Concussion/TBI and Nutrition

What is the Role of Neuro-Rehabitative / Developmental Optometrist

Kavita Malhotra, OD, FCOVD

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Disclosure of Conflict

None

Incidence of TBI

- 2.8 million TBI emergency department visits, hospitalizations and deaths in 2013 (CDC data).
- 47% increase in emergency department visits from 2007 to 2013.
- Leading cause: Falls, struck by/against object, motor vehicle accidents

Protein

- 1 to 1.5 g / kg body weight / day
- Nutrition and Traumatic Brain Injury: Improving Acute and Subacute Health Outcomes in Military Personnel. The National Academies Press. 2011

  http://www.nap.edu/catalog/13121/nutrition-and-traumatic-brain-injury-improving-acute-and-subacute-healthConnect EF skills within a learning and work environment

EPA and DHA Omega 3 Fatty Acids

Docosahexaenoic acid (DHA) - omega-3 fatty acid

Increases fluidity of cell membranes, reduces inflammation

Shown to be decreased for a month or longer in athletes who take longer to recover

Meier TB, Bellgowan PS, Singh R, Kuplicki R, Polanski DW, Mayer AR. Recovery of cerebral blood flow following sports-related concussion. JAMA Neurol 2015;72(5):530-8.

EPA / DHA Supplementation

Limits structural damage and decline in brain function in animal studies.

- Mills JD, Hadley K, Bailes J. Dietary supplementation with the omega-3 fatty acid docosahexaenoic acid in traumatic brain injury? Neurosurgery 2011;68:474–81
- Wu A, Ying Z, Gomez-Pinilla F. Omega-3 fatty acid supplementation restores mechanisms that maintain brain homeostasis in traumatic brain injury. J Neurotrauma 2007;24:1587–95
- Wu A, Ying Z, Gomez-Pinilla F. Dietary omega-3 fatty acids normalize BDNF levels, reduce oxidative damage, and counteract learning disability after traumatic brain injury in rats. J Neurotrauma 2004;21:1457–67
- Wang T, Van K, Gavitt B, Grayson J, Lu T, Lyeth B, Pichakron K. Effect of fish oil supplementation in a rat model of multiple mild traumatic brain injuries. Restor Neurol Neurosci 2013;31:647–59
- Mills JD, Bailes J, Sedney C, Hutchins H, Sears B. Omega-3 fatty acid supplementation and reduction of traumatic axonal injury in a rodent head injury model. J Neurosurg 2011;114:77–84
- Wu A, Ying Z, Gomez-Pinilla F. The salutary effects of DHA dietary supplementation on cognition, neuroplasticity, and membrane homeostasis after brain trauma. J Neurotrauma 2011;28:2113–22

DHA Omega 3 studies

- NCAA division athletes with 2200 mg/d DHA for 30 days after head injury
- University of Texas Southwestern Medical Centre, supplements children (14-18 years of age) with 2000 mg/d DHA for three months and looks at their return to competitive
- Preventative treatment for athletes in high risk sports?

How Much?

No consensus

4,000 mg daily for first few weeks, reduce to 2,00 to 4,000 mg for next 3 months

a. Salmon, tuna, mackerel, herring 2x/week
b. Fish oil, algal oil, krill oil - daily
c. Flax seed / oil, walnuts, chia seeds
d. DHA / Omega 3 fortified food / beverages ex. orange juice, milk, yogurt
e. FDA up to 3 grams per day is safe

Omega 3 Protocol

- Molecularly distilled, pharmaceutical grade, triglyceride form (not ethyl esters). Meets European Pharmacopeia standards.
- For Soft Gel Capsules: the highest quality concentrated soft gels will contain a combined 1000mg EPA+DHA per soft gel, usually in a 1250mg sized soft gel.
- With these newer concentrates, ONE dose equals only three (3) soft gels.
- At a minimum, each soft gel capsule should contain at least 600mg of EPA & DHA omega-3s combined. *At this lesser concentration, a dose would be five (5) soft gels.*
- For Liquid concentrate: the best concentrates should contain approximately 2500-3000mg (3gm) of EPA+DHA per teaspoon (5 ml) for one dose.

Week 1 (Phase 1 – Loading Dose)

- TAKE ONE DOSE, three (3) best quality concentrated soft gels (3 g of EPA+DHA), THREE TIMES A DAY for at least 7 days (Breakfast-Lunch-Dinner or before work/school-after work/school-and bedtime). This is a total of NINE (9) soft gels per day.
- If the injury is more severe or months/years prior and symptoms are still an issue, consider extending this phase out to one entire month.

Week 2 (Phase 2 – Tapering Down)

- TAKE ONE DOSE, three (3) best quality concentrated soft gels (3 g of EPA/DHA), TWO TIMES A DAY for 7 days (Breakfast-Dinner)
- Total of SIX (6) soft gels per day.

Step 3 – Phase 3 Maintenance

- Take one dose, three (3) best quality concentrated soft gels (3 g of EPA/DHA) every day
- Michael Lewis, MD
- http://www.brainhealtheducation.org/resources/brain-injury-protocol/

Antioxidants

- Brightly colored vegetable
- Vitamin C – tropical fruit, citrus, berries, bell pepper
- Vitamin D – sun exposure, fortified beverages

- Vitamin E – dark green leafy vegetables, nuts, seeds, wheat germ, avocado, fish and eggs
- Vitamin B – whole grain, dark leafy vegetables, legumes, nuts, seeds, citrus, meat, poultry
- Coenzyme Q10

Vitamin D

- 5,000 IU daily for first few weeks
- If low vitamin D before then continue with 2,000 IU daily

Curcumin / Turmeric

- Phytochemical
- Animal studies improves neural plasticity, signaling, reduces neural inflammation, balance
- Need human studies
- Concussion?

Magnesium

- Supplements in the form of magnesium-l-threonate cross the brain-blood barrier more effectively than other forms and don't cause digestive upset
- Take up to 600 mg daily

Melatonin

- Prescribed to help patients sleep
- Play Game trial – effects of melatonin on Post-Concussion syndrome in youths
- Sublingual placebo, low dose, high dose

Zinc

- 40 mg / day upper limit

Creatine

- Not recommended for children and adolescents
- 10 grams a day to protein drink

Resveratrol

- Polyphenol thought to be neuroprotective
- Animal studies improves motor performance, visual spatial memory, behavior post concussion
- Nuts, grapes, grape juice, blueberries, cranberries, chocolate
- No human trials / should we include in diet

Glutathione

- Natural antioxidant
- Study with IV administration after injury reduced tissue damage by 70 percent
- Substances that support the glutathione pathway
- vitamin C, selenium, niacinamide (vitamin B3), N-acetyl-L-cysteine (750 to 1,000 mg) and broccoli extract.
- Roth, T. et al. Transcranial Amelioration of Inflammation and Cell Death Following Brain Injury Nature. 2014 Jan 9; 505(7482): 223–228. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3930079/

Caffeine

- Neuronal regeneration and improving function
- Increasing glutamate release and inflammatory cytokine production
- Animal study – chronic , but not acute, treatment with caffeine protects the brain against injury in animal models of Parkinson's disease and stroke
- Li W, Dai S, An J, Li P, Chen X, Xiong R, Liu P, Wang H, Zhao Y, Zhu M, Liu X, Zhu P, Chen JF, Zhou Y. Chronic but not acute treatment with caffeine attenuates traumatic brain injury in the mouse cortical impact model. Neuroscience. 2008;151(4):1198–207. [PubMed]

Probiotics / Prebiotics

- Natural food – fermented foods, celery, cucumber
- Supplements

Foods to Avoid

- Sugar
- Simple Carbohydrates
- Alcohol

Saturated Fat and High Sugar Diet

- Diet for 1 to 2 months
- Reduced performance on spatial learning maze
- Molteni R, Barnard JR, Ying Z, Roberts CK, Gomez-Pinilla F. A high-fat, refined sugar diet reduces hippocampal brain-derived neurotrophic factor, neuronal plasticity, and learning. Neuroscience. 2002;112(4):803–14. [PubMed]

Beyond Nutrition

- Visual Rehabilitation – lenses, prism, therapy
- Sleep
- Exercise
- Manage stress – mindfulness
- J Head Trauma Rehabil. 2013 Jul-Aug;28(4):323-31. doi: 10.1097/HTR.0b013e318250ebda. **A pilot study examining the effect of mindfulness-based stress reduction on symptoms of chronic mild traumatic brain injury/postconcussive syndrome.** Azulay J[1], Smart CM, Mott T, Cicerone KD.

Diet and Exercise

- Exercise is boosts the healthy effects of certain diets such as omega-3 fatty acids
- Exercise counteracts the deleterious effects of a saturated-fat diet on synaptic plasticity and cognitive function of rats
- Wu A, Ying Z, Gomez-Pinilla F. DHA dietary supplementation enhances the effects of exercise on synaptic plasticity and cognition. Neuroscience 2008 Aug 26; 155(3); 751-759 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3208643/
- Molteni R, Wu A, Vaynman S, Ying Z, Barnard RJ, Gomez-Pinilla F. Exercise reverses the harmful effects of consumption of a high-fat diet on synaptic and behavioral plasticity associated to the action of brain-derived neurotrophic factor. Neuroscience. 2004;123(2):429–40

Key Points

- Nutrition can impact recovery
- Specific nutrients / supplements can have a major impact
- Coordinate care
- Recommend – comfort level, knowledge

Communicate With

- Patients / Parents
- Physicians
- OT / PT
- Dietician

Take Home

- Neuro-Optometric Rehabilitation / Developmental Optometrist are key part of the team working with Post-Concussive / TBI patients
- Communicate patients / caregivers / providers
- Recommend – Eat healthy, hydrate
- No added sugar, Omega 3, Vitamin D, magnesium

What are your recommendations?

- Patients
- Your child / friend

References

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- Bailes Julian E.Patel Vimal. (2014) The Potential for DHA to Mitigate Mild Traumatic Brain Injury. *Military Medicine***179**:11S, 112-116. (Adv Nutr. 2014 May 14;5(3):268-77.) https://academic.oup.com/milmed/article/179/suppl_11/112/4210214/

Thank You

drmalhotra@cox.net

Kavita Malhotra, OD, FCOVD
501 Church St. NE, Suite 215
Vienna, VA 22180

(703) 242-0737