



NEURO
INSTITUTE

Continuing Education for Rehabilitation Professionals



Nutrition and Traumatic Brain Injury

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This Presentation will Address:

1. Affect of carbohydrates, sugar, and fats on brain function.
2. Neurotransmitters important for learning and memory.
3. The foods that promote good brain chemistry.
4. Vitamins and minerals that promote healthy brain functioning.
5. Benefits of exercise on memory.

Impact of TBI on Cognition and Memory

- Short-term memory loss
- Long-term memory loss
- Slowed ability to process information
- Trouble concentrating or paying attention for periods of time
- Difficulty keeping up with a conversation; other communication difficulties such as word finding problems

Cognitive, Memory and Executive Functioning Consequences, Cont'd

- Spatial disorientation
- Organizational problems and impaired judgment
- Unable to do more than one thing at time (multi-task)
- A lack of initiating activities, or once started, difficulty in competing tasks without reminders

Nutrition and Cognitive Functioning

After a Traumatic Brain Injury what we eat can affect our cognitive abilities positively or negatively.

Nutrition and Cognition

- Normal brain function demands glucose
- The brain uses 25% of the body's total glucose
- Enzymes breakdown carbohydrates into glucose
- Carbohydrates are a main source of energy

Carbohydrates

- Not all Carbohydrates are the same
- Two sources: Simple and Complex

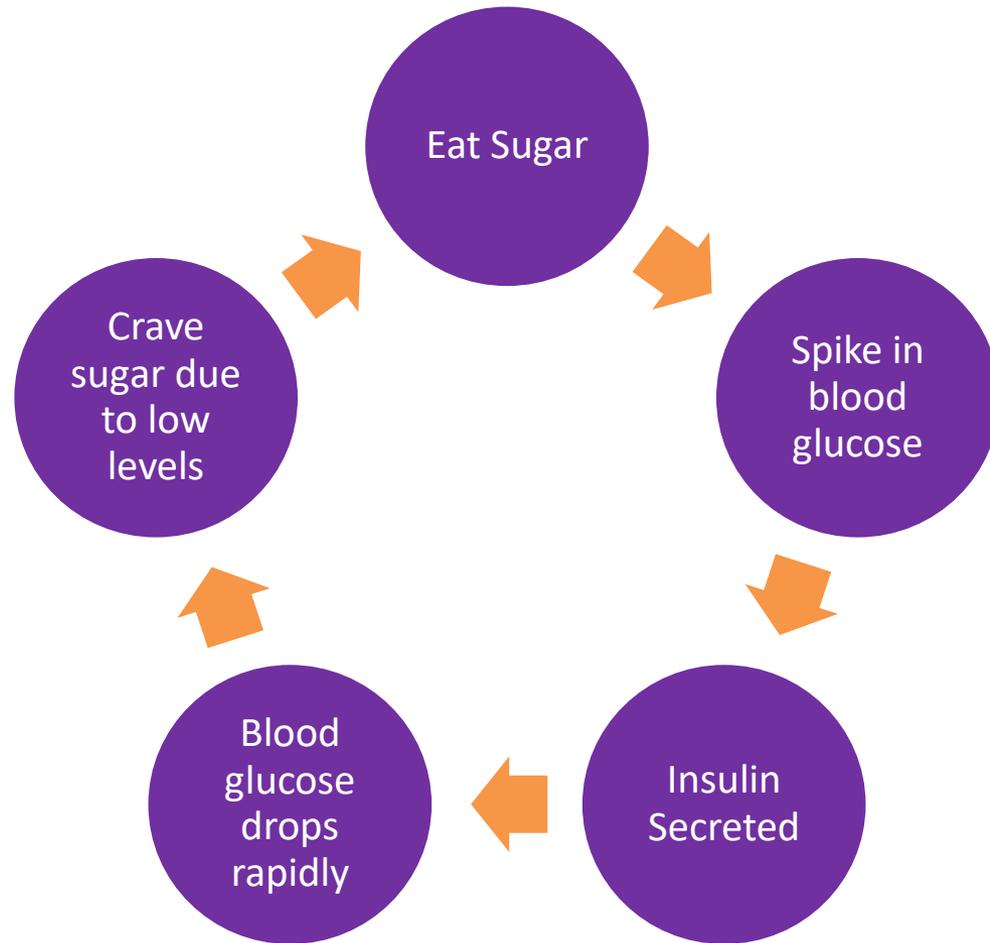
Carbohydrates

- Simple Carbohydrates
 - Converts into glucose quickly
 - Boost but crash
 - More difficult to focus and sustain attention
- Sources of Simple Carbohydrates
 - Sugar, processed flour

The Trouble with Sugar

- Effect of Refined Sugars (crystallized process sugar)
 - Taste great but “additive properties” dopamine release
 - Glucose levels rise rapidly then crash causing fatigue and diminished ability to concentrate

The Sugar Cycle



- Complex Carbohydrates
 - Breakdown more slowly than simple carbs
 - Provide a slow rise of glucose
 - Stays with you longer
 - Avoids sharp drop in blood sugar
 - Improves ability to sustain attention and concentrate
 - Facilitates better STM

Sources of Complex Carbs

- Good brain foods
 - Legumes, beans, peas
 - Whole grain breads
 - Brown rice
 - Soy
 - Vegetables
 - Fruits

Brain Nutrition

- Fats
 - 60% of our brain consist of fat
 - Fats source of energy
 - Fats preserve insulation
- Good fats: unsaturated
- Bad fats: saturated

Brain Nutrition

- Saturated fats contribute to blood platelets sticking together, clogs arteries – lead to stroke
- Negative effect is cumulative

Brain Nutrition

- Unsaturated fats
 - Monounsaturated
 - Polyunsaturated
- Polyunsaturated fats the most helpful: involved in healthy cell membrane structure and are a source of energy.

Brain Nutrition

Sources of Polyunsaturated fats

- Salmon (cold water fish)
- Vegetable oils
- Seeds
- Nuts

Trouble with Salt

- Essential for good health (e.g. iodized salt facilitates the production of thyroid hormone critical for infant brain development)
- Too much salt causes potassium depletion – triggers anxiety, impairs STM
- Exacerbates Hypertension (H₂O retention raises BP – stress on heart)
- Recommendation: 2300mg, or approximately 1 teaspoon

Caffeinism

- Tension headaches
- Stress/anxiety
- Insomnia
- Racing thoughts
- Rapid heart rate

Recommendation: No more than 2-3 cups of coffee or 250 milligrams per day

Nutrition and Neurotransmitters

Neurotransmitters Important to Learning and Memory

- GABA: inhibitory – reduces neuronal excitability. Low levels linked to extreme anxiety.
- Acetylcholine: involved in attention, memory, and motivation. Degeneration of neurons that produce Ach linked to Alzheimer's disease.
- Serotonin: involved in sleep, mood, pain, depression.
- Glutamate: involved in long-term memory.
- Norepinephrine: involved in arousal, learning, memory and mood.

Foods that promote good brain chemistry (GABA, Serotonin, Norepinephrine)

- Avocado
- Eggs
- Peaches
- Granola
- Grape juice
- Peas
- Sunflower seeds
- Almonds
- Cottage cheese
- Milk
- Shredded wheat
- Soybeans
- Turkey
- Lima beans
- Yogurt

Foods that promote good brain chemistry:
Acetylcholine

- Eggs
- Beef
- Fish
- Whole grains

Foods that promote good brain chemistry: Glutamate

- Cheese
- Tomatoes
- Soy protein
- Broccoli
- Walnuts

Vitamins and Minerals Supporting Brain Health

B-vitamins

- B-vitamins aid in the manufacture of neurotransmitters
important for memory

B-vitamins

- Low in vitamin B1 can result in:

Decreased alertness

Decreased reaction time

Emotional instability

Fatigue

B-vitamins

Foods rich in B1:

- Bran
- Oatmeal
- Peanuts
- Vegetables
- Wheat

B-vitamins

Low in B12 may cause:

- Confusion
- Mental slowness
- Limb weakness
- Stammering
- Psychosis

B-vitamins

Foods rich in B12:

- Beef
- Cheese
- Eggs
- Liver
- Milk

B-vitamins

Low in Folic acid may cause:

- Irritability
- Forgetfulness
- Mental sluggishness

B-vitamins

Foods rich in folic acid:

- Cantaloupe
- Carrots
- Dark leafy vegetables
- Whole wheat

Vitamin D

- Some evidence that Vitamin D supports cognitive function. High concentrations in the hippocampus an area of the brain important for short term memory. (Eyles et al. 2005, Levenson & Figueiroa, 2008).
- 400 IU per day

Creatine

- Creatine supplements shown to improve cognitive function under stressful conditions (Dechent et al. 1999, Pan & Takahashi, 2007).
- Shown to enhance working memory (Rae, et al. 2003).
- Shown to improve verbal and spatial memory in elderly individuals (McMorris et al. 2007).
- Helps with age related cognitive decline (Gualano et al. 2010).
- 5 grams/day considered safe

Magnesium

- Supports working memory
- Reduces risk of severe stroke among hypertensives (Ascherio, et al. 1998)
- Foods rich in Magnesium
 - Dark Chocolate
 - Avocados
 - Nuts
 - Legumes
 - Bananas
 - Leafy greens

Omega 3 fatty acids

- Omega-3 fatty acids are essential to the brain
- There has been a dramatic shift in the ratio of omega-3: omega-6 fatty acids in the last century.
- Competing omega-6 fatty acids - mainly from soy, corn, and sunflower oil, increase inflammation.

Omega-3 fatty acids

- More than 160 studies about food's affect on the brain were analyzed.
- Omega-3 fatty acids -- found in salmon, walnuts and kiwi fruit -- provided benefits, including improving learning and memory and helping to fight against such mental disorders as depression and mood disorders, schizophrenia, and dementia.
- Omega-3 fatty acids support synaptic plasticity and seem to positively affect the expression of several molecules related to learning and memory.

Omega-3 fatty acids

- Omega-3 fatty acids supplementation restores mechanisms that maintain brain homeostasis in traumatic brain injury.
 - Wu A, Ying Z, Gomez-Pinilla F. J Neurotrauma. 2007 Oct;24(10):1587-95.

Omega-3 supplementation

- Reduced suicidal thinking and depression among Irish subjects with a history of deliberate self-harm,
- Reduced anger and anxiety among polysubstance abusers,
- Successfully treating depression during and after pregnancy,
- Reduced the severity of bipolar symptoms in children.
 - **Joseph Hibbeln**, acting chief of the Section on Nutritional Neuroscience, Laboratory of Membrane Biochemistry and Biophysics, Nat Inst Alc Abuse & Alcoholism.

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Brain Derived Neurotrophic Factor - (BDNF)

- Involved in Neurogenesis
- Facilitates neuroplasticity - specifically dendritic spreading.
- When BDNF is absent it is difficult to normalize the HPA axis. (hypothalamic-pituitary-adrenal axis, involved regulates temperature, digestion, immune system, mood, sexuality, and energy)
- Stress/Pain decreases BDNF.

BDNF

- Excitatory neurotransmission from excess glutamate (prolonged stress) results in not enough serotonin and norepinephrine to support BDNF synthesis
- Decrease in BDNF results in neurons shriveling, synapses get disconnected

BDNF and Exercise

- BDNF improves the function of neurons, encourages neurogenesis and maintains cell health.
- Evidence for a release of BDNF from the brain during exercise. Rasmussen P, Brafford P, et al, Experimental Physiology, August 7, 2009, doi:10.1113/expphysiol.2009.048512
- Exercise increases BDNF production.
- Also, aerobic exercise has been shown to increase size of hippocampus which in turn improves memory. Erickson K I, Voss MW, Prakash RS, et al, PNAS Feb 15, 2011, vol 08, no. 7, 3017-3022.

Conclusion

1. Nutritional intake has a significant impact on neural functioning.
2. Making the right nutritional choices lays a strong foundation for optimal cognitive performance.
3. The right mix of vitamins and minerals help to restore and maintain optimal neurochemical balance.
4. Aerobic exercise done consistently helps to promote long term memory.

The End

Questions?

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