

## Nutritional Therapies and Ketogenic Diets

### *Overview*

It is a fact that most mainstream allopathic or osteopathic physicians do not consider much beyond basic nutrition when discussing TBI patients or other patients in general. Indeed, functional medicine physicians, naturopathic physicians, nutritionists, chiropractors, acupuncturists, and lay practitioners have given more credence to the health benefits of diet and nutrition. However, for the treatment of TBI, dietary control is one of the most beneficial ways patients can impact and improve their overall health.

### *Benefits*

- Improved protection from oxidative stress
- Increased synthesis of calming neurotransmitters (including GABA)
- Produce cortical sparing and less apoptotic neuro-degeneration
- Improves metabolic activity
- Improves detoxification
- Reduces systemic pain and inflammation

### *Application for TBI*

In the clinic, IV and IN therapies allow practitioners to rapidly access the brain and body of the TBI patients. We have a few studies about the use of intranasal nutritional substances.

IN glutathione has been used to reduce oxidative stress and enhance cellular detoxification in Parkinson's disease patients.<sup>1</sup> IN methylcobalamin has been shown to improve QEEG Theta activity in ADHD and autism patients.<sup>2</sup>

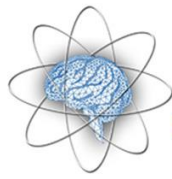
The Myers cocktail is the standard IV cocktail used by many functional medicine practitioners. The biggest factor in the use of IV nutrients is that many vitamins, minerals, and other micronutrients are cofactors for metabolic processes, which mean they protect the body from free radicals (Vitamin C), improve energy production (B-vitamins), and help eliminate waste products (glutathione). TBI Therapy provides these IV nutrients on a regular basis to every TBI patient as part of their treatment for TBI and overall health.

Oral nutrition is also critical for patients, as most all modern, Western patients are deficient in primary

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<sup>1</sup> Mischley, L. K., Conley, K. E., Shankland, E. G., Kavanagh, T. J., Rosenfeld, M. E., Duda, J. E., ... & Padowski, J. M. (2016). Central nervous system uptake of intranasal glutathione in Parkinson's disease. *npj Parkinson's Disease*, 2, 16002.

<sup>2</sup> UHN Staff. (2015). Vitamins for Memory Loss and Stroke Prevention – These 3 Are Critical. University Health News Daily. Retrieved August 15, 2016 from <http://universityhealthnews.com/daily/memory/vitamins-for-memory-loss-and-stroke-prevention-these-3-are-critical/>



nutrients. The following shows the percentage of Americans with vitamin deficiencies<sup>3</sup>:

- Potassium: 97%
- Vitamin D: 70%
- Vitamin K: 65%
- Vitamin E: 60%
- Vitamin A and C: 30%
- Magnesium: 23%

For TBI patients, correcting vitamin deficiencies can have significant benefits. Vitamin D deficiency has been found in over 65% of TBI patients suffering from chronic fatigue.<sup>4</sup> B vitamin supplementation (particularly B12, folate, B6) has been found to improve memory, mood, and energy levels and has been used to prevent stroke and Alzheimer's disease.<sup>5</sup>

Dr. Robert Cantu, MD supports the use of optimizing energy metabolism for TBI patients in his below statement:

The brain is in a metabolic crisis in a concussion, potassium ion from inside the cell going extracellular, calcium ions going intracellular, neurotransmitters widely released in a chaotic manner. It takes energy to pump that potassium back, put the neurotransmitters back on so the cell can function.<sup>6</sup>

By using nutritional substrates to the brain that correct the metabolic crisis, we can help to stabilize neurotransmitter release and repair damaged neurons. Ultimately, a TBI is a problem of energy metabolism. Healing from TBI requires solving that energy crisis.

See Dr. Cantu's comments on film at <http://www.brainline.org/content/multimedia.php?id=9022>

Ketogenic diets are a proven treatment for patients suffering from epileptic seizures. Ketogenic diets studied in brain trauma (CCI) produce cortical sparing and less apoptotic neurodegeneration and overall improvements in cognitive and motor functioning.<sup>7</sup>

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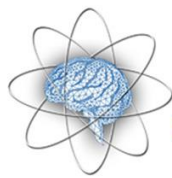
<sup>3</sup> Huskisson, E., Maggini, S., & Ruf, M. (2007). The role of vitamins and minerals in energy metabolism and well-being. *Journal of international medical research*, 35(3), 277-289.

<sup>4</sup> European Society of Endocrinology. (2010). Vitamin D deficiency associated with chronic fatigue in brain injured patients. ScienceDaily. Retrieved August 15, 2016 from [www.sciencedaily.com/releases/2010/04/100427182609.htm](http://www.sciencedaily.com/releases/2010/04/100427182609.htm)

<sup>5</sup> UHN Staff. (2015). Vitamins for Memory Loss and Stroke Prevention – These 3 Are Critical. University Health News Daily. Retrieved August 15, 2016 from <http://universityhealthnews.com/daily/memory/vitamins-for-memory-loss-and-stroke-prevention-these-3-are-critical/>

<sup>6</sup> Gunther, N. & Queen, E. (2013). What Physical and Cognitive Rest Really Mean After a Concussion. *Brainline*. Retrieved from <http://www.brainline.org/content/multimedia.php?id=9022>

<sup>7</sup> Stafstrom, C. E., & Rho, J. M. (2012). The Ketogenic Diet as a Treatment Paradigm for Diverse Neurological



The mechanism of how ketone bodies work to help TBI patients is diagrammed below. It is theorized that ketones work because they increase the available calming neurotransmitter GABA, thereby reducing neuronal hyperpolarization and the excitatory neurotransmitter glutamate. With less glutamate, there is less oxidative stress and improved neuroprotection.

In simple terms, a brain with more protection from the rapid oxidative stress from an increased need to heal metabolically makes ketones the ideal fuel for an injured brain. More GABA production means a calmer brain with slower more healing brainwaves available to restore the brain to its balance.

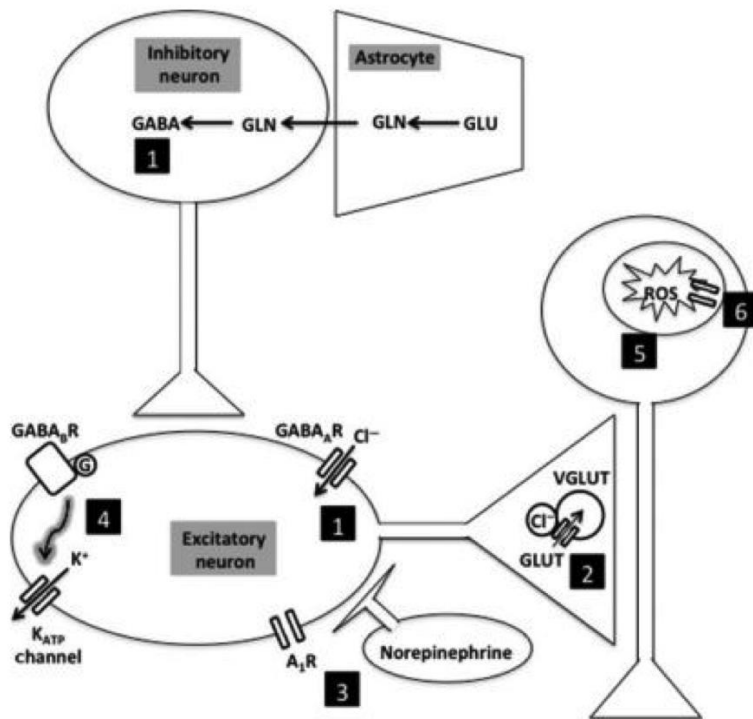


Fig. 2 Possible anticonvulsant effects of ketone bodies on the brain. (1) Increased GABA synthesis through alteration of glutamate cycling in glutamate-glutamine cycle or altered neuronal responsiveness to GABA at GABA<sub>A</sub> receptors. (2) Decreased glutamate release by competitive inhibition of vesicular glutamate transporters. (3) Other neurotransmitters, including norepinephrine and adenosine. (4) Increased membrane potential hyperpolarization via K<sub>ATP</sub> channels possibly mediated by GABA<sub>B</sub> receptor signaling. (5) Decreased reactive oxygen species production from glutamate exposure. (6) Electron transport chain subunit transcription. A<sub>1</sub>R, adenosine receptor; Cl<sup>-</sup>, chloride; GLN, glutamine; GLU, glutamate; GABA,  $\gamma$ -aminobutyric acid; GABA<sub>B</sub>R,  $\gamma$ -aminobutyric acid beta receptor; GABA<sub>A</sub>R,  $\gamma$ -aminobutyric acid alpha receptor; VGLUT, vesicular glutamate transporter; ROS, reactive oxygen species.

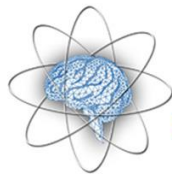
McNally, M. A., & Hartman, A. L. (2012). Ketone bodies in epilepsy. *Journal of neurochemistry*, 121(1), 28-35.

### Procedure

Oral nutrition for TBI Therapy has primarily been focused on the upregulation of stem cells and maintaining a ketogenic state for the body. Several nutrients and foods have been found to improve circulating stem cells and growth factors: blueberries, Vit D3, AFA (blue-green algae), elk antler. Patients are instructed to take these foods and supplements before and after HBOT and PRP treatment.

Patients are advised to continue on the Brain Octane (1-2 Tbsp 2x/day) and a ketogenic diet for the next

Disorders. *Frontiers in Pharmacology*, 3, 59. <http://doi.org/10.3389/fphar.2012.00059>.



**TBI Therapy**  
Regenerative Therapy for Brain Injury

3 months. Brain Octane helps maintain high amounts of ketones in the patient's body and brain.

### *Dangers and Side Effects*

Several patients report some detox symptoms from getting IV nutrition. Other patients may need more nutrition include supplements to aid with heavy metal detoxification, hormone balancing, etc. TBI Therapy takes a very focused approach to its protocols with the forethought that many patients may need more than just the specific nutrients or drugs discussed.

MCT oils can be derived using hexane so be aware of which brands you may select. We have found Brain Octane to be pure from this toxic processing. Of note, Brain Octane is more than just coconut oil... it is 16x more concentrated in ketones. Because of that fact, it may cause stomach upset, so it is recommended to take with food.

### *For More Information*

See the "Ketogenic Diet" (By Dr. Scott Sherr) resource for an outline of the Ketogenic Diet protocol.

Also see <http://tbitherapy.com/tbi-protocol-references/> for more research on ketogenic diets and brain injury.