Mindful Nutrition: Nutrition Strategies for Peak Cognitive Performance

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Disclosures

No conflicts of interest or financial relationships to disclose.

Objectives

- Explore the connection between nutrition and cognitive function, highlighting specific foods and dietary patterns that support mental clarity, improved focus, and sustained energy levels to optimize cognitive performance.
- Provide evidence-based insights into how various nutrients and food choices can enhance mental capabilities such as memory, attention, and problem-solving for improved human performance.
- Identify the efficacy of common supplements for cognitive function and athletic performance
- Offer practical and sustainable strategies for incorporating cognitive-boosting foods into daily nutrition plans for optimal mental and physical performance

Cognitive Wellness

Nutrition & Cognitive Function

- The brain is a metabolically demanding organ
  - Makes up ~20% of our basal metabolic rate
  - Composed of ~75% water
  - Uses about 130 grams of carbs per day
- Inadequate macronutrient intake compromises the optimal functioning of the human body
- Dietary intake can affect cognitive function via multiple acute and long-term pathways
  - Glucose and insulin metabolism, neurotransmitter synthesis, membrane fluidity, signal-transduction pathways, long term influence of oxidation and inflammation

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Modifiable Risk Factors for Cognitive Decline

- Dietary inhibitors: alcohol, excess sugar, excess saturated fat, chronically consuming too many or too few calories
- Acute consumption
  - Negatively impacting memory, focus, attention…
  - Can be small or short-term impact
  - Usually reversible
- Chronic consumption
  - Increased risk for T2D, cardiovascular, and neurologic conditions
  - Some risk is reversible, some is not

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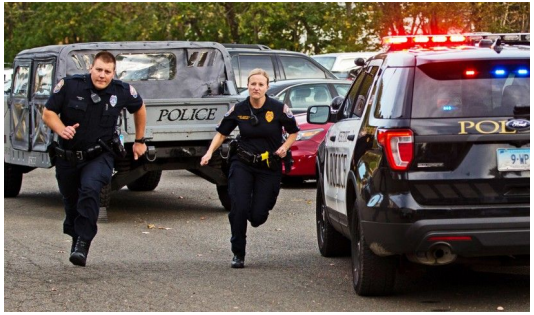
The Foundation

- Establishing a fueling pattern to support balanced energy levels
- Adjusting portions according to energy needs
- Incorporating foods that support neurological health and also positively impact other bodily systems
- Employ strategies for a strong nutrition foundation with more specific recommendations for cognitive health and performance

Cognitive Performance

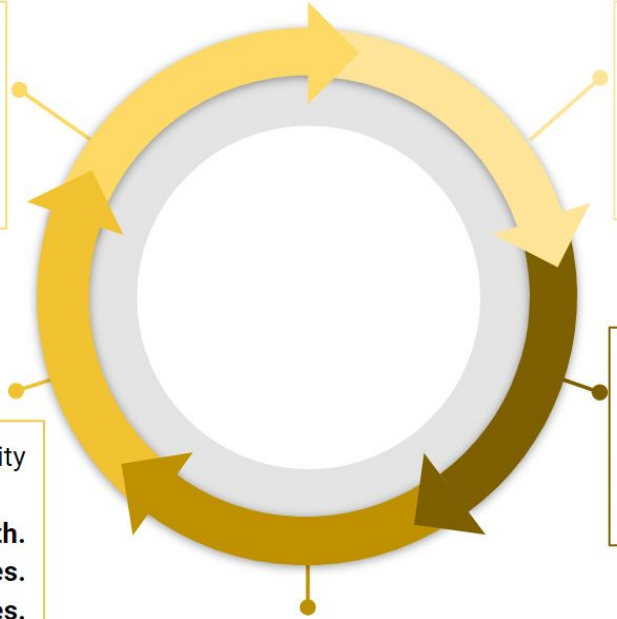
Optimal cognitive performance is essential for athletes, tactical athletes, first responders, and even physical laborers.



The Cognitive Performance Nutrition Model

Supplement Safety

Overseen by clinician or dietitian.
Using only third party tested supplements.
Maximizing ergogenic and cognitive aids.



Total Nutrient Intake

Eating for the work you do.
Variety; moderation; quality.
Adjusted as training and testing changes.

Hydration Strategy

Consuming fluids to maintain levels.
Electrolytes replenished as needed.
Limiting alcoholic beverages.

Nutrient Density

Prioritize nutrient dense foods for brain health.
All labs fall within healthful ranges.
Safe protocol is followed to correct values.

Nutrient Timing

Eats constantly to maintain energy and blood sugar levels.
Consuming adequate nutrients before and after training/testing.

The Brainpower Plate

Protein
About ¼ of meal or 1-2+ servings
Aim for leaner protein options with less saturated fat.

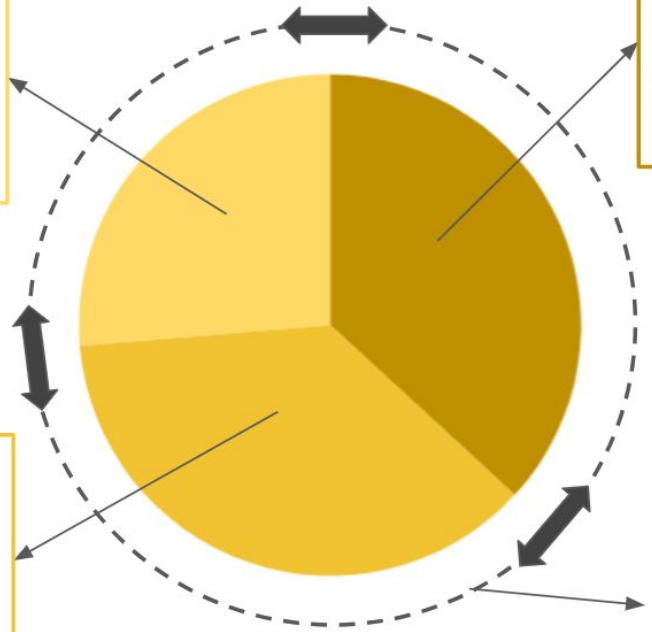
Ex: Poultry, seafood, soy

Produce
About ¼ - ½ of meal or 1-3+ servings
Aim for nutrient dense fruits and vegetables.

Ex: All fruits and berries, all vegetables and leafy greens

Meals can take many shapes beyond a plate. Consider including balanced portions in your soups, salads, burritos, and other meals.

Aim to include some healthful unsaturated fats too. Try cooking with olive oil, adding avocado or nuts and seeds.



Starch
About ¼ - ½ of meal or 1-3+ servings
Aim for fiber-rich options.

Ex: Whole grain bread or wraps, whole wheat or bean pasta, beans, rice, oats

Portions can be adjusted based on how much energy you are using that day. A meal that is about ½ produce, ¼ starch, and ¼ protein will have less calories than a meal that is divided in thirds.

Aim to eat 3-4 meals daily for consistent energy for your brain.

Hydration

- Acute decrements (≥1-2% body mass) can have a detrimental effect on physical and cognitive performance
  - Attention, alertness, concentration, energy, fatigue, executive & psychomotor functions
- Be proactive and have hydration/rehydration strategies
  - Hydration schedule, reusable bottles, infused waters, fluid containing foods, etc
- Aim for ½ body weight in oz + 16-20oz per hour of exercise or pound lost

GSSI SSE #210

Omega-3

- EPA and DHA are essential for normal brain function; crucial for neurogenesis and regulation of neurons, cell membrane composition, neurotransmitter production, anti-inflammatory properties
- Diets low in omega-3
  - Reduce neuronal growth and size in brain regions such as the hippocampus
  - Reduced levels of neurotransmitter function
- Diets high in saturated and trans fats can negatively affect cognition
  - Can stimulate the hippocampus to produce a neuro-inflammatory response
  - Reduced telomere length
  - Worse performance in learning tasks, verbal memory

Omega-3

- Higher levels of EPA, DHA, and Omega-3 Index have been associated with a larger hippocampus volume
- Increased cerebral blood flow increases oxygen and nutrient delivery to the brain
- Anti-inflammatory properties may support recovery from intense exercise, which could improve sleep and indirectly benefit cognitive function

Atlantic Salmon, 3 oz
1200mg EPA/DHA

Canned Pink Salmon,
910mg EPA/DHA

Shrimp, 3 oz
267mg EPA/DHA

Light Tuna, 3 oz
228mg EPA/DHA

Albacore Tuna, 3 oz*
1300mg EPA/DHA

Sockeye Salmon, 4 oz
2265 EPA/DHA

Oysters, 3 oz
585mg EPA/DHA

Halibut , 3 oz
396mg EPA/DHA

Nori Wraps , 1 oz
100mg EPA/DHA

Herring, 3 oz
1,400mg EPA/DHA

Trout, 3 oz
840mg EPA/DHA

Sardines, 3 oz
835mg EPA/DHA

Mussels, 3 oz
665mg EPA/DHA

Wakame Salad, 3 oz
156mg EPA/DHA

Mackerel, 3 oz
1,600mg EPA/DHA

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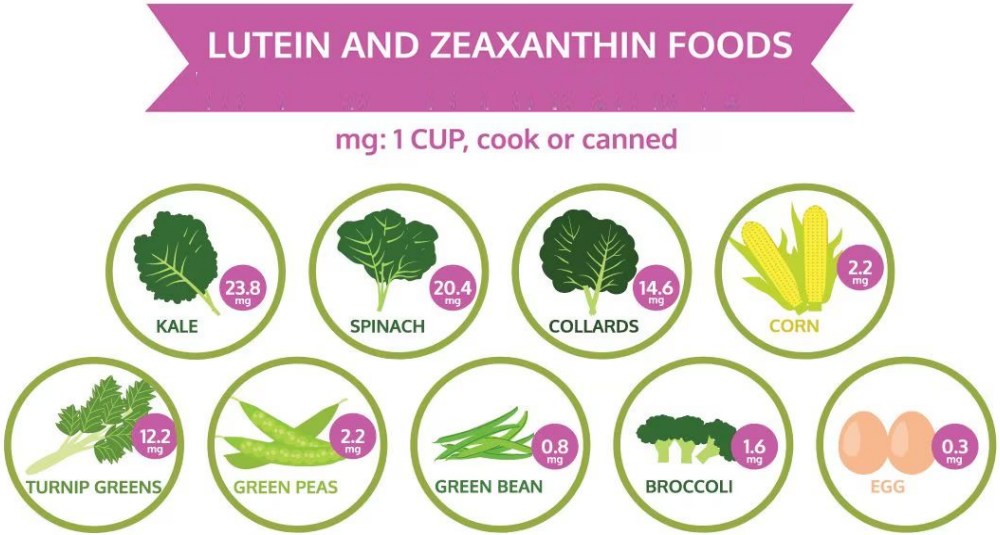
Antioxidants

- Zeaxanthin & lutein are associated with greater improvements in visual memory and learning
  - Found in the hippocampus, cerebellum, frontal, occipital and temporal cortices
  - Powerful antioxidant and anti-inflammatory properties



https://www.allaboutvision.com/eye-care/vision-health/nutrition/lutein/

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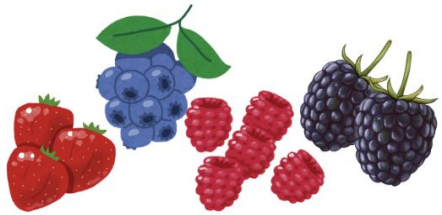
Antioxidants

- Flavonoids show promising effects on cognitive function
  - Executive functioning, memory and processing speed for young adults
  - Episodic memory for children and older adults
- Associated with reduction of neuroinflammation, improved cerebrovascular blood flow, vascular function
- Flavonoid-rich, mixed berry smoothie intervention proved the ability to maintain or improve executive function during times of fatigue with cognitively demanding tasks compared to placebo



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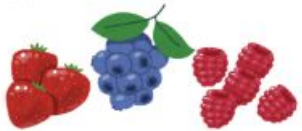
MIND Diet

Mediterranean-DASH Intervention for Neurodegenerative Delay

Green, leafy vegetables *6+ servings/week*

Non-starchy vegetables *At least 1x/day*

Berries *At least 2x/week*



Nuts *1 ounce serving 5+/week*

Beans *4 servings/week*

Fatty fish *1-2 servings/week*

Poultry *2+ servings/week*

Whole Grains *3 servings/day*

Olive oil

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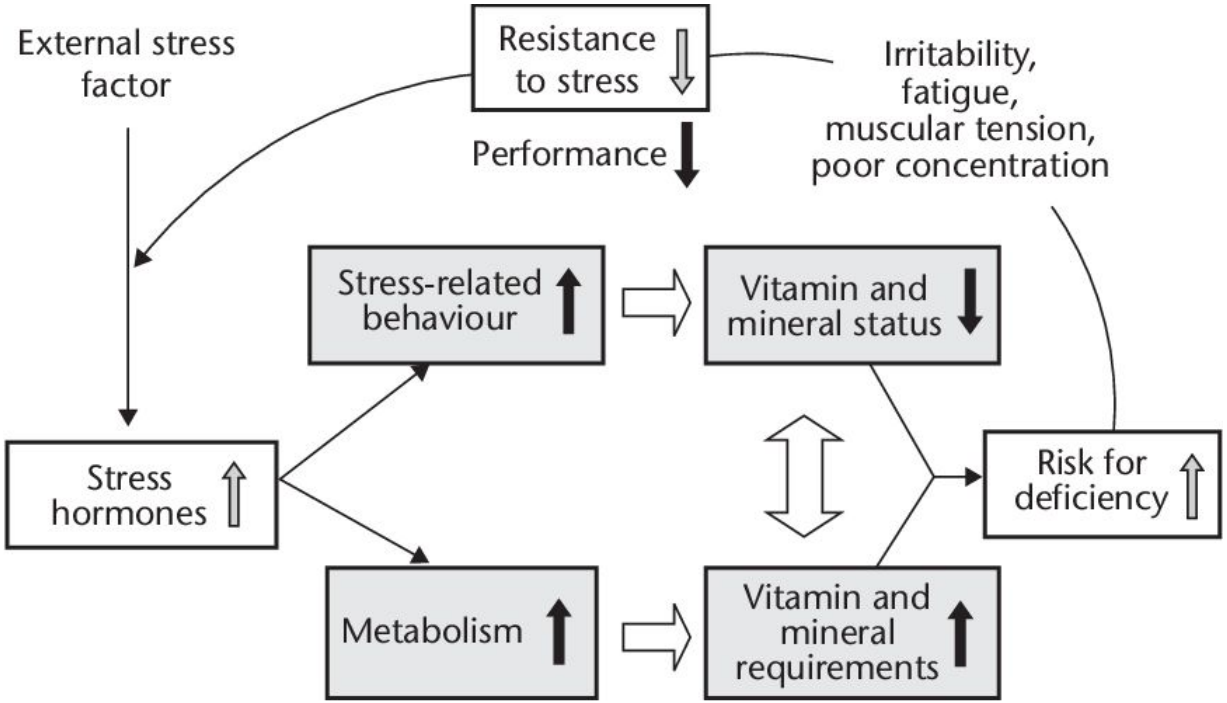
The Cycle of Stress: Impact on Micronutrient Needs



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Influence of Micronutrients on Cognitive Function & Performance

TABLE 3:
Consequences of water-soluble vitamin deficiencies on cognitive performance[3,4,27,33]

Vitamin	Consequence
Vitamin B_1	Fatigue, mental changes (e.g. apathy, decrease in short-term memory, confusion and irritability), visual difficulties
	Frank deficiency: beriberi, Wernicke–Korsakoff syndrome
Vitamin B_2	B_2 deficiency is most often accompanied by other micronutrient deficiencies
	Severe B_2 deficiency may impair the metabolism of vitamin B_6 and the conversion of tryptophan to niacin
Vitamin B_6	Depressed mood and neurological disturbances
	Frank deficiency: peripheral neuropathy, convulsions, depression and confusion
Vitamin B_{12}	Fatigue and weakness, irritability, depressed mood, loss of concentration to memory loss, mental confusion, disorientation
	Frank deficiency: peripheral neuropathy, subacute combined system degeneration, frank dementia
Folic acid	Symptoms of folate deficiency include depression, insomnia, forgetfulness and difficulty in concentrating, irritability, apathy, fatigue and anxiety
Biotin	Irritability, depressed mood, central nervous system abnormalities
Nicotinamide	Marginal deficiency: irritability, weakness, mental confusion and dizziness
	Frank deficiency: pellagra, dementia
Panthotenic acid	Irritability and restlessness, fatigue, apathy and malaise, neurobiological symptoms, such as numbness, muscle cramps. Myelin degeneration
Vitamin C	Weakness, fatigue, depression

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Cognitive Therapeutics

Caffeine

- CNS stimulant associated with
    - Improved attention, accuracy, vigilance, reaction time, memory, and problem solving
    - Reduced feelings of fatigue
    - Enhanced mood and ability to perform complex activities
- Consider caffeine content, bioavailability, and practicality of different sources for use

Acute Use

- 3-6mg/kg 30-60min prior to event
- 100mg per 2hr or 200mg per 4hr during periods of sleep deprivation or maintained exposure to stress

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Caffeine

- Repeated 200mg doses of caffeine had positive impacts on cognitive function for 20 Special Forces SM during three successive nights of sustained wakefulness
  - Maintained psychomotor vigilance
  - Improved detection of events during field vigilance
  - Increased response speed and accuracy of responses to logical reasoning tests

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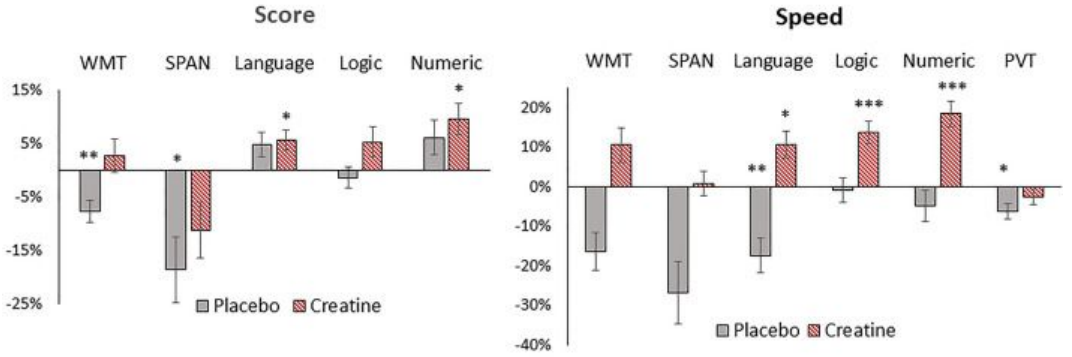
Creatine Monohydrate

- Supplementation increases brain creatine content and ratio of PCr to ATP
- May improve short-term memory, processing speed and performance on complex central executive tasks
- Offers additional strategies beyond caffeine for sleep deprivation

Chronic Use: 5g/d (0.1g/kg/d)
Acute Use: 0.35g/kg

- Single high-dose CM supplementation (0.35g/kg) acutely improved cognitive performance during sleep deprivation in a 2024 double-blind, RCT with crossover
  - Subjects were provided with creatine or placebo in the early evening with testing completed 3x throughout the night for 2 nights with a 5 day wash out between interventions.
  - Significantly improved speed processing, short-term memory, and reaction speed, reduced fatigue



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Tyrosine

- Precursor for catecholamine synthesis including dopamine and norepinephrine
- Supplementation may be effective to mitigate the impact of short-term external stressors or cognitively demanding situations
    - Associated with improved working memory, reasoning, and vigilance during sleep deprivation
    - Reversal of cognitive impairments (memory performance) caused by cold exposure and/or hypothermia
- Habitual intake is associated with maintained or improved working and episodic memory

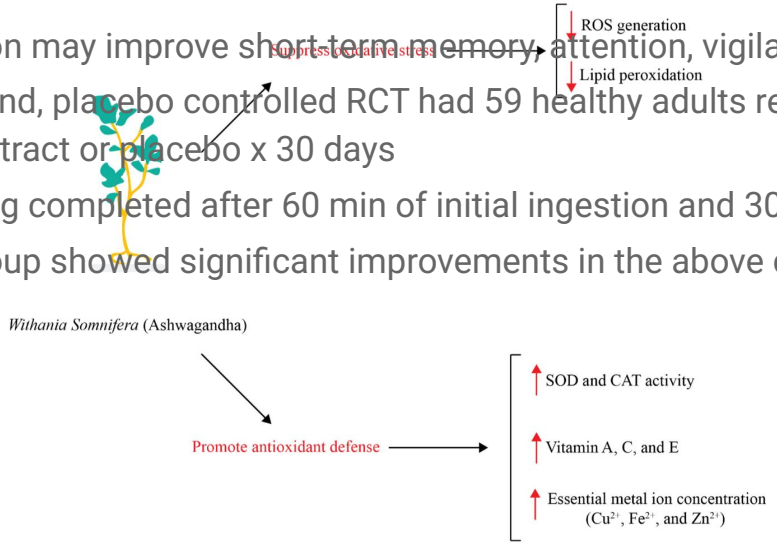
Acute Use: 500-2000mg

Food Sources: poultry, beef, fish, soy products, dairy products, peanuts, almonds, eggs, lima beans

PMID: 26424423
PMID: 29255945

Ashwagandha

- Thought to attenuate cognitive decline associated with inflammation and neurodegeneration
- Antioxidant, anti-inflammatory, anti-stress, cardioprotective, and neuroprotective properties
- Acute supplementation may improve short-term memory, attention, vigilance, and executive function
  - 2024 double-blind, placebo controlled RCT had 59 healthy adults receive 225mg *Withania somnifera* root and leaf extract or placebo x 30 days
  - Cognitive testing completed after 60 min of initial ingestion and 30 days of supplementation.
  - Intervention group showed significant improvements in the above cognitive functions



PMID: 38931168
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Ashwagandha

- Reduced stress levels and improved sleep quality may indirectly benefit cognitive performance
  - Double blind RCT with 125 adults perceived to be under stress received 300mg ashwagandha or placebo x 90 days
  - Intervention group showed improved memory, focus, sleep quality and reduced stress levels

Index	Baseline visit[§]	Visit 4	*p* value; change from baseline to visit 4	Baseline	Visit 4	*p* value; change from baseline to visit 4	*p* value; the difference in Ashwagandha SR vs. placebo groups at visit 4
	Ashwagandha SR			Placebo			
PSS-10	19.5 ± 3.2	13.0 ± 5.0	<.0001	19.4 ± 3.1	18.7 ± 4.6	*p* = 0.4955	<.0001
Serum cortisol, μg/dL	9.04 ± 3.77	6.34 ± 2.31	<.0001	9.01 ± 3.69	7.38 ± 3.31	*p* = .0078	*p* = 0.0443
OHQ	3.93 ± 0.60	4.39 ± 0.78	*p* = .0003	3.91 ± 0.77	3.44 ± 0.69	*p* = .0001	<.0001
PSQI	4.6 ± 2.7	2.5 ± 1.6	<.0001	4.6 ± 2.2	4.0 ± 2.0	*p* = 0.0794	<.0001

Visit 2
Visit 4

Visit 4

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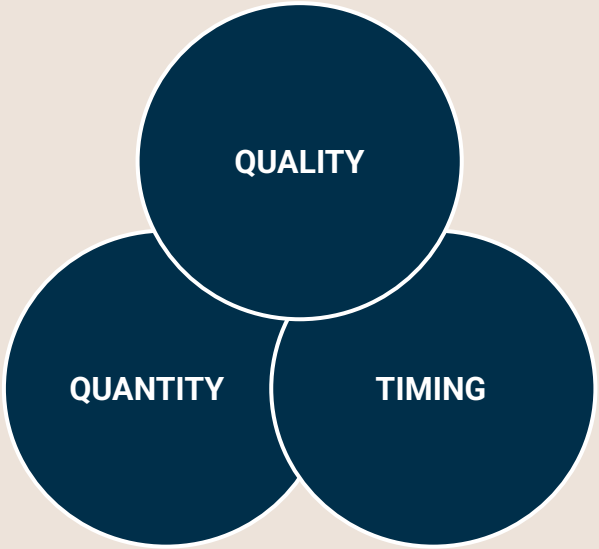
Summary



- Create a strong foundation of sustainable nutrition habits and skills to rely on for good health
  - QQT
  - Strategies for an adequate and consistent fueling pattern
- Omega-3, antioxidants, MIND diet show promising impacts on cognitive health & performance
- Consider supplementation where appropriate for acute impacts on cognitive performance
- Flexibility and focus - choose nutrient dense foods most of the time and enjoying other foods as you feel comfortable with

Summary

Chronic Use

Omega-3: 2g EPA/DHA

Creatine: 5g/d (0.1g/kg/d) or single high dose 20-35g

From Food

Omega-3: 2g EPA/DHA

Lutein: 8-10mg

Zeaxanthin: 2mg

Acute Use

Caffeine: 30-60mg/kg 30-60 min before event

Creatine: single high dose 20-35g

Tyrosine: 500-2000mg

Ashwagandha: 250-500mg/d

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Thank you! Questions?

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