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Memory Preservation Nutrition: A Practical Evidence-Based Program For Brain Health

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Now that science has begun to prove that a proper nutrition can decrease risk of cognitive decline, and slow the buildup of Alzheimer's pathology in the brain, the public urgently needs "ready-to-use," evidenced-based nutrition programs for brain health. The need is particularly poignant for people recently diagnosed with Alzheimer's disease or mild cognitive impairment given that no drug currently on the market can slow the underlying disease process.

In 2005, I led a team of medical doctors and scientists from Boston University School of Medicine and Tufts University School of Medicine to develop such a program, the Memory Preservation Nutrition (MPN) program.[1] Later, dietitians, nutritionists, and educators joined me in implementing the MPN program in adult day programs, senior residences, and for individuals of all ages. In doing so, we have ready-for-use menus, shopping lists, cooking guides, lists of brain foods and lists of foods which are toxic to brain, along with hundreds of delicious recipes, many of them now tested with real people, and perfected. (See Resources below.)

The evidence-based MPN program is an integrated whole-foods nutrition program that improves cognitive and emotional health while increasing overall health. To be brain healthy, nutrition must be heart-healthy and safe for people with diabetes; thus it can be a therapeutic and delicious program for most people. It's continually updated and enhanced as new brain-relevant research becomes available.

Researchers studying Alzheimer's disease (AD) believe brain changes and damage begin two to three decades before AD symptoms appear, indicating the need for early intervention. Following the MPN program can help protect brain health, delay the onset of AD and other dementias, and even help those already experiencing cognitive problems.

How MPN Works

MPN involves following six key strategies that target specific biological outcomes. Each strategy involves consuming a variety of foods that can be customized for each person or patient according to his or her individual tastes, preferences, ethnic/cultural proclivities, and available foodstuffs and allowing for flexibility in the presence of comorbidities or food allergies/intolerances.

MPN's overall goal is to promote brain health and, specifically, to reduce the risk of AD and other neurodegenerative diseases, delay the onset of symptoms in those with presymptomatic AD, and slow progression in those already diagnosed with mild cognitive impairment (MCI) or AD. An additional objective is to promote overall health, particularly in the areas identified as being closely related to brain health: sugar metabolism, healthy insulin function, and healthy cardiovascular function.

Strategies Emphasize Whole Foods

Individuals who adhere to the MPN program adopt the following practices:

- They increase their intake and the variety of antioxidants they consume, including those found in spices, nuts and seeds, whole grains, green leafy vegetables, and berries.

- They work to reduce insulin resistance by limiting their sugar intake and eating complex carbohydrates such as beans and lentils, root vegetables, and whole grains (along with other foods listed here).

- They work to reduce their level of very fine particle LDL cholesterol by eating much less sugar and refined carbohydrates. They limit their intake of animal-based saturated fats (keeping in mind consuming certain saturated fats are essential to health). They also avoid trans fats.

- They boost their consumption of omega-3s and other healthful fats (eg, monounsaturated), such as those found in fish and seafood; walnuts; seeds such as flax, chia, and hemp; canola and extra-virgin olive oils; leafy greens and purslane; and flax, fish, and marine oils. They also eat fewer foods containing omega-6s, including corn oil.

- They choose anti-inflammatory foods such as fish, berries, spices, and vegetables, and reduce sugar and animal food intake. They protect gut health by eating probiotic and prebiotic foods and avoiding foods that harm the microbiome.

- They consume adequate amounts of vitamins B, C, D, and E, which are critical for brain health. Those of particular importance include vitamin D3; the family of eight vitamin Es, including tocotrienols; vitamin B12; and niacin.

Recommended Foods

Individuals following the MPN program should consume more plant foods and fewer animal foods. They should obtain their nutrients from whole foods or juices, reducing their consumption of processed foods as much as possible and preferably avoiding them. They should stay hydrated, preferably by drinking plenty of water.

Probiotics and prebiotics are important for maintaining good gut microbiome health. To achieve this goal, people can eat fermented foods such as Greek yogurt and other fermented dairy products, pickles, sauerkraut and other fermented vegetables along with foods high in insoluble fiber polysaccharides, such as onions, leafy greens, beans and lentils. People can also take good quality probiotic supplements. It is also important to avoid foods that upset the balance and harm healthy gut bacteria such as such as excess sugar and refined carbs.

Vegetables are critical for good brain health, especially leafy greens, which contain omega-3s, vitamin E, and key B vitamins (including folate). Some leafy greens, such as romaine lettuce, also contain S-adenosylmethionine, which has been identified as directly benefiting cognitive health.[2] Legumes have been linked to good brain health as well.[3-6]

Berries offer potent antioxidant properties and anti-inflammatory action, and facilitate brain-cell signaling, which has been established as being especially beneficial for good brain health.[7,8]

All antioxidant nutrients tested so far help lower the amount of beta amyloid in the brain, one of the two problem proteins that are pathological in Alzheimer's disease. While the details of the etiology of Alzheimer's is still debated, scientists agree that when the beta amyloid protein, normal in small amounts, starts to accumulate, it begins to aggregate, a process called oligomerization. Beta Amyloid oligomers of various sizes are toxic to the brain, especially when still small enough to be soluble, interfering with synapses and killing neurons. The larger oligomers precipitate as "plaque" and clutter up spaces between neurons. Antioxidants as well as other nutrients can retard this process by reducing amounts of beta amyloid, retarding oligomerization, or by removing accumulated beta amyloid from the brain. Herbs and spices are particularly useful as anti-amyloid agents.

The MPN program advocates replacing dietary salt and sugar with herbs and spices. All spices, herbs, teas (especially green tea), and dark chocolate, which are potential antioxidants and anti-inflammatories, help protect the brain and heart. For instance, mice studies suggest that cinnamon, turmeric, and grape

seed extract can prevent oligomerization of beta-amyloid. Cinnamon also appears to remove excess beta- amyloid from the brain. [9-11]

Some studies have established spices, including cinnamon, tumeric, and hot peppers, as potent means of reducing LDL cholesterol and improving blood sugar levels and insulin resistance.[12-14] The emphasis on herbs and spices as a nutrient-dense, delicious way to maximize MPN's key strategies helps distinguish it from other programs.

In addition, some herbs have been established as agents that improve acetylcholine availability in the brains of Alzheimer's patients, including sage, lemon balm, and saffron.[15-17]

In fact, saffron has been found to be as effective as donepezil (Aricept) in a head-to-head trial and superior in that it has no side effects and costs less.[17]

More recently, he University of Miami reported that in a small pilot clinical trial, a certain over the counter formulation of Aloe Vera dramatically decreased inflammation and improved cognition in patients with early stage Alzheimer's disease.[18]

Fish, seafood, and other sources of omega-3 fats also are important for good brain health; fatty fish such as salmon, sardines, and tuna are especially beneficial along with plant-based sources such as leafy greens, walnuts, and seeds such as chia, flax, and hemp. The recommendation is to eat fish or seafood at least three times per week and omega-3–rich plant foods daily. Marine oil supplementation also is recommended.

MPN focuses on reducing cholesterol and animal-based saturated fats while increasing healthful fats, especially omega-3 and monounsaturated fats. People diagnosed with MCI or AD may benefit from consuming a higher proportion of calories from healthful fats found in extra-virgin olive oil, sesame oil, avocados, nuts, and seeds.

Foods to Avoid and Reduce

Individuals should avoid trans fats and processed meats with nitrates and limit red meats such as beef, pork, and lamb to no more than once per week. Multiple studies of trans fats agree that higher consumption is associated with a higher risk of cognitive impairment.[19] Fortunately the Federal Drug Administration in 2015 announced that within three years all artificial transfats much be removed from the American food supply.

Excess sugar consumption has been linked to brain problems such as hippocampus shrinkage, increased beta-amyloid levels, impaired insulin function and glucose use in the brain, impaired memory and cognitive processes, and increased LDL cholesterol, the very fine particle form that is so easily oxidized and when oxidized sticks to the inside of blood vessels causing plaque and potential blockages.[20-26] Therefore, individuals should limit their intake of sugars and foods that are quickly converted to sugar after consumption, such as starches and refined grains, including white rice, white skinless potatoes, products made with white flour, and the omnipresent starch maltodextrin. Maltodextrin is a sweet tasting starch that spikes the blood sugar worse than sugar and is popular main ingredient in "no-sugar" processed dessert mixes.

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Mechanisms of Action

Nutrition is pleiotrophic, working simultaneously through multiple mechanisms. In terms of brain health, similar and complementary nutrients promote both cognitive and emotional health. With regard to AD, MPN is designed to block or delay multiple mechanisms identified as possibly related to AD etiology with minimal or no side effects. For example, omega-3 fatty acids can reduce beta-amyloid burden, improve cognition, and protect against dendritic pathology.

Because scientists don't agree on the sequence of causal events or whether there may be multiple pathways that result in the classic pathology of AD, nutrition can be an excellent recourse to recommend to clients and patients already dealing with cognitive impairment or diagnosed with MCI or AD as well as those considered to be at risk based on family or medical history.

Some studies show that people with an elevated risk of AD due to the APO E4 allele gene can reduce their risk by eating a brain-healthy diet and getting regular physical activity.[27,28] The mechanisms by which specific foods may help or harm the brain appear to vary, and with many whole foods, there can be multiple actions at work simultaneously.

Moreover, foods work together synergistically. For example, while olive oil and leafy greens are individual brain foods, when eaten together the olive oil

promotes better absorption of the leafy greens' key antioxidants, such as lutein and zeaxanthin, thus increasing their health benefits.

A few ways foods can enhance brain health include the following:

- increasing the availability of the memory neurotransmitter acetylcholine in the brain by directly increasing production or slowing its metabolic breakdown, similar to the action of the cholinesterase inhibitors currently on the market;

- raising levels of other neurotransmitters;

- influencing antioxidant and/or anti-inflammatory action on multiple mechanisms that regulate beta-amyloid peptides, including reducing the amount of beta-amyloid;

- slowing or preventing oligomerization or fibrilization of the beta-amyloid molecule or removing beta-amyloid from the brain;

- inhibiting extracellular signal-regulated kinase and nuclear factor-kappa B pathways by affecting secretase activity;

- protecting omega-3 fatty acids in brain cell membranes;

- regulating blood sugar and insulin and/or cholesterol;

- creating estrogenic effects that can be neuroprotective, promoting the creation of new brain cells or connective parts (e.g., dendritic branching) or slowing their destruction; and

- improving neuronal signaling and synapse activity, restoring the mitochondrial function (related to energy) of brain cells[29], and retarding tau pathology (the other problem protein in AD).

Additional pathways that are positively influenced by nutrients (evidence based) include microtubule stability, microgliosis, metal ion homeostasis, cAMP-response element-binding protein, calcium channel regulation, phosphorylation state of extracellular signal-related kinase, and improved vascular function.

Motivating People to Adopt MPN

Nutritional and dietary changes are challenging for many, but my team and I have observed that people of all ages, including those in assisted-living facilities and senior citizen day programs, can be motivated to make the changes necessary to preserve brain health. Further, the success of clinical

trials shows that older adults can be motivated to change their diet and lifestyles with positive results. This evidence can then be used to further motivate ordinary consumers and especially patients, who are not in clinical trials.

Latest Research Evidence for the MPN

The results of the Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability (FINGER Study), a two-year clinical trial, showed that proper nutrition, physical activity, cognitive training, and social activities improved cognitive performance in older adults aged 60 to 77.[30] The Predimed Diet clinical trial proved that good diet alone can improve cognitive functioning in older adults, in this case the Mediterranean diet.[31]

Increasing intake of olive oil to ¼ cup a day improved executive and overall cognitive functioning

They showed that increasing intake of olive oil to ¼ cup a day improved executive and overall cognitive functioning while eating one ounce of nuts six days a week improved memory.

Solidifying these clinical trial results, an Australian longitudinal cohort study using PiB PET scans (a type of imaging, using Pittsburg Compound B in positron emission tomography, that is able to see build-up of one of the two problem proteins implicated in development of Alzheimer's disease) reported at the July 2015 Alzheimer's Association International Conference[32] that people who ate foods typical of a Mediterranean style diet had dramatically lower levels of beta amyloid accumulating in their brains over a three-year period than did those who did not eat such foods.

In addition, people who ate less meat and more grains (meat/grain ratio), also had less accumulation of beta-amyloid in the brain scans. Fish, vegetables and certain other foods typical of the Mediterranean diet also were associated with less accumulation of beta-amyloid.

These studies are just the beginning. Martha Clare Morris ScD of Rush University published results of using a point system to apply her MIND diet to a cohort study which recorded study subject's foods consumed, and suggested her diet was superior to the Mediterranean or DASH diets in being associated with reduced risk of cognitive impairment.[33] Dr. Morris based her MIND diet on the series of epidemiological (cohort) studies she has published over the last two decades. She hopes to one day run a clinical trial.

People in other countries are planning clinical trials with their national or other dietary programs. Our MPN diet is unique in being based on *all* the evidence published thus far, including animal studies, cohort/epidemiological studies, and clinical trials of both individual nutrients and broader diets.

Consumers can adopt the MPN directly by contacting the author directly or ordering materials from the author's website. Dietitians and other healthcare providers can introduce the MPN program to clients and patients through physician referrals or on their own in homes, hospitals, long-term care facilities, and other food service institutions.

If it's difficult for an individual with moderate AD to adopt MPN on his or her own, caregivers or companions taught to follow MPN can offer assistance or partnership to adhere to the program. People with MCI and mild AD can make changes on their own with the help of MPN guides and menus, recipes, and shopping lists (available at http://www.brainwellness.com) along with occasional coaching. Individuals' motivation varies, but the idea of being able to maximize brain power or preventing or slowing MCI and AD by eating specific foods, particularly with the broad choices available, may be enough to prompt people to adopt a lifestyle change and embrace MPN.

MPN appears safe and should improve overall health. However, it's important to remember that good food choices are most beneficial when combined with adequate sleep, frequent physical exercise, mental stimulation, and social activity.

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Note: Team members who helped implement the MPN program include Cheryl Franchi, MS, MBA, RD, CSG, LD/N, FADA, FAND; Jayne Hunter Gilbert, MEd, RD, LD, FADA; nutritionists Nadja Meireles, Kristina Scangas, Jane Duford and Kammy DeMello; educator CC Donelan, operations/finance expert Mary Lesko, and marketing, Michele Rizzo and Julie Bolt

Resources:

The following resources are available at the Brain Health and Wellness Center (BHWC) website (http://www.brainwellness.com):

- daily menus, recipes, nutrition facts, and shopping lists based on the Memory Preservation Nutrition (MPN) program;
- a 30-page, illustrated description of the MPN program and suggested brain foods;
- a list of BHWC services;
- resources for foodservice clients: a two-volume cookbook for meals

and parties, practical guidelines for implementing the MPN program, and handouts, flyers, and published articles on the MPN program; menu, recipe and pantry assessment programs to assist clients in changing what they offer to their customers

- training programs for dietitians and chefs; and
- in-person presentations in any location
- and webinars (planned).

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