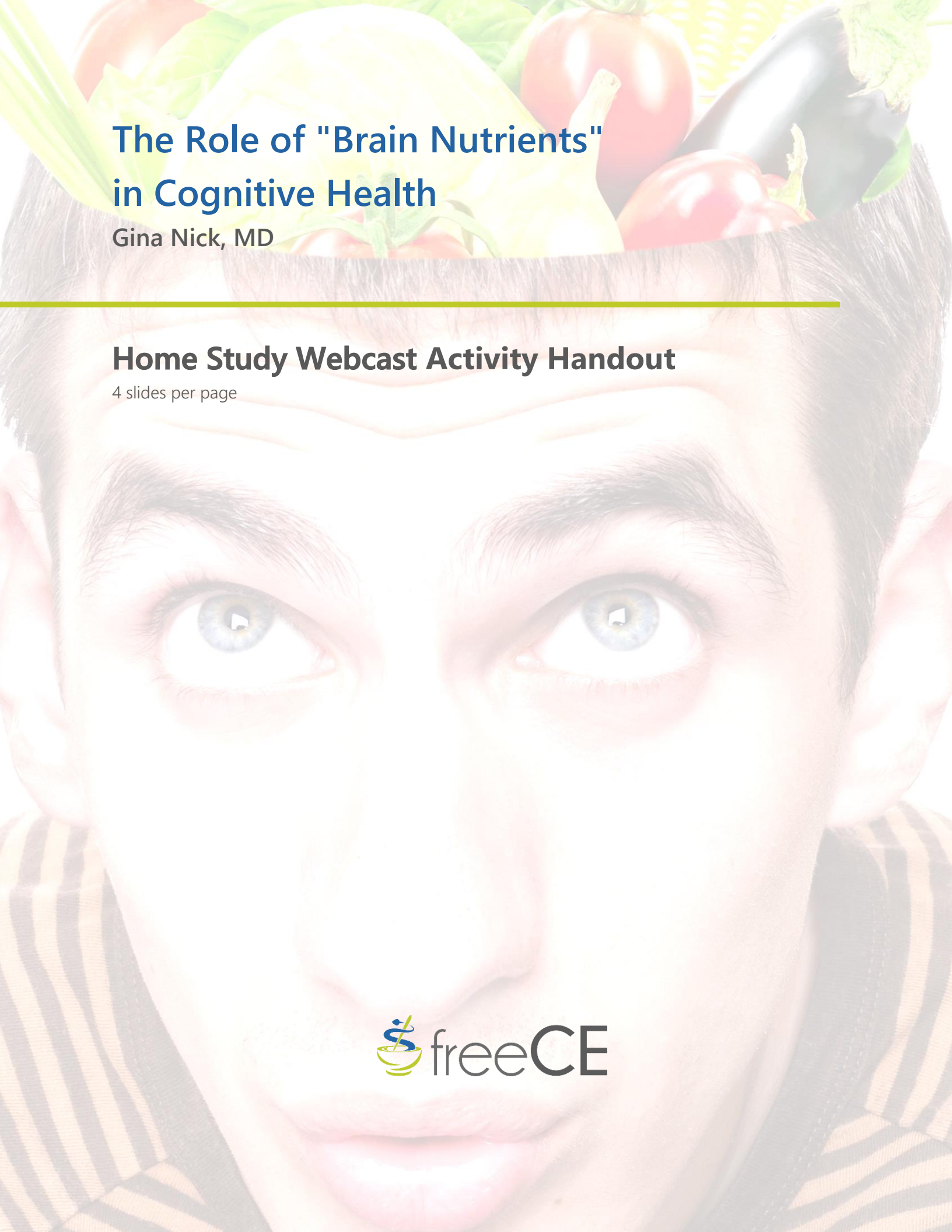




The Role of "Brain Nutrients" in Cognitive Health

Gina Nick, MD

Home Study Webcast Activity Handout

4 slides per page



The Role of "Brain Nutrients" in Cognitive Health

ACTIVITY DESCRIPTION

The effects of nutrition on cognitive processes has long been studied. There are newly described influences of key brain nutrients on cognitive function that reveal important mechanisms of action that provide neuronal protection and improve brain metabolism.

TARGET AUDIENCE

The target audience for this activity is **pharmacists, pharmacy technicians, and nurses** in hospital, community, and retail pharmacy settings.

LEARNING OBJECTIVES

After completing this activity, the **pharmacist** will be able to:

- Identify the relationship between brain nutrients and cognitive health.
- Describe the primary nutrients which play a significant role in brain function.
- Review the biochemical roles, safety, and dosing of brain nutrients.

After completing this activity, the **pharmacy technician** will be able to:

- List the key nutrients that influence cognitive function.
- List the effects of brain nutrients on cognition

ACCREDITATION

Pharmacy



PharmCon, Inc. is accredited by the Accreditation Council for Pharmacy Education as a provider of continuing pharmacy education.

Nursing

PharmCon, Inc. is approved by the California Board of Registered Nursing (Provider Number CEP 13649) and the Florida Board of Nursing (Provider Number 50-3515). Activities approved by the CA BRN and the FL BN are accepted by most State Boards of Nursing.

CE hours provided by PharmCon, Inc. meet the ANCC criteria for formally approved continuing education hours. The ACPE is listed by the AANP as an acceptable, accredited continuing education organization for applicants seeking renewal through continuing education credit. For additional information, please visit:
<http://www.nursecredentialing.org/RenewalRequirements.aspx>

Universal Activity No.: 0798-0000-18-056-H04-P

Credits: 1.0 contact hour (0.1 CEU)

Release Date: 5/1/2018

freeCE Expiration Date: 5/1/2021

ACPE Expiration Date: 5/1/2021

ACTIVITY TYPE

Knowledge-Based Home Study Webcast

FINANCIAL SUPPORT BY

Pharmaceutical Education Consultants, Inc.



Gina Nick, MD

Bridge to Health LLC

ABOUT THE AUTHOR

Dr. Gina Nick, NMD is a California and Hawaii licensed Naturopathic Physician, President Emeritus of the California Naturopathic Doctors Association, Founder of HealthBridge Newport in Newport Beach, CA, and Physician Spokesperson for the American Association of Naturopathic Physicians and the American College for Advancement in Medicine. Dr. Gina is respected internationally in the fields of Integrative and Functional Medicine, Detoxification, Hormone Treatments, and Addiction Treatment and Recovery.

She is a graduate of the University of California, Los Angeles; where she received College and Latin Honors and is a UCLA Alumni Scholar and member of the Golden Key Honors Society, and a graduate of Southwest College of Naturopathic Medicine where she was awarded her Doctorate Degree at the age of 23 and received Distinguished Honors for her work in nutritional biochemistry, homeopathy and herbal medicine.

Dr. Gina has practiced Naturopathic Medicine for 18 years with unparalleled results and, in most cases, without the need for traditional medications that cause unnecessary side effects. Her treatment methods have produced consistent results for patients with conditions running the gamut from dietary and allergic response to diabetes, autoimmune disorders and hormone imbalance.

FACULTY DISCLOSURE

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The Role of Brain Nutrients on Cognitive Health

Faculty: Gina Nick, NMD, PhD

freeCE



Gina Nick, NMD, PhD
Bridge to Health LLC

faculty

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What is Cognitive Health?

Cognitive health: the ability to clearly think, learn, and remember

—NIH, National Institute on Aging



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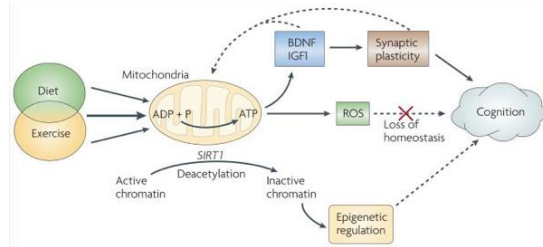
What is Cognitive Health?

- Diet & Exercise
- Smart Drugs/Brain Nutrients



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Diet & Exercise



Nat Rev Neurosci. 2008 Jul; 9(7): 568-578.

Neuroinflammation

- Oxidative stress
- The inflammatory cascade

Brain Nutrients

- **Omega 3 Fatty Acids**
- Citicoline/CDP Choline
- Curcumin
- Amino Acids, Vitamins and Minerals
- Flavonoids



Omega 3 Fatty Acids

- Docosahexaenoic acid (DHA; 22:6n-3) is a long-chain omega-3 fatty acid, commonly found in fish (such as salmon or tuna) and marine animals
- In the same family as the omega-3 fatty acid alpha-linolenic acid (18:3n-3), precursor of DHA and is commonly found in plant foods such as flax, soy, and walnuts.
- Also in the same family as eicosapentaenoic acid (EPA; 20:5n-3), the other fatty acid commonly found in fish and marine products.
- In the human body, DHA is present in very high concentrations in the brain.

Natural Medicines Comprehensive Database 2018

Omega 3 Fatty Acids

- Omega 3 fatty acids upregulate genes that are important for maintaining synaptic function and plasticity.
- On the other hand, excess saturated fats in diet reduces molecular substrates that support cognitive processing and increase the risk of neurological dysfunction.

Natural Medicines Comprehensive Database 2018



Omega 3 Fatty Acids

- Amelioration of cognitive decline in the elderly
- Improvement of cognition in traumatic brain injury in rodents
- Amelioration of cognitive decay in mouse model of Alzheimer's disease

van Gelder BM, et al. Fish consumption, n-3 fatty acids, and subsequent 5-y cognitive decline in elderly men: the Zutphen Elderly Study. *Am J Clin Nutr*. 2007;85:1142-1147; Wu A, et al. Dietary Omega-3 fatty acids normalize BDNF levels, induce oxidative damage, and counteract learning disability after traumatic brain injury in rats. *J Neurotrauma*. 2004;21:1457-1467; Hashimoto M, et al. Chronic administration of docosahexaenoic acid ameliorates the impairment of spatial cognition learning ability in amyloid β -infused rats. *J Nutr*. 2005;135:449-455.



Omega 3 Fatty Acids

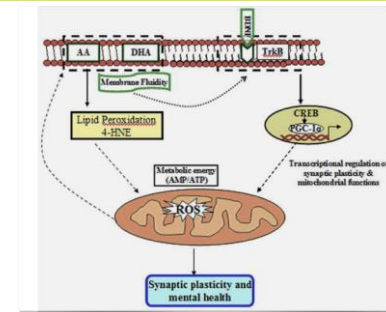
- Food sources:
- Fish (salmon)
 - Flax seeds
 - Krill
 - Chia
 - Kiwi fruit
 - Butternuts
 - Walnuts



Available as dietary supplement in US



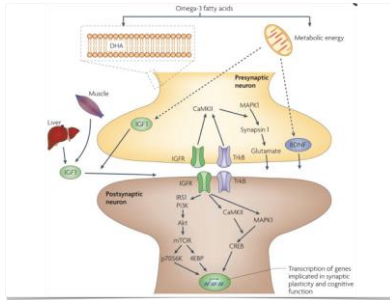
Omega 3 Fatty Acids



Curr Opin Clin Nutr Metab Care. 2013 Nov; 16(5): 720-723.



Omega 3 Fatty Acids



Curr Opin Clin Nutr Metab Care. 2013 Nov; 16(5): 726-733.

Omega 3 Fatty Acids

The evidence thus far shows that supplementation in patients with low omega 3 fatty acids experience improved short term memory.

Natural Medicines Comprehensive Database 2018

Omega 3 Fatty Acids

- Typical dosage is EPA 400-600/DHA 200-300 mg/day.
- Clinically:
 - Dementia: DHA 0.72 grams daily for one year has been used.
- Maternal supplementation with DHA 400-600 mg daily from 16-20 weeks gestation until delivery.
- Research thus far shows that treating a deficiency improves cognitive function.

Natural Medicines Comprehensive Database 2018

Omega 3 Fatty Acids—Safety

- DHA has been used safely in studies lasting up to 4 years and fish oil supplements containing DHA have also been safely used in studies lasting up to 7 years.
- Doses greater than 3 grams daily might decrease platelet aggregation and increase the risk of bleeding. In women, lower doses of 1 gram daily might have this effect. Use caution in all conditions and medication use where there is an increased risk of bleeding or compromised platelet aggregation.

Natural Medicines Comprehensive Database 2018; Saylor R, Gillatt T. Lipids. 1992;27:513-8;FDA. Center for Food Safety and Applied Nutrition. http://www.fda.gov/oc/ohrt/ohrt_docs/ohrt_050311/050311_0311e_040312_38-Appendix-C-Reference-F-028-v0201.pdf

Omega 3 Fatty Acids—Safety

- Theoretically, concomitant use of fish oil with anticoagulant or antiplatelet drugs (including aspirin) might increase risk of bleeding.
- Some anticoagulant or antiplatelet drugs include aspirin, clopidogrel (Plavix), enoxaparin (Lovenox), heparin, ticlopidine (Ticlid), warfarin (Coumadin), and others.

Natural Medicines Comprehensive Database 2018; Seiner R, Gilbert T. Lipids. 1992;27:533-8;FDA. Center for Food Safety and Applied Nutrition. <http://www.fda.gov/cfsan/foodcolor/foodcolor/5333116/533-63116-Appendix-C-Reference-F-Data-vol001.pdf>

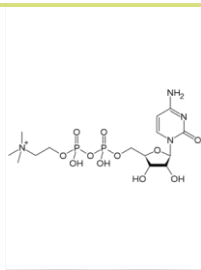


Brain Nutrients

- Omega 3 Fatty Acids
- **Citicoline/CDP Choline**
- Curcumin
- Amino Acids, Vitamins and Minerals
- Flavonoids

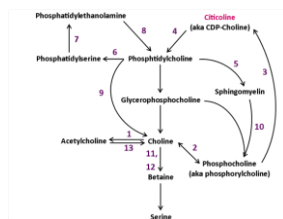


Citicoline



CDP Choline C14H26N4O11P2

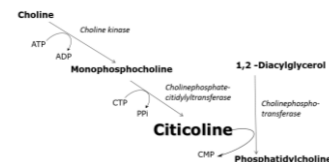
Bioavailable source of choline and of uridine.



Citicoline

Cognizin® Overview

Biosynthesis



- Citicoline is an endogenous substance and an essential intermediate in the synthesis of cell membrane phospholipid
- It is the rate limiting step in the production of Phosphatidylcholine – an important brain phospholipid



Citicoline

Citicoline is commonly used for:

- In the healthy aging population:
- Supporting healthy brain function
- Preventing cognitive decline
- Supporting attention and focus



Weiss GB et al. *Life Sciences*. 1995;56(1):637-60; Conant R, Schaus AG. *Adv Med Rev*. 2004;9(1):17-31; Scolding JJ, Lorenzo JL. *Neurol Endocr Clin Pharmacol*. 2006;27(Suppl 8):1-56; Babik SM et al. *Psychopharmacology*. 2002;161:248-254; Flanagan M, Yarnall M. *The Cochrane Library*. Oxford, England. 2006; Issue 4; Silver HM et al. *Neuro Biomed*. 2008;21(10):1066-75.



Citicoline Research

- In people ages 50-85: improves memory performance and prevents cognitive decline.
- In healthy adult women aged 40-60: enhances attention performance.
- In adolescents: Improves motor speed and attention.
- For drug addiction: At a dose of 500 mg bid; reduces cocaine cravings and intake and alcohol intake.

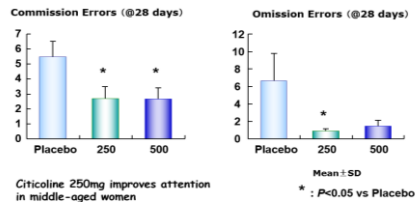
Alvarado A et al. *Neurol Endocr Clin Pharmacol*. 1997;19(3):201-210; Spier PA et al. *Arch Neurol*. 1996;53:641-48; Psychopharmacology (Berl). 1999 Feb;142(2):152-8; Renshaw PF et al. *Psychopharmacology (Berl)*. 1999 Feb;142(2):112-8; Looze SC et al. *J Addict Med*. 2011 Mar;5(1):57-64; McGlade E et al. *Food and Nutrition Sciences*. 2012;3:769-773; McGlade E et al. *J Intern Med*. 2015 Jul 15.



Citicoline: Mild Vascular Cognitive Impairment

Cognizin® Supporting Literature

Citicoline effects on middle-aged women



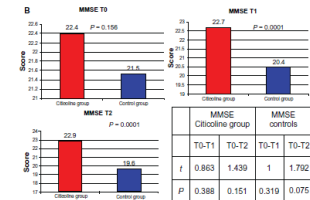
McGlade E. et al., *Food and Nutrition Sciences*. 2012;3:769-773. (Modified)



Citicoline: Mild Vascular Cognitive Impairment

The IDEALE Study

- After 9 months of citicoline treatment prevented decline in score of MMSE while control group did not
- (Note: 22.9 at 9 months vs. 22.4 at baseline while the control group continued to decline from 21.5 at baseline to 19.6 after 9 months)



Cotroneo AM, et al. *Effectiveness and safety of citicoline in mild vascular cognitive impairment: the IDEALE study*. *Clin Interv Aging*. 2013;8:131-7. doi: 10.2147/CIA.S38420. Epub 2013 Feb 5.



Citicoline Mild Vascular Cognitive Impairment

The IDEALE Study

Conclusion: "...citicoline was effective and well tolerated in patients with mild vascular cognitive impairment. Citicoline activates biosynthesis of phospholipids in neuronal membranes, increases brain metabolism as well as norepinephrine and dopamine levels in the central nervous system, and has neuroprotective effects during hypoxia and ischemia."



Cotroneo AM, et al. Effectiveness and safety of citicoline in mild vascular cognitive impairment: the IDEALE study. Clin Interv Aging. 2013;8:131-7. doi: 10.2147/CIA.S38420. Epub 2013 Feb 5.



Citicoline

- Well established safety profile in elderly, patients with cognitive decline, healthy patients and in adolescents.
- CDP Choline studied in healthy subjects and shown to be safe.
- Most common side effect (though rare and occurring in approximately 3 % of people between 60-80 yrs of age) according to safety studies is digestive disturbance.

Liuzzo G, et al. Efficacy and safety of oral CDP-choline. Drug surveillance study in 2017 cases. Arzneimittelforschung. 1983;33(7A):1073-80. Killgore WD, et al. Citicoline affects appetite and cardio-embolic responses to images of high-calorie foods. Int J Eat Disord. 2010 Jun;41(5):15-23. doi: 10.1002/eat.20658. Forward M, Nangai M. The Cochrane Library, Oxford, England. 2006; Issue 4.



Citicoline/CDP Choline

Dosing:

- 250-500mg/day to support healthy cognition

How supplied:

- Available as a dietary supplement alone or in combination with other brain nutrients

Natural Medicines Comprehensive Database 2018



Brain Nutrients

- Omega 3 Fatty Acids
- Citicoline/CDP Choline
- **Curcumin**
- Amino Acids, Vitamins and Minerals
- Flavonoids



Curcumin



- Comes from the rhizome portion of turmeric (yellow pigment).
- Anti-inflammatory activity seems to come from inhibiting cyclooxygenase-2 (COX-2), prostaglandins, leukotrienes, and other cytokines involved in proinflammatory signaling pathways.
- Preliminary evidence that curcumin might have activity in Alzheimer's disease.

Natural Medicines Comprehensive Database 2018



Curcumin



- Anti-inflammatory and antioxidant
- Ameliorates cognitive decay in TBI mouse model of Alzheimer's disease
- Dosage: 1000-4000 mg/day in divided dose.

Prasanthi SA, et al. Phenolic anti-inflammatory antioxidant reversal of Aβ-induced cognitive deficits and neuropathology. *Neurobiol Aging*. 2017;122:993-1005. Wu A, et al. Dietary curcumin counteracts the outcome of traumatic brain injury on oxidative stress, synaptic plasticity, and cognition. *Eur Neurol*. 2006;157:209-217.



Curcumin



- Orally, turmeric is generally well tolerated.
- Most common reports of side effects are gastrointestinal, including dyspepsia, diarrhea, distension, gastroesophageal reflux, nausea, and vomiting.

Natural Medicines Comprehensive Database 2018



Curcumin Drug Interactions



- Anticoagulant/Antiplatelets
- Theoretically may increase risk of bleeding by decreasing platelet aggregation.
- Anti diabetics- Curcumin can reduce blood glucose levels and HbA1C.

Natural Medicines Comprehensive Database 2018



Curcumin Disease Interactions



- Gallbladder disease and gallstones-use with caution as curcumin can cause gallbladder contractions.
- Bleeding disorders-curcumin has antiplatelet effects so may increase risk of bleeding and bruising.
- Diabetes-use with caution as curcumin can lower blood sugar and increase risk of hypoglycemia in diabetic patients.

Natural Medicines Comprehensive Database 2018



Curcumin Disease Interactions (Cont.)



- Surgery
- Hormone Sensitive Cancers-theoretical
- Infertility

Natural Medicines Comprehensive Database 2018



Brain Nutrients



- Omega 3 Fatty Acids
- Citicoline/CDP Choline
- Curcumin
- **Amino Acids, Vitamins and Minerals**
- Flavonoids



Acetyl-L-Carnitine



- Crosses the blood brain barrier.
- Once inside the central nervous system, promotes acetylcholine release and increases choline acetyltransferase activity.
- Provides Alzheimer's patients some benefit in memory, behavioral performance, and a delayed progression of deterioration.

Natural Medicines Comprehensive Database 2018; Curr Opin Clin Nutr Metab Care. 2013; 16(6): 726-733.



Acetyl-L-Carnitine



- Most beneficial in patients less than 66 years of age with early onset and a fast rate of disease progression.
- Dosage: 1500-4000 mg divided into 2-3 doses daily. Usually well-tolerated.
- In rare cases can cause nausea, vomiting, and agitation.
- Some reports of depression, mania, confusion, and aggression in Alzheimer's patients who take acetyl-L-carnitine.

Natural Medicines Comprehensive Database 2018; Curr Opin Clin Nutr Metab Care. 2013 Nov; 16(6): 726-733.



B Vitamins



- Folate supplementation either by itself or in conjunction with other B vitamins prevents cognitive decline and dementia during aging.
- 3-year folic acid supplementation can help to reduce the age-related decline in cognitive function.

Natural Medicines Comprehensive Database 2018; Curr Opin Clin Nutr Metab Care. 2013 Nov; 16(6): 726-733; Nat Rev Neurosci. 2008 Jul; 9(7): 568-578.



B Vitamins



- Supplementation with vitamin B6, vitamin B12 and folate has positive effects on memory performance in women of various ages.
- Dosage: Varies considerably. Intramuscular B12 at 1000 mcg/mL common.

Natural Medicines Comprehensive Database 2018; Curr Opin Clin Nutr Metab Care. 2013 Nov; 16(6): 726-733; Nat Rev Neurosci. 2008 Jul; 9(7): 568-578.



Additional Vitamins & Minerals



- Vitamin D3: Preserves cognition in the elderly. Dosage varies. Clinically, 5,000 IU per day, and if baseline blood level under 40 then an additional 15,000 IU one time per week until level reaches 70-80.
- Vitamin E: Reduces cognitive decay in elderly.
- Calcium: High serum calcium is associated with faster cognitive decline in the elderly.

Natural Medicines Comprehensive Database 2018; Curr Opin Clin Nutr Metab Care. 2013 Nov; 16(6): 726-733; Nat Rev Neurosci. 2008 Jul; 9(7): 568-578.



Additional Vitamins & Minerals



- Zinc: Zinc in diet helps to reduce cognitive decay in the elderly.
- Selenium: Lifelong low selenium level associated with lower cognitive function in humans.
- Cu: Cognitive decline in patients with Alzheimer's disease correlates with low plasma concentrations of copper.
- Fe: Iron treatment normalizes cognitive function in young women

Natural Medicines Comprehensive Database 2018; Curr Opin Clin Nutr Metab Care. 2013 Nov; 16(6): 726-733; Nat Rev Neurosci. 2008 Jul; 9(7): 569-578



Vitamins & Minerals



Dosing & Safety:

- "Biochemical Individuality"
- It is best to administer vitamins and minerals at physiologic levels unless doing blood tests to determine actual deficiencies paired with symptoms assessment and physical exam.



Combined Effects



- Omega-3 fatty acids (DHA 88 mg per day and eicosapentaenoic acid (EPA) 22 mg per day) and micro-nutrients (iron, zinc, folate and vitamins A, B6, B12 and C) provided in a drink mix to 396 children (6–12 years of age) in Australia and 394 children in Indonesia.
- Results showed higher scores on tests that measured verbal intelligence and learning and memory after 6 and 12 months in both boys and girls in Australia, and in girls in Indonesia.

Okenberg S et al. Am J Clin Nutr. 2007 Oct; 86(4):1062-63.; Innis SM. Dietary (n-3) fatty acids and brain development. J Nutr. 2007 Apr; 137(4):855-9



Brain Nutrients



- Omega 3 Fatty Acids
- Citicoline/CDP Choline
- Curcumin
- Amino Acids, Vitamins and Minerals
- **Flavonoids**



Flavonoids



- Flavonols are part of the flavonoid family that is found in various fruits, cocoa, beans and the Ginkgo biloba tree.
- Quercetin, flavonol found in red wine, onions, green tea, apples, berries, and Brassica vegetables, and major component of G. biloba extracts, shown to reduce learning and memory impairment in cerebral ischemic rodents.
- Anti-inflammatory.
- Dosage range 300 - 500 mg bid before meals.

Natural Medicines Comprehensive Database 2018; Curr Opin Clin Nutr Metab Care. 2013 Nov; 16(6): 726-733.



Flavonoids



- Plant-derived flavanol (–) epicatechin (found in green tea) dietary supplement crosses the blood–brain barrier. In animal studies shown to elevate indices of synaptic spine density and angiogenesis and increase hippocampus-dependent memory.
- Positive effects of epicatechin dietary supplementation on memory formation enhanced by concomitant exercise.
- Catechins in green tea appear to have anti-inflammatory activity by inhibiting COX-1, production of leukotriene-B4 and the activity of 5-lipoxygenase.

Natural Medicines Comprehensive Database 2018; Curr Opin Clin Nutr Metab Care. 2013 Nov; 16(6): 726-733.



Flavonoids



Dosage:

- Varies. Generally between 240-320 mg per day.
- Some clinical evidence suggests that taking two capsules of specific combination product containing green tea extract 360 mg/capsule and L-theanine 60 mg/capsule twice daily after meals for 16 weeks improves memory and attention in patients with mild cognitive impairment compared to placebo.

Natural Medicines Comprehensive Database 2018



Combined Effects



Exercise in humans shown to:

- Counteract mental decline associated with aging
- Enhance mental capacity of young adults
- Facilitate functional recovery after brain injury or disease.
- Promote neurogenesis in the brain

Curr Opin Clin Nutr Metab Care. 2013 Nov; 16(6): 726-733; Nat Rev Neurosci. 2008 Jul; 9(7): 558-578.



Combined Effects



- Exercise proven to enhance effects of epicatechin supplementation on memory formation.
- Combination of a flavonoid-enriched diet and exercise increased expression of genes that have a positive effect on neuronal plasticity and decreased expression of genes that are involved in deleterious processes, such as inflammation and cell death. Promote neurogenesis in the brain.

Curr Opin Clin Nutr Metab Care. 2013 Nov; 16(6): 726-733; Nat Rev Neurosci. 2008 Jul; 9(7): 568-578.



The MIND Diet



- Mediterranean-DASH Intervention for Neurodegenerative Delay
- MIND diet lowered risk of Alzheimer's disease by 54%.
- Adults who followed the diet only part of the time still cut their risk of the disease by about 35%.

Rigid Fetschi, MD, PhD, lecturer, Harvard Medical School, chairman and CEO, Neurosyn Neurology Institute, Lutherville, MD; Martha Clare Morris, ScD, associate professor, Rush Institute for Healthy Aging, director of Nutrition and Nutrition Epidemiology, Rush University Medical Center, Chicago, Morris, M.C. Alzheimer's and Dementia, 2015.



Kindness and Cognitive Health



- Meta-analysis of the evidence available from randomized controlled trials looking at the effects of Kindness-based meditation (KBM) on cognitive health and well-being.
- Twenty two studies included with the conclusion that KBM shows evidence of benefits for the health of individuals and communities through its effects on well-being and social interaction.
- KBM optimizes blood oxygen level signaling and functional connectivity on the brain.

Galante, J et al. (2014). J. Consult. Clin. Psychol. 82, 1101-1114. doi: 10.1037/a0037249; Garrison, K. A et al (2014). Brain Behav. 4, 337-347. doi: 10.1002/brb.1219.



Brain Nutrients, Diet, and Lifestyle



Brain Nutrients CE Questions

1) Which of the following is true about fatty acids:

- A. Omega 3 fatty acids upregulate genes that are important for maintaining synaptic function and plasticity.
- B. Excess saturated fats in diet reduces molecular substrates that support cognitive processing and increase the risk of neurological dysfunction.
- C. Research shows that omega 3 fatty acids ameliorate cognitive decline in the elderly
- D. All of the above
- E. None of the above

2) Use caution when recommending Omega 3 Fatty Acids in patients who:

- A. Have an increased risk of bleeding
- B. Have a decreased risk of bleeding
- C. Are on an anticoagulant or anti platelet medication
- D. A and B
- E. A and C
- F. All of the above
- G. None of the above

3) Citicoline/Cognizin:

- A. Improves attention in healthy middle aged women
- B. Increases brain metabolism
- C. Increases norepinephrine and dopamine levels in the central nervous system
- D. Decreases norepinephrine and dopamine levels in the central nervous system
- E. A, B and C
- F. A, B and D
- G. All of the above

4) CDP Citicoline is commonly used as a dietary supplement to:

- A. Improve memory performance and prevent cognitive decline
- B. Enhance attention performance in healthy women aged 40-60
- C. Improve motor speed and attention in adolescents
- D. A and C only
- E. A and B only
- F. All of the above

5) True or false: Curcumin has Anti-inflammatory activity that seems to come from inhibiting cyclooxygenase-2 (COX-2), prostaglandins, leukotrienes, and other cytokines involved in proinflammatory signaling pathways.

- A. True
- B. False

6) Which of the following statements are true about curcumin:

- A. In gallbladder disease and gallstones-use with caution as curcumin can cause gallbladder contractions.
- B. Curcumin has antiplatelet effects so may increase risk of bleeding and bruising.
- C. In diabetics-use with caution as curcumin can lower blood sugar and increase risk of hypoglycemia in diabetic patients.
- D. All of the above
- E. None of the above

7) True or False: Vitamins and mineral deficiencies can significantly impact cognition.

- A. True
- B. False

8) •The following statements about flavonoids and cognitive health are true:

- A. Flavonoids are found in various fruits, cocoa, beans, red wine, onions, green tea, apples, berries, and Brassica vegetables, Ginkgo biloba extracts,
- B. The combination of a flavonoid-enriched diet and exercise increases expression of genes that have a positive effect on neuronal plasticity.
- C. The combination of a flavonoid-enriched diet and exercise decreases expression of genes that are involved in deleterious processes, such as inflammation and cell death.
- D. Flavonoids promote neurogenesis in the brain.
- E. All of the above
- F. None of the above

9) True or false: •Kindness based meditation (KBM) optimizes blood oxygen level signaling and functional connectivity on the brain.

- A. True
- B. False

10) Which of the following statements are true about vitamins and minerals and cognitive health:

- A. Introduction of zinc in the diet helps to reduce cognitive decay in the elderly.
- B. Lifelong low selenium level is associated with lower cognitive function in humans.
- C. Cognitive decline in patients with Alzheimer's disease correlates with low plasma concentrations of copper.
- D. Vitamin D3 preserves cognition in the elderly.
- E. Vitamin E reduces cognitive decay in elderly.
- F. All of the above
- G. None of the above