Health is not just the absence of disease, but the presence of optimal wellness. Though nutritional guidance historically focused on preventing deficiency and toxicity from nutrients, today there is a growing interest in leveraging nutrients to improve the “healthspan,” or years of life in good health.

Time is of the essence to apply this to neuronutrition. According to the Alzheimer’s Association, the number of Americans living with Alzheimer’s dementia is expected to more than double by 2050 from today’s 5.7 million to nearly 14 million.1 Worldwide, today’s 50 million people with dementia will more than triple by 2050, according to the World Health Organization.2

Lutein and choline are among the most underconsumed and underappreciated nutrients emerging into the spotlight for brain health and cognition. Recent research highlights their potential for preventing and improving cognitive decline.

CONTINUED on Page 2...
In exciting, first-of-its-kind animal research published in early 2019, when female animals consumed 5 mg/kg of choline during pregnancy and lactation, their offspring had fewer risk factors for Alzheimer’s disease, including reduced beta-amyloid accumulation, homocysteine, and pro-inflammatory gene expression.\(^5\)

The study looked at two generations. The first generation only had exposure to choline in utero and during breastfeeding. They showed fewer cognitive deficits in old age compared to peers without any exposure to choline. What’s more, the second generation also enjoyed cognitive benefits.

The researchers found brain homocysteine levels went down in both generations, as did expression of 27 genes, including those that promote inflammation. While these findings are encouraging, the results need to be confirmed in well-designed human trials.

Recent research in humans has shown that maternal choline intake benefits at least one generation. Caudill and colleagues tested 930 mg/d choline in the maternal diet during the third trimester, which resulted in improved infant information processing speed, aka reaction time, compared to the group with maternal intake at recommended levels (480 mg/d).\(^6\) Even in the 480 mg/d group, the infants with the longest exposure performed significantly better. Therefore, there seem to be benefits of increasing choline intake beyond current recommended levels and starting early.

### TABLE 1: CHOLINE mg/d

<table>
<thead>
<tr>
<th></th>
<th>CHOLINE DRI</th>
<th>CURRENT INTAKE</th>
<th>GAP</th>
<th>CHOLINE UL</th>
</tr>
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<tbody>
<tr>
<td>Men 19+ yrs(^3)</td>
<td>550</td>
<td>402</td>
<td>148</td>
<td>3500</td>
</tr>
<tr>
<td>Women 19+ yrs(^3)</td>
<td>425</td>
<td>278</td>
<td>147</td>
<td>3500</td>
</tr>
<tr>
<td>Pregnant 13-44yrs(^3,4)</td>
<td>450</td>
<td>319</td>
<td>131</td>
<td>3000 to 3500</td>
</tr>
<tr>
<td>Lactating 14+ yrs(^3)</td>
<td>550</td>
<td>N/A</td>
<td>N/A</td>
<td>3000 to 3500</td>
</tr>
</tbody>
</table>

Seeing Lutein’s Impact on Brain Health through Novel Measures

Dietary Reference Intakes for lutein do not currently exist, though there is strong interest and rationale for developing them. Americans average 1-2 mg/d of lutein. For now, the best estimate we have from the body of scientific literature is that 6 mg/d may be an effective level of lutein to reduce the risk of age-related macular degeneration (AMD). The evidence suggests that lutein is likely safe at long-term doses up to 20 mg/d. (Table 2) Long-term studies demonstrating the safety of doses are needed, though the daily intake from average food intake is generally safe.

Lutein accumulates in the human brain, and its neuroprotective role may be due to antioxidant activity, anti-inflammatory properties, and its role in stabilizing cell membranes. A 2019 randomized-controlled trial examined the effects of lutein on brain function in a small group of older white men. After a year of taking 10 mg/d lutein, researchers found significantly increased brain connectivity. What was surprising is that rather than restoring “youth-like” brain activity, the older brains seemed to show enhanced connections between networks that are separated earlier in life. Their brains weren’t turning back the clock, they were just making better use of what they had.

A late-2018 study in a small group of older adults found that better lutein status was associated with stronger white matter integrity in the brain. White matter refers to the white myelin sheath protecting neurons and information transfer speed. This study’s findings adds to prior studies linking better lutein status to improved white matter integrity in areas of the brain that commonly experience age-related decline.

These new research studies add to our understanding of how lutein improves brain health.

Putting it on the Plate

Like we say in the trade, it’s not nutrition until you eat it. When thinking about putting choline and lutein on the plate, consider what’s realistic and can easily be made into delicious, nutritionally-balanced meals and snacks. For a look at the choline and lutein content in accessible, convenient, brain-boosting foods, check out Table 3. You’ll notice that some foods are strong in choline, others in lutein. Eggs are one of the only foods that provide both choline and lutein. All the foods fit into a diet for optimal brain health.

More recently, it’s been shown that intermittent fasting may help slow aging and extend lifespan. Studies conducted in mice show that fasted rodents live much longer than rodents who ate freely every day. These findings are complementary to human studies which show that fasting lowers several biomarkers for aging and cancer, which can help

{ CONTINUED on Page 6... }
If you ask two different people to define “plant-based eating,” you will likely get two different responses. Because this term isn’t defined by any governing body, it’s up for interpretation. The Academy of Nutrition and Dietetics (AND) says that plant-based diets include vegetarian and vegan diets, while U.S. News & World Report describes plant-based diets “as an approach that emphasizes minimally processed foods from plants, with modest amounts of fish, lean meat and low-fat dairy, and red meat only sparingly.” Regardless of the definition, the common denominator among all descriptions of a plant-based diet is, well, plants!

The rise in popularity of plant-based diets is accompanied by many health benefits. Research suggests that eating mostly plants can prevent obesity, decrease the risk of developing diabetes, and lower mortality rates. Plant-based diets are also associated with lower rates of heart disease and cancer. The majority of these studies observed vegetarian diet patterns, which include plenty of fruits, vegetables and meatless proteins, like eggs, dairy, whole grains, nuts, seeds and soy. In other words, plants were paired with protein sources, like eggs, to make a nutritious and well-rounded meal. Eggs can and should be part of a plant-based diet, and these five suggestions showcase how easy it is to incorporate the incredible egg into your plant-forward dishes.

Frittatas
This baked egg dish is best with whatever seasonal veggies and herbs you have on hand. Simply beat eggs, your favorite vegetables, herbs and spices in a bowl. Heat a non-stick skillet over medium high heat and pour in the egg mixture. Cook for 5-10 minutes or until eggs set and remove from heat. Try different flavor variations, like sun-dried tomato, parmesan cheese and basil for a Mediterranean flair or asparagus, radish and goat cheese for a spring twist. Both options contain protein to keep you full and an assortment of vitamins and minerals.

Stuffed Veggies
Did you know that eggs make a great addition to stuffed veggies? Peppers, tomatoes and squash make great vehicles for stuffing. Cut the veggie in half, scoop out the seeds, fill with your favorite whole grain, like rice or quinoa, and top with an egg. For an extra hit of heart-healthy fat, cut a ripe avocado in half and top with cheesy scrambled eggs for breakfast, lunch or dinner!

Put An Egg On It
Whether you’re revamping leftover veggies for a quick dinner or looking for a protein boost on your pizza, there are so many reasons to putanegggonit. Eggs make a great addition to pasta or frozen veggies, too.

Salad Protein
The base of any good salad is vegetables, but the part that fills you up is the protein. Next time you’re at the salad bar, load up on as many veggies as you want and top the whole thing off with a hard-boiled egg. Each egg you add will provide six grams of protein and several nutrients, including

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WHOLE EGGS UNIQUELY SUPPORT MUSCLE HEALTH

by MARIE SPANO, MS, RD, CSCS, CSSD

Key Messages

- Other nutrients found in protein-rich whole foods, beyond protein, may support muscle maintenance and strength.
- Whole foods provide a package of nutrients that cannot be replicated or broken down and put back together.

Healthy strong muscles are important throughout the lifespan. Resistance training and sufficient dietary protein help support muscle maintenance and strength. Research has shown the importance of both the total amount of protein consumed each day as well as the amount of protein per meal. However, emerging research is showing other factors within food, besides protein, influence the synthesis of new proteins in muscle.

Over the past several years, scientists have examined how amino acids and isolated sources of protein impact muscle protein synthesis. This research serves as a foundation to better examine aspects beyond protein. Leucine, an essential amino acid, turns on the machinery driving the synthesis of new proteins in muscle. While leucine is the switch turning this process on, all essential amino acids are necessary to provide the building blocks for muscle protein synthesis to be running optimally. Quality sources of protein including whey, egg, soy and beef contain all essential amino acids in appreciable quantities to support this process. Yet studies comparing protein-rich drinks and whole foods have led to results that cannot be explained by differences in leucine or the amount of high quality protein consumed.

One recent study was designed to examine how protein, in its whole, natural state in the form of eggs, impacted muscle protein metabolic responses. Researchers took resistance-trained men and gave them either whole eggs or egg whites, each containing 18 grams of protein, after exercise. Both the whole eggs and egg whites turned on the synthesis of new proteins in muscle. However, whole eggs increased muscle protein synthesis to a greater extent than egg whites. In this study, the authors noted that differences between whole eggs and egg whites cannot be explained by leucine content, the appearance of leucine within the bloodstream, or variances in the muscle signaling pathway. Researchers suggest there may be something about the whole egg matrix, which consists of high-quality protein, fat, vitamins and minerals, that may support a greater response in muscle compared to the response seen with egg whites.

Whole foods that are good sources of protein, such as eggs, provide a package of nutrients that may lead to greater muscle protein synthesis than...
RESEARCH NEWS: CHOLINE, LUTEIN, AND COGNITION

(Continued from Page 3...)

prolong lifespan. In a very recent study conducted at Harvard University, fasting was shown to help keep certain cell components in a “youthful” state, which may in turn improve life expectancy.

Maggie Moon, MS, RD, is the best-selling author of The MIND Diet: A Scientific Approach to Enhancing Brain Function and Helping Prevent Alzheimer’s and Dementia, and proud contributor to the upcoming edition of Krause and Mahan’s Food and the Nutrition Care Process 15th Ed. textbook (2019) as lead author on Medical Nutrition Therapy for Neurologic Disorders. She completed culinary school in Los Angeles, and shares her culinary medicine recipes at MINDdietMeals.com

REFERENCES


| TABLE 3
<table>
<thead>
<tr>
<th>FOOD (USDA #)</th>
<th>CHOLINE mg</th>
<th>LUTEIN mcg</th>
<th>SERVING</th>
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<tbody>
<tr>
<td>Proteins</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eggs (#01128)</td>
<td>146</td>
<td>250</td>
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<tr>
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<td>1006</td>
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<tr>
<td>buckwheat groats (#20010)</td>
<td>34</td>
<td>101</td>
<td>1 cup cooked</td>
</tr>
</tbody>
</table>
INCORPORATING EGGS INTO A PLANT-BASED DIET

{ CONTINUED from Page 4... }

vitamin D, lutein, riboflavin and choline. Plus, eggs not only provide the carotenoid lutein, but research has found that consuming eggs can help increase absorption of carotenoids from other foods9, and adding eggs to a salad means higher absorption of vitamin E – 7 times as much10!

Snack On Eggs
Research suggests that including protein at snack time can improve appetite and hunger control, which can prevent overeating later in the day11. That makes eggs the perfect addition to your midday plans. Hard boil a batch of eggs early in the week to enjoy as a quick snack. Pair an egg with a side of fruit or veggies and a handful of nuts to get a good balance of protein, carbs and good fats.

Natalie Rizzo, MS, RD is a NYC-based media Dietitian, food and nutrition writer, national spokesperson and owner of Nutrition à la Natalie, a successful sports nutrition blog. Natalie has a Master’s of Science in Nutrition and Exercise Physiology from Columbia University.

REFERENCES

WHOLE EGGS UNIQUELY SUPPORT MUSCLE HEALTH

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equal amounts of isolated protein. Whole foods have a unique food matrix that include not only protein, but also vitamins, minerals, fats and other compounds that cannot be deconstructed and isolated or put back together with the same result. As evidence mounts to support the benefits of non-protein food compounds or the synergistic action of compounds found in whole foods, consumers would be wise to follow the age-old advice from registered dietitians: eat more whole foods closer to the way these foods are found in nature.

Marie A. Spano, MS, RD, CSCS, CSSD, is a nutrition communications expert and one of the country’s leading sports nutritionists. Spano has appeared on CNN as well as NBC, ABC, Fox and CBS affiliates, and authored hundreds of magazine articles and trade publication articles. She is lead author of the textbook Nutrition for Sport, Exercise and Health and co-editor of the NSCA’s Guide to Exercise and Sport Nutrition (Human Kinetics Publishers).

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UPCOMING EVENTS

Alzheimer’s & Brain Awareness Month
June is Alzheimer’s & Brain Awareness Month. Eggs have choline and lutein, nutrients important for brain development and health. Visit EggNutritionCenter.org to learn more. { JUNE 1-30 }

Better Breakfast Month
September is Better Breakfast Month! Visit EggNutritionCenter.org for some delicious breakfast recipes featuring eggs. { SEPTEMBER 1-30 }

Food & Nutrition Conference & Expo
Academy of Nutrition and Dietetics
Philadelphia, PA { OCTOBER 25-29 }

is a quarterly publication produced by the Egg Nutrition Center (ENC) that presents up-to-date reviews, summaries and commentaries on nutrition for health promotion and disease prevention, including the role of eggs as part of a nutritious and healthful diet. ENC accepts article submissions from health professionals. Opinions expressed by the authors may not be those of ENC. Some authors are compensated for their articles.