitamin D status is insufficient, TPH2 is not expressed well and little serotonin is produced. Insufficient EPA status results in inhibition of 5HT release from the presynaptic neuron. Insufficient DHA status changes the serotonin receptor accessibility resulting in less 5HT binding to the serotonin receptor on the postsynaptic neuron. This leads to abnormal serotonin neurotransmission and poor executive function, poor sensory gating, and impulsive behavior.

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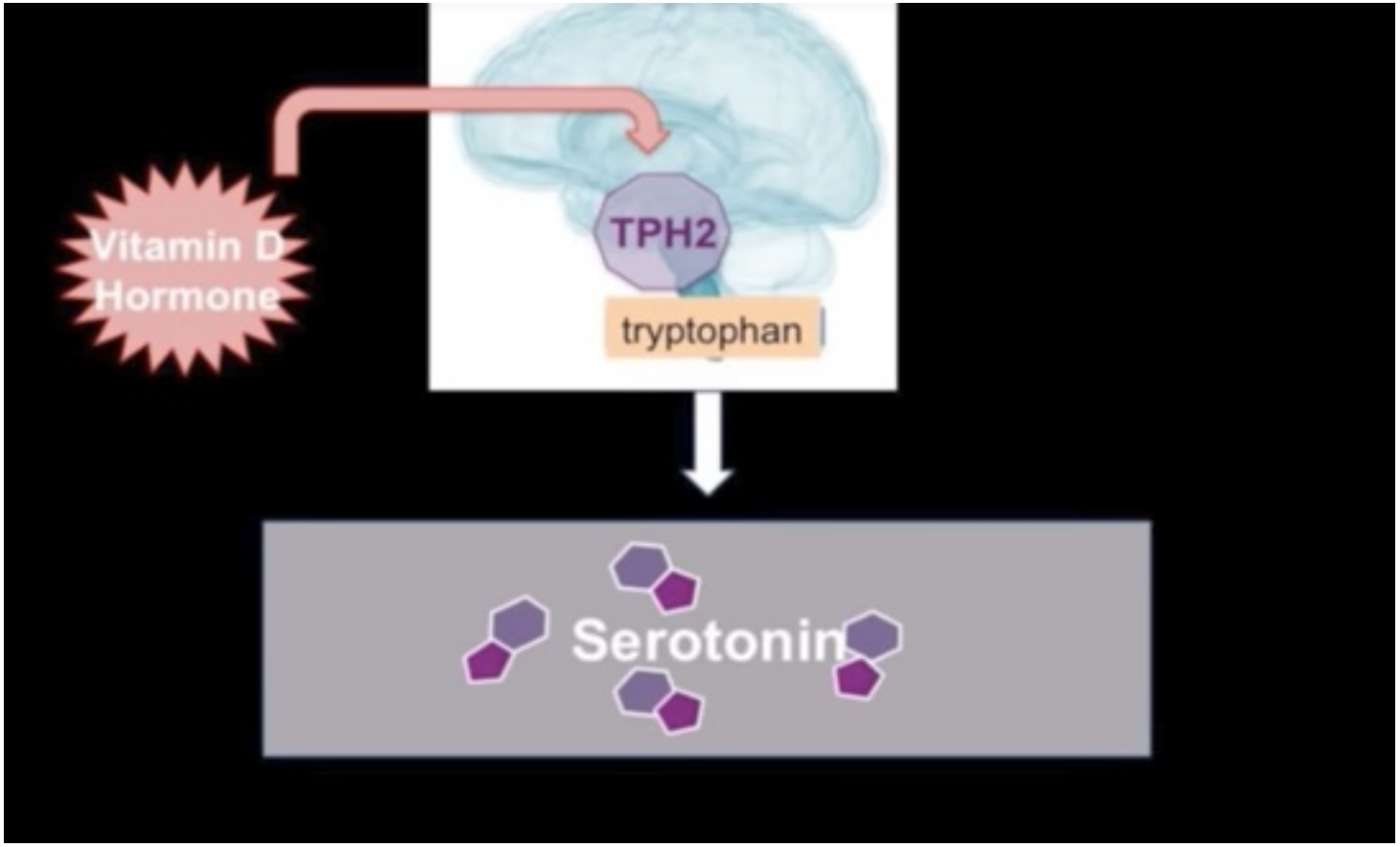


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Journal of *Clinical Medicine*

MDPI

*Review*

# Supplementation with Omega-3 Fatty Acids in Psychiatric Disorders: A Review of Literature Data

**Paola Bozzatello, Elena Brignolo, Elisa De Grandi and Silvio Bellino ***

Centre for Personality Disorders, Department of Neuroscience, University of Turin, 10126 Turin, Italy; paola.bozzatello@unito.it (P.B.); elena.brignolo@yahoo.com (E.B.); elisa.degrandi@gmail.com (E.D.G.)

The main evidence for the effectiveness of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) has been obtained in mood disorders, in particular in the treatment of depressive symptoms in unipolar and bipolar depression. There is some evidence to support the use of omega-3 fatty acids in the treatment of conditions characterized by a high level of impulsivity and aggression and borderline personality disorders. In patients with attention deficit hyperactivity disorder, small-to-modest effects of omega-3 HUFAs have been found.

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J Am Geriatr Soc. 2017 Oct;65(10):2161-2168. doi: 10.1111/jgs.15012. Epub 2017 Jul 31.

# A Systematic Review and Meta-Analysis of The Effect of Low Vitamin D on Cognition.

Goodwill AM[1], Szoeke C[1,2].

**Author information**

**Abstract**

Observational evidence demonstrates low vitamin D is related to poorer cognition; however, interventional studies are yet to show a clear benefit from vitamin D supplementation. From the evidence to date, there is likely a therapeutic age window relevant to the development of disease and therefore vitamin D therapy.

**DESIGN:** Systematic review and random effect meta-analysis.

**SETTING:** Observational (cross-sectional and longitudinal cohort) studies comparing low and high vitamin D status and interventions comparing vitamin D supplementation with a control group were included in the review and meta-analysis.

**PARTICIPANTS:** Studies including adults and older adults without a dementia diagnosis were included.

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frontiers in Pharmacology

REVIEW
published: 30 June 2017
doi: 10.3389/fphar.2017.00414

# The Emerging Role for Zinc in Depression and Psychosis

*Matthew A. Petrilli[1], Thorsten M. Kranz[2], Karine Kleinhaus[3], Peter Joe[3], Mara Getz[3], Porsha Johnson[3], Moses V. Chao[2] and Dolores Malaspina[3]**

[1] Creedmoor Psychiatric Center, Queens, NY, United States, [2] Departments of Cell Biology, Physiology and Neuroscience

Well powered clinical studies have shown beneficial effects of supplemental zinc in depression and it important to pursue research using zinc as a potential therapeutic option for psychosis as well. Meta-analyses support the adjunctive use of zinc in major depression and a single study now supports zinc for psychotic symptoms.



anti-inflammatories and others also impact zinc absorption. Furthermore, inefficient genetic variants in zinc transporter molecules that transport the ion across cellular membranes impede its action even when circulating zinc concentrations is in the normal

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Psychiatry Res. 2017 May;251:41-47. doi: 10.1016/j.psychres.2017.02.006. Epub 2017 Feb 3.

# Dietary zinc and iron intake and risk of depression: A meta-analysis.

Li Z[1], Li B[1], Song X[1], Zhang D[2].

**Author information**

**Abstract**

A total of 9 studies for dietary zinc intake and 3 studies for dietary iron intake were finally included in present meta-analysis. The pooled RRs with 95% CIs of depression for the highest versus lowest dietary zinc and iron intake were 0.67 (95% CI: 0.58-0.76) and 0.57 (95% CI: 0.34- 0.95), respectively. In subgroup analysis by study design, the inverse association between dietary zinc intake and risk of depression remained significant in the cohort studies and cross-sectional studies.

dietary zinc intake and risk of depression remained significant in the cohort studies and cross-sectional studies. The pooled RRs (95% CIs) for depression did not substantially change in the influence analysis and subgroup analysis by adjustment for body mass index (BMI). The present meta-analysis indicates inverse associations between dietary zinc and iron intake and risk of depression.

Biol Trace Elem Res. 2017 Mar;176(1):56-63. doi: 10.1007/s12011-016-0798-9. Epub 2016 Jul 30.

# Analysis of Relations Between the Level of Mg, Zn, Ca, Cu, and Fe and Depressiveness in Postmenopausal Women.

Szkup M[1], Jurczak A[2], Brodowska A[1], Brodowska A[3], Noceń I[4], Chlubek D[5], Laszczyńska M[6], Karakiewicz B[7], Grochans E[1].

**Author information**

**Erratum in**

Erratum to: Analysis of Relations Between the Level of Mg, Zn, Ca, Cu, and Fe and Depressiveness in Postmenopausal Women. [Biol Trace Elem Res. 2017]

## Abstract

The study included 198 healthy postmenopausal women at the average age of 56.26 ± 5.55 years.

The lowest Mg levels were observed in women with depressive symptoms (14.28 ± 2.13 mg/l), and the highest in women without depressive symptoms (16.30 ± 3.51 mg/l), ($p \leq 0.05$).

women without depressive symptoms (1.07 ± 0.22 mg/l) and the highest in those with severe depressive symptoms (1.19 ± 0.17 mg/l), ($p \leq 0.05$). The lowest Mg levels were observed in

JBI Database System Rev Implement Rep. 2017 Feb;15(2):402-453. doi: 10.11124/JBISRIR-2016-002965.

# The impact of essential fatty acid, B vitamins, vitamin C, magnesium and zinc supplementation on stress levels in women: a systematic review.

McCabe D[1], Lisy K, Lockwood C, Colbeck M.

**Author information**

The current review suggests that EFAs may be effective in reducing prenatal stress and salivary cortisol and may reduce anxiety during premenstrual syndrome and during menopause in the absence of depression. Magnesium and vitamin B6 may be effective in combination in reducing premenstrual stress, and vitamin B6 alone may reduce anxiety effectively in older women. High-dose sustained-release vitamin C may reduce anxiety and mitigate increased blood pressure in response to stress.

**TYPES OF INTERVENTION(S):** Dietary supplementation with EFAs, B vitamins, vitamin C, magnesium and/or zinc.

Biol Psychiatry. 2013 Dec 15;74(12):872-8. doi: 10.1016/j.biopsych.2013.05.008. Epub 2013 Jun 24.

# Zinc in depression: a meta-analysis.

Swardfager W[1], Herrmann N, Mazereeuw G, Goldberger K, Harimoto T, Lanctôt KL.

**Author information**

**Abstract**

**BACKGROUND:** Zinc is an essential micronutrient with diverse biological roles in cell growth, apoptosis and metabolism, and in the regulation of endocrine, immune, and neuronal functions implicated in the pathophysiology of depression. This study sought to quantitatively summarize

CONCLUSIONS: Depression is associated with a lower concentration of zinc in peripheral blood. The pathophysiological relationships between zinc status and depression, and the potential benefits of zinc supplementation in depressed patients, warrant further investigation.

quantitatively in random-effects meta-analysis, and summarized as a weighted mean difference (WMD).

Mind-Body Medicine

*nutrients*

MDPI

*Review*

# The Effects of Magnesium Supplementation on Subjective Anxiety and Stress—A Systematic Review

**Neil Bernard Boyle *, Clare Lawton and Louise Dye**

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* Correspondence: n.b.boyle@leeds.ac.uk; Tel.: +44-113-343-1403

Received: 31 January 2017; Accepted: 17 April 2017; Published: 26 April 2017

18 studies were included in the review. All reviewed studies recruited samples based upon an existing vulnerability to anxiety: mildly anxious, premenstrual syndrome (PMS), postpartum status, and hypertension. Four/eight studies in anxious samples, four/seven studies in PMS samples, and one/two studies in hypertensive samples reported positive effects of Mg on subjective anxiety outcomes.

was performed in May 2016. Ovid Medline, PsycINFO, Embase, CINAHL and Cochrane databases were searched using equivalent search terms. A grey literature review of relevant sources was also undertaken. Results: 18 studies were included in the review. All reviewed studies recruited samples based upon an existing vulnerability to anxiety: mildly anxious, premenstrual syndrome (PMS), postpartum status, and hypertension. Four/eight studies in anxious samples, four/seven studies in PMS samples, and one/two studies in hypertensive samples reported positive effects of Mg on

*nutrients*

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*Review*

# B Vitamins and the Brain: Mechanisms, Dose and Efficacy—A Review

**David O. Kennedy**

Brain, Performance and Nutrition Research Centre, Northumbria University, Newcastle-upon-Tyne NE1 8ST, UK; david.kennedy@northumbria.ac.uk; Tel.: +44-191-243-7720

Received: 24 September 2015; Accepted: 21 January 2016; Published: 28 January 2016

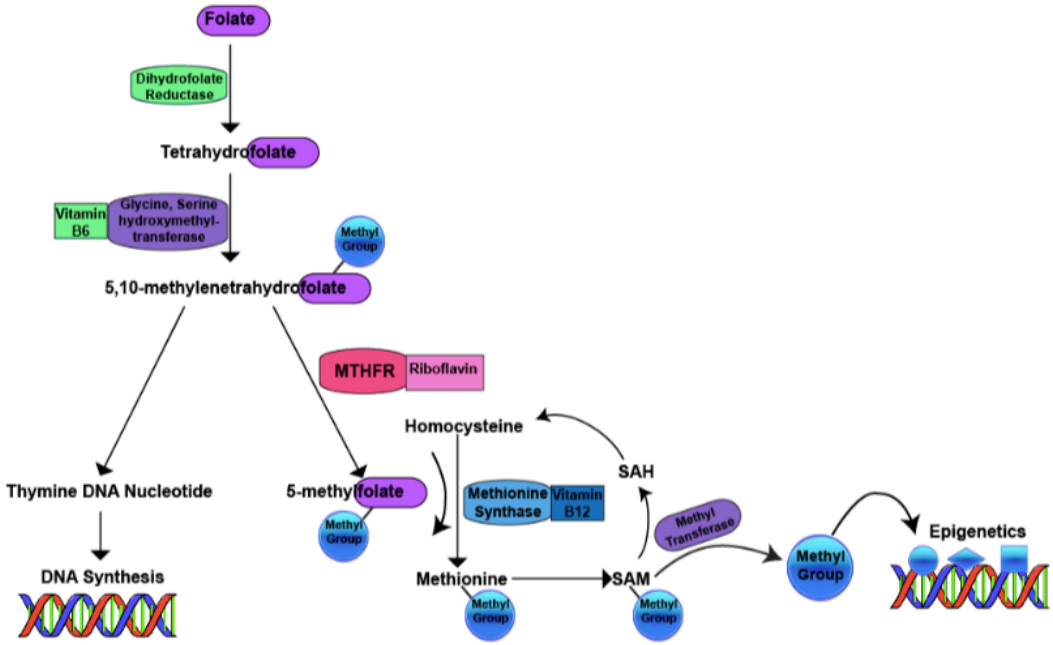
**Abstract:** The B-vitamins comprise a group of eight water soluble vitamins that perform essential

this group of micronutrients are essential for optimal physiological and neurological functioning. Furthermore, evidence from human research clearly shows both that a significant proportion of the populations of developed countries suffer from deficiencies or insufficiencies in one or more of this group of vitamins, and that, in the absence of an optimal diet, administration of the entire B-vitamin group, rather than a small sub-set, at doses greatly in excess of the current governmental recommendations, would be a rational approach for preserving brain health.

Evidence from human studies clearly shows a significant proportion of people suffer from deficiencies or insufficiencies in one or more of B-vitamins. Supplementing, in the absence of an optimal diet at doses greatly in excess of current recommendations would be a rational approach for preserving brain health.

# MTFHR SNP

- Folate and MTHFR: Thymine synthesis and methylation
- 40% population heterozygous which results in a 40% reduction in functional MTHFR
- 10% homozygous with 80-90% reduction in the functional efficiency of MTHFR
- Treatment resistant depression

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# Nutritional Considerations-Supplementation

- Choline: 500 mg/day (4-5 egg yolk equivalents; 4 oz liver/week, cruciferous veggies, nuts). Strongly consider supplementation.
- Folate: 2-3 servings, liver, leafy greens, legumes; Supplementation methyl-folate 1200 mcg/day
- Glycine: non-hydrolyzed whey protein, bone broth,
- Creatine (spares methyl-folate): 3-5 gms/day

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# Effectiveness of add-on l-methylfolate therapy in a complex psychiatric illness with MTHFR C677 T genetic polymorphism.

Jha S[1], Kumar P[2], Kumar R[2], Das A[3].

**Author information**

**Abstract**

The 5,10-methylenetetrahydrofolate reductase (MTHFR) gene plays a central role in folate metabolism. Many studies have demonstrated an association between MTHFR C677 T variant

Adjunctive L-methylfolate 15 mg/d may be an early option in patients who fail to adequately respond to antidepressant monotherapy, with preliminary evidence demonstrating sustained remission and sustained recovery.

such complex psychiatric phenomenon and comorbid diagnosis with genetic polymorphism of MTHFR C677 T mutation.



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# Supplement considerations


- Magnesium threonate, citrate, glycinate: 300-400 mg at bedtime
- Zinc: 15-30 mg/day
- EPA-DHA: 2,000-3,000 mg/day
- Vitamin D to achieve levels 40-60 ng/dl (sun is our friend)
- B6 (pyridoxal-5-phosphate): 25-50 mg/day
- Methylated cobalamin (1,000 mcg) and folate 800-1200 mcg (higher doses in resistant depression with MTHFR)
- Choline 500 mg/day (MTHFR)
- Probiotics: 20 + billion CFUs, broad-spectrum e.g. lactobacillus, bifidobacter, saccharomyces

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# Summary

- Micronutrient deficiencies will be present in many individuals with disrupted brain function, mind and mood.
- 3-day food diary review
- Personalized testing for micronutrient deficiencies
- Nutritional interventions to include nutrient-dense whole foods; elimination trial; incremental prebiotic rich foods
- Personalized supplementation
- Integrative lifestyle management

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# USING WHOLE FOODS AS MEDICINE

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Presented by Tanmeet Sethi, MD
January 17, 2018, 12 PM ET

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# Mind, Mood & Food

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