



# Brain Food:

GCBH Recommendations on  
Nourishing Your Brain Health

Global Council on  
**Brain Health**<sup>SM</sup>  
A COLLABORATIVE FROM AARP

# BACKGROUND: ABOUT GCBH AND ITS WORK

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The Global Council on Brain Health (GCBH) is an independent collaborative of scientists, health professionals, scholars, and policy experts from around the world who are working in areas of brain health related to human cognition. The GCBH focuses on brain health relating to people's ability to think and reason as they age, including aspects of memory, perception and judgment. The GCBH is convened by AARP with support from Age UK to offer the best possible advice about what older adults can do to maintain and improve their brain health. GCBH members gather to discuss specific lifestyle issue areas that may impact people's brain health as they age, with the goal of providing evidence-based recommendations for people to consider incorporating into their lives.

We know many people across the globe are interested in learning that it is possible to influence their own brain health and in finding out what can be done to maintain their brain health as they age. We aim to be a trustworthy source of information, basing recommendations on current evidence supplemented by a consensus of experts from a broad array of disciplines and perspectives.

## NUTRITION AND BRAIN HEALTH

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On September 12 and 13, 2017, members of the GCBH met in Baltimore, Maryland to examine the impact of diet on brain health in adults age 50 and older. Throughout the discussion, experts examined the evidence on whether and how dietary patterns and food choices can influence brain health. The GCBH is planning a separate discussion and report addressing supplements, nutraceuticals and specific vitamins at a later meeting. For this report, the GCBH focused on the foods people eat. Participants are listed in appendix 1.

This paper summarizes the consensus reached by the experts and describes the major points of discussion that led to their recommendations for men and women age 50 and older. It also identifies gaps in our knowledge about diet and brain health, provides a glossary of terms used in the document, and lists resources for additional information. This paper is not intended to be a systematic, exhaustive review of all pertinent scientific literature on the topic. Rather, the selected references

provided at the end of the document give helpful background material and present a sizeable sample of the current evidence underpinning the GCBH consensus in this area.

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# INTRODUCTION

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These recommendations are based on the experts' evaluation of the best available evidence from observational studies and randomized controlled trials that link certain nutrients, food, and dietary patterns to better cognitive outcomes in older adults. The experts also considered a range of studies involving animal models that describe the mechanisms through which certain dietary patterns can improve or harm brain health. Research on the impact of the Mediterranean diet, DASH diet (Dietary Approaches to Stop Hypertension) and the MIND diet (Mediterranean-DASH Intervention for Neurodegenerative Delay) in particular have provided critical evidence on how diet can potentially affect brain health. Increasingly, research is showing that a healthy diet is crucial to optimal brain health.

The [2017 AARP Brain Health and Nutrition survey](#) found that people who often eat well-balanced and nutritious meals also reported better brain health.<sup>1</sup> Among individuals age 50 and older, three-quarters (75%) who said they ate well five to seven days per week reported their brain health/mental sharpness as “excellent” or “very good.” Only about 40% of those who said they rarely or never ate well reported their brain health as high. See appendix 9, figure 1.

The experts agreed that foods and diets that are good for heart health are also good for brain health, lending support to the adage, “what’s good for the heart is good for the brain.” In support of this, some recent studies evaluating the incidence of dementia among large groups of people over several decades have found decreases in the age-adjusted incidence of dementia occurring simultaneously with improvement in cardiovascular health. The experts pointed to large, well-designed epidemiological studies among populations in the United States, Great Britain, the Netherlands, Finland and Sweden corroborating this relationship. The 2017 AARP Brain Health and Nutrition survey also found that significantly more adults age 50 and over without heart disease rated their brain health/mental sharpness as “excellent” or “very good” compared to those with heart disease (64% vs. 50%).

Further details about the relationship between brain health and heart health and many other issues are provided in the discussion and knowledge gap section of this report. But we note that despite the promising decrease in age-adjusted incidence and/or delay of onset of dementia shown in these studies, the worldwide burden of dementia is still expected to increase as average life expectancy increases. This is particularly true for older adults, the economically vulnerable, and for those in low-to-middle income countries, as well as in countries where vascular risk factors continue to rise.

These GCBH recommendations are based on current peer-reviewed evidence suggesting that the recommended foods are beneficial to cognitive health. However, the data does not conclusively support that eating any of the recommended foods can prevent cognitive decline. More research in this area is recommended. Nonetheless, members of the GCBH feel confident in making the following consensus statements and recommendations.

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<sup>1</sup> A nationally representative survey of individuals age 40 and older was conducted October 25–November 8, 2017. The final sample consisted of a total of 2,033 respondents. The margin of error for the full sample is  $\pm 2.7$  percentage points, the margin of error for subgroups is higher. All estimates in this document are for adults age 50 and older.

# CONSENSUS STATEMENTS

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These consensus statements and the recommendations that follow are based on extensive sources and research within nutritional science, basic science (with greater emphasis placed on human studies), well-designed randomized controlled trials and observational studies.<sup>2</sup> The results of such studies were published in peer-reviewed journals. Definitions of the terms used in the consensus, recommendations, and practical tips are provided in the discussion sections and attached glossary at appendix 2.

- 1.** Diet impacts brain health.
- 2.** What is good for the heart is good for the brain. Common conditions influenced by diet such as elevated blood pressure, high cholesterol, and diabetes harm both cardiovascular and cognitive health. Therefore, a heart healthy diet is a brain healthy diet.
- 3.** Long-term healthy eating habits promote good brain health.
- 4.** You can benefit from changing to a healthy diet at any age. However, the sooner you start the better.
- 5.** The typical, contemporary Western diet (high in salt, sugar, excess calories, and saturated fats) is not good for the brain. See a discussion of healthy diets including the Mediterranean diet, the DASH diet, the MIND diet and the Nordic diet below.
- 6.** No single food acts as a silver bullet for improving or maintaining brain health. The combination of different types of food and nutrients together in our diets likely determines health benefits.
- 7.** A plant-based diet that is rich in a variety of fruits and vegetables, particularly green-leafy vegetables and berries, is associated with better brain health.
- 8.** Consumption of fish, as well as other types of seafood, seems to benefit cognitive function. This may be due to the omega-3 fatty acid content.
- 9.** Multiple studies link high levels of saturated fat with cognitive decline. A diet that is higher in unsaturated fats and lower in saturated fats is linked to better cognition. See further discussion below.
- 10.** Excessive alcohol is bad for brain health.
- 11.** Excessive salt intake can contribute to high blood pressure. Because high blood pressure is an important risk factor for stroke, and strokes are detrimental to cognitive health, excessive salt intake is harmful for your brain health.

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<sup>2</sup> Randomized controlled trials and epidemiological observational studies are defined in the Glossary in appendix 2. An overview of the differences, strengths and limitations of the two study types in humans is listed in appendix 5.

# EXPERT RECOMMENDATIONS

## FOR INDIVIDUALS

A. ENCOURAGE:	B. INCLUDE:	C. LIMIT:
<ul style="list-style-type: none"><li>• Berries (not juice)</li><li>• Fresh vegetables (in particular leafy greens)</li><li>• Healthy fats (such as those found in oils, including extra virgin olive oil)</li><li>• Nuts (a high calorie food, so limit to a moderate amount)</li><li>• Fish and seafood</li></ul>	<ul style="list-style-type: none"><li>• Beans and other legumes</li><li>• Fruits (in addition to berries, previously mentioned)</li><li>• Low fat dairy, such as yogurt</li><li>• Poultry</li><li>• Grains</li></ul>	<ul style="list-style-type: none"><li>• Fried food</li><li>• Pastries</li><li>• Processed foods</li><li>• Red meat</li><li>• Red meat products</li><li>• Whole fat dairy, such as cheese and butter</li><li>• Salt</li></ul>

1. We recommend the food guidelines in the table above for brain health. We encourage people to eat the “A-list” healthy foods regularly, include other “B-list” foods in their diet, but to limit the amount of “C-list” foods.
2. If you don’t drink alcohol, don’t start drinking in order to protect your brain health. If you drink alcohol, do so in moderation, because it is unclear whether there is any beneficial level of consumption for brain health.
3. Eat whole, non-processed foods to limit unintentional intake of too much salt, sugar, and saturated fats, which often appear in processed, packaged and fried foods.
4. Be cautious when it comes to eating chocolate. Cocoa-rich products are generally high calorie because they often include sugar and high fat dairy products. Therefore, when incorporating chocolate in your diet, it is important to avoid excess weight gain, which could counterbalance, or even exceed, any benefits from eating cocoa.
5. Avoid trans fats.

## FOR HEALTHCARE PROVIDERS

1. Evaluating nutritional habits of patients should be part of good routine clinical care.
2. Consider screening patients for nutrient deficiencies or excesses based on symptoms. Unless deficiencies are identified, we do not recommend routine supplementation.

# PRACTICAL TIPS

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- 1. Stay physically active to complement eating a healthy diet.** Physical activity has been shown to improve cognition in adults and is important to promote healthy aging. Your diet should provide the nutrients and energy you need to maintain a good balance between energy intake from food and energy expenditure from physical activity. (See the [GCBH's Brain-Body Connection report](#) for a more thorough discussion on how physical activity helps brain health.)
- 2. Avoid eating in excess. Quantity and moderation of intake of nutrients matters.** Too much of a good thing is often not good either. Using smaller plates is a very effective method for controlling portion sizes.
- 3. Eat at least one meal per week with fish that is not fried.**
- 4. Look at the sodium content in prepared foods you are eating.** Baked goods, such as bread, canned soups and frozen foods are typically high in salt content that you may not realize you are eating. Note that frozen vegetables and fruit are typically low in salt and high in essential nutrients, while frozen, ready-to-eat meals are typically high in salt.
- 5. Use vinegar, lemon, aromatic herbs, and spices to increase flavor in food without increasing salt content.** Check the labels of spice blends to determine if they contain salt.
- 6. Consider dietary counseling if you are trying to overcome conditions such as hypertension, diabetes, and obesity.**
- 7. Snack on raw, plain, unsalted nuts; they may be beneficial for brain health.** Nuts tend to be high-calorie foods because of high fat content, so they should be eaten in moderation.
- 8. Eat a wide variety of different colored vegetables.** Try to add new vegetables to your diet and experiment with new ways of cooking and preparing vegetables.
- 9. Choose fresh, frozen or canned fruits and vegetables stored in water or their own juice.** If you do buy canned vegetables or fruits with added salts or sugars, rinse them before eating. Look for vegetables without added salt, butter or cream.
- 10. Purchase food and prepare meals at home.** This gives you more control over the salt, sugar, and fat content than if you frequently buy prepared meals or food from restaurants.
- 11. Use mono and polyunsaturated fats in cooking.** Usually these are the cooking oils that are in a liquid state at room temperature. Avoid manufactured oils with partially hydrogenated fats and animal fats such as lard and butter. Unsaturated fats seem to be beneficial to heart health and are also thought to be beneficial to brain health. Unsaturated fats are often found in liquid oils such as olive oil, canola oil (also known as rapeseed oil), corn, and safflower oils, as well as walnuts and certain fish.
- 12. Read packaged food labels to help you choose healthier options.** The nutrition facts panel and ingredients list provides helpful information, such as saturated fat, sodium and sugar content.

# PROCESS USED TO PRODUCE THE CONSENSUS AND RECOMMENDATIONS

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Issue specialists from around the world, who are leaders in their fields, were selected to participate on the GCBH panel on brain health and nutrition. These experts have conducted research that significantly contributed to the body of evidence that links diets with brain health in older adults. Their diverse areas of expertise represent perspectives from disciplines including nutritional epidemiology, geriatric psychiatry, human nutrition science, gastroenterology, genomics, gerontology, internal medicine, neuropsychology, neurology, neuroscience, physiology, and public health.

Eleven issue specialists from four continents were asked to critically examine the state of the science as of September 2017. They discussed findings from observational studies as well as randomized controlled trials. The experts considered the cumulative body of evidence to determine whether it is sufficient to issue recommendations for individuals to maintain and improve brain health. The issue specialists considered 13 different questions as a framework to guide their deliberations. The complete list is available in appendix 3.

After an in-depth moderated discussion, several follow-up conference calls and an exchange and refinement of drafts, the issue specialists arrived at 11 consensus statements to summarize the impact of diet on brain health. Based on their consensus, they made numerous recommendations related to nutrition in the context of brain health and cognitive decline. Further, they agreed on 12 practical tips to help people around the world adopt behaviors to improve their brain health.

Liaisons from civic and non-profit organizations with relevant expertise in brain health were invited to provide input and technical feedback during the refinement of the draft recommendations.

Two Governance Committee members attended the meeting in Baltimore. The entire Governance Committee reviewed and finalized the document during subsequent conference calls and emails with the issue experts between October 2017 and December 2017. The Governance Committee members issuing the recommendations are independent health professionals representing diverse expertise across three continents

in epidemiology, psychology, public health, neurology, psychiatry, geriatrics, cognitive neuroscience, neuropsychology, pharmacology, medical ethics, health policy, and neurodegeneration.

The Governance Committee applied their expertise to determine whether they concurred with the statements and to evaluate the objectivity and feasibility of the proposed recommendations. The GCBH Governance Committee reviewed this summary document to decide whether it accurately reflected the expert opinions expressed and the current state of science in the field. The Governance Committee approved the document on December 20, 2017.

# DISCUSSION

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## GUIDING PRINCIPLES UNDERLYING THE EXPERT CONSENSUS AND RECOMMENDATIONS

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Science and knowledge of brain health are continually evolving. These recommendations are based upon the current state of scientific and medical knowledge in order to provide people with reliable information on what is known and not yet understood about the relationship between nutrition and brain health. People make choices every day about what to eat. Waiting until definitive evidence exists on all the issues related to food and cognitive health would mean that we would not be able to provide practical guidelines to people who are seeking answers now. The GCBH feels confident in making these recommendations for people to incorporate into a healthy lifestyle in order to help maintain and improve their brain health.

These recommendations are meant for all healthy adults, particularly focusing on men and women age 50 and older who have not been diagnosed with a neurodegenerative disease such as Alzheimer's disease. The intent is to be as inclusive as possible for people as they age.

## CONTEXTUAL FACTORS MATTER IN TAILORING RECOMMENDATIONS TO ANY PARTICULAR INDIVIDUAL

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Making wise choices about your diet is something you can do to promote better brain health and choosing healthier options more often can have long term benefits. Nutritional value, type of food, quantity and quality, setting, convenience, and cost all factor into the complex choices you need to make when you choose one food over another. But each of these individual choices is made within a broader context that helps to shape a person's daily diet over his or her lifespan.

Nutritional recommendations need to be tailored to take into account your state of health, lifestyle and culture. It is always wise to consult with a health care provider before beginning or significantly changing your diet, particularly if you are currently managing

health conditions or taking medications. A person's environment and what is practically and economically feasible must also be factored into plans to sustain healthy food choices.

Most, if not all cultures, place a high degree of importance on food. Food is a cornerstone of cultural and religious practices and celebrations around the world. People place great importance on the flavor, smell and presentation of food, and food choices are often made as part of cultural traditions. We know that the cultural traditions of family and friends can powerfully influence the food choices people make every day.

## DIETARY PATTERNS

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No single food is key to good brain health, but rather a combination of healthy foods is likely to help protect the brain. See appendices 4a and 4b. The pattern of your whole diet over your life span affects your brain health. There is growing evidence that micronutrients (such as vitamins and minerals) offer the greatest benefit when consumed as part of a balanced diet. While scientists continue to investigate the contributions of individual micronutrients to overall dietary patterns, research over the past several decades has highlighted the importance of eating patterns and maintaining a balance between food groups. Members of the GCBH provided examples of different brain-healthy diets during our discussion that have garnered headlines in recent years.

*The Mediterranean diet*, common in countries such as Greece, Italy and Spain, has received widespread media attention. It is characterized by high intake of monounsaturated fat (with extra virgin olive oil as the main source), vegetables, fruits, plant proteins, whole grains and fish. The Mediterranean diet also typically includes low consumption of red meat, refined grains and sweets. Moderate intake of wine accompanies this diet. Among other health benefits, studies have shown that this diet can lower risk of cardiovascular disease and can help manage diabetes.



## MAKING CHANGES TO YOUR DIET

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*The Nordic diet* draws upon many locally sourced foods traditionally consumed in Scandinavian countries including Denmark, Finland, Iceland, Norway, and Sweden. Similar to the Mediterranean diet, there is an emphasis on plant-based foods, such as fruits and vegetables, as well as meat, fish and oils. Key differences between the Mediterranean diet and Nordic diet include differences in types of individual fruits, vegetables and cereal used, differences in cooking methods, and differences in the type and quantity of oil that is used. The Nordic diet uses rapeseed oil, also known as canola oil, instead of olive oil.

*The DASH (Dietary Approaches to Stop Hypertension) diet:* emphasizes low sodium and portion size and is associated with health improvements in blood pressure, blood lipids and other benefits linked to reduced risk of chronic disease. The DASH diet is a plant-focused diet, rich in fruits, vegetables and nuts, with low-fat and non-fat dairy, lean meats, fish, and poultry, mostly whole grains, and heart healthy fats.

*The Okinawan diet:* This diet is based on the eating habits of the indigenous people of the Ryukyu Islands in Japan, who are recognized as having exceptional longevity. The diet emphasizes yellow, orange and green vegetables; includes soy and legumes and low amounts of meat, refined grains, sugar, salt or dairy. The diet features large percentage of sweet potatoes (purple yams), and the Okinawans tend to eat less rice and fish than their other Japanese counterparts. They also eat until they are 80% full in order not to overeat, a practice called *hara hachi bu*.

*The MIND (Mediterranean – DASH Intervention for Neurodegenerative Delay) diet:* The MIND diet draws from both the Mediterranean and the DASH diets and includes an abundance of vegetables, whole grains and a daily glass of wine. It recommends green leafy vegetables six times a week, other vegetables at least once a day and two or more servings a week of berries. It also advocates snacking on nuts most days, eating beans every other day, poultry twice a week and fish at least once a week. Dieters should limit eating unhealthy foods, such as butter, cheese, and fried or fast food. It highlights blueberries and leafy greens as especially beneficial for the brain.

It is never too late to start eating a healthy diet, such as those suggested above. Improvements in your diet can help your brain health and lower your risks of cognitive decline whenever you decide to start. Making small practical changes, such as those recommended here by the GCBH, is a useful and sustainable way to maintain a healthier diet. These can then be built upon by incorporating additional changes to build a brain healthy lifelong dietary pattern.

A September 2017 article published in *JAMA (Journal of the American Medical Association)* points out that “changing lifelong nutrition behaviors can seem overwhelming, but even exceedingly small shifts can have an effect.”<sup>3</sup> For example, “increasing fruit intake by just 1 serving per day has the estimated potential to reduce cardiovascular mortality risk by 8%, the equivalent of 60,000 fewer deaths annually in the United States and 1.6 million deaths globally. Other examples include reducing intake of sugar-sweetened beverages, fast food meals, processed meats, and sweets, while increasing vegetables, legumes, nuts, and whole grains.” When you replace potato chips and sour cream dip with nuts or carrots and hummus, for example, you lower trans fats and saturated fats and increase whole grain and vegetable intake, while still having a satisfying snack.

Practical tools and tips for adopting healthy eating habits, specifically targeted to issues relevant to the age 50 and over population, can be found in [MyPlate for Older Adults](#). See appendix 4a. This resource encourages consumption of colorful food choices, healthy oils, and a variety of whole grains and proteins. Nutrition scientists at Tufts University partnered with the [AARP Foundation](#) in 2015 to revamp *MyPlate for Older Adults* following the updated [2015-2020 Dietary Guidelines for Americans](#).

Another good source of information for people trying to improve their diet and exercise habits is the guide to [Changing Your Habits for Better Health](#), from the National Institutes of Health. See the further discussion below about behavior change in the knowledge gaps section.

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3 <http://jamanetwork.com/journals/jama/fullarticle/2653762>

Simply incorporating more fruits and vegetables into your diet appears to be helpful. According to the 2017 AARP Brain Health and Nutrition survey, adults age 50 and older who get the recommended amount of fruits and vegetables in a typical day report significantly better brain health compared to those who do not get the recommended amount (70% vs. 61%). The survey found that the more fruits and vegetables men and women consume, the more likely they are to rate their brain health higher. Of those who said they don't eat any vegetables, fewer than half (49%) considered their brain health as "excellent" or "very good." See appendix 9, figure 2.

## BRAIN HEALTH AND ALCOHOL CONSUMPTION

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There is a lot of interest about whether alcohol is good or bad for brain health. The Mediterranean and MIND diets typically include a moderate amount of wine, and studies showing the benefits of wine have generated many headlines. The Mediterranean diet includes wine consumed with meals, and generally no more than 5 ounces (148 milliliters) of wine daily for women, and no more than 10 ounces (296 milliliters) of wine daily for men. The benefit of red wine on brain health reported in studies on the Mediterranean diet may be related to components in the wine such as polyphenols (micronutrients found in plant-based foods). These micronutrients may act as antioxidants which affect blood pressure, and which are not typically contained in spirits or beer.

The *Dietary Guidelines for Americans* notes the short and long term risks with alcohol consumption and recommends that if any alcohol is consumed, it should be done only in moderation, meaning up to one drink per day for women and two drinks per day for men. The *Dietary Guidelines for Americans* defines a standard drink as containing 0.6 ounces (14.0 grams or 1.2 tablespoons) of pure alcohol. Generally, this amount of pure alcohol is found in 12-ounces of beer (5% alcohol content), 8-ounces of malt liquor (7% alcohol content), 5-ounces of wine (12% alcohol content), 1.5-ounces of 80-proof distilled spirits or liquor such as gin, rum, vodka or whiskey (40% alcohol content). As you age, your body processes alcohol differently, and experts often recommend older people consume even smaller quantities.

Neither the GCBH nor the *Dietary Guidelines for Americans* recommends that anyone begin drinking alcohol if they do not already do so. While there is some evidence that moderate alcohol consumption can have protective health and cognitive benefits, recent studies indicate there are also adverse effects on the brain from alcohol consumption. Alcohol consumed even in moderate quantities has been associated with adverse brain health outcomes. There are both short-term and long-term risks associated with excessive alcohol consumption, including learning and memory problems. In the United Kingdom, for example, drinking guidelines from 1987 were updated in 2016 to reflect new research findings and lowered the amount of alcohol consumption considered to be safe. The updated United Kingdom 2016 guidelines call for no more than 14 drinks over the course of a week for men or women, which is still significantly more than the United States' recommendations.

Moreover, in some groups of people the consumption of any kind of alcohol, including red wine, is discouraged. Women at a higher risk for breast cancer, for example, should consider limiting alcohol because studies have found that even moderate alcohol use increases breast cancer risk. Individuals below age 21 are strongly advised not to drink alcohol.

## HARMFUL DIETARY FATS / HEALTHIER DIETARY FATS

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The primary dietary sources for trans fats in processed food are "partially hydrogenated oils." Look for them on the ingredient list on food packages. Trans fats raise your harmful (LDL) cholesterol levels and lower good (HDL) cholesterol levels. Eating trans fats increases risk of developing heart disease, stroke and type 2 diabetes. All of these diseases can harm the brain and increase risk of cognitive decline. Trans fats are found in processed foods, fried foods like doughnuts, and baked goods including cakes, piecrusts, biscuits, frozen pizza, cookies, crackers, margarines and other spreads, though many companies have made great strides in eliminating trans fats from these products. Healthier dietary fats include monounsaturated fatty acids and polyunsaturated fatty acids, particularly omega-3 fatty acids. For a full description of different types of dietary fats, see appendix and recommendations.

Regulations surrounding trans fats is an evolving area of health policy around the world. In many countries, vegetable oils with trans fats are found everywhere—in

pastries, bakeries, supermarkets, etc... In the United States, the Food and Drug Administration has set 2018 as the deadline to rid foods of trans fats. This announcement was made in 2015 when the FDA gave the food industry three years to eliminate trans fats from the food supply. At the time of this review, four member states of the European Union (EU) have set legal limits on industrially produced trans fats in foods (Denmark, Austria, Hungary, Latvia). There has been growing pressure to establish this as an EU-wide practice. In a report on trans fats published in December 2015, the European Commission concluded that a legal limit for industrial trans fat content would be the most effective measure for tackling the problem. The European Union is currently working on legislation that would regulate and reduce trans fat content in foods.

## **FISH, OMEGA-3 FATTY ACIDS AND BRAIN HEALTH**

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The present document only refers to the evidence on food sources of omega-3 polyunsaturated fatty acids and not on supplements. The impact of omega-3 fatty acids on the brain has been extensively studied, and there is an abundance of information on the link between omega-3 fatty acids and healthy brain aging. Studies examining the role of omega-3 fatty acids have widely considered omega-3 fatty acids together as a whole rather than looking at the specific types of omega 3 fatty acids: EPA, ALA and DHA. DHA is the most prevalent omega-3 fatty acids in the brain and has been shown to play an important role in the maintenance of neuronal membranes.

There is growing recognition of the importance of incorporating omega-3 fatty acids into diet. Fish is a good source of protein and omega-3 fatty acids, and it constitutes an important part of the Mediterranean, Nordic, DASH, Okinawan and MIND diets as described earlier. Those who typically eat fish or other seafood every week report better brain health compared to those who never ate fish or seafood, according to the 2017 AARP Brain Health and Nutrition survey. In fact, 67% of those who eat fish or seafood reported their brain health as “excellent” or “very good.” See appendix 9, figure 3.

Fish is also easily accessible to consumers in many regions of the world. Communities near the Pacific Ocean, for example, have easy access to fish. In some areas, fish is even cheaper than meat. In some regions of the world, such as Asia, however, there is concern about the mercury content in some fish, which may

have adverse health effects since the heavy metal cannot be eliminated. This is a topic of ongoing investigation, and the impact may depend on the level of mercury consumed through contaminated fish. In the additional resources section, we reference the Monterey Seafood websites that provide information on mercury levels in fish caught in the United States and Canada.

It should also be noted that omega-3 fatty acids are found in sources other than fish. Plant sources of omega-3 fatty acids include flaxseed, oils (olive, canola, flaxseed, soybean), nuts and other seeds (walnuts, butternut squash and sunflower). Replacements for vegans/vegetarians exist that are not supplements, but the evidence is not as robust for plant sources of omega-3 fatty acids.

## **SALT AND APPROACHES TO QUANTITY**

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There is a well-established relationship between consuming high levels of sodium and risk of stroke. In Japan, a public health education intervention in the 1960s showed the effectiveness of dietary interventions to reduce sodium intake. A 50% reduction in salt in the diet was associated with an 85% reduction in mortality caused by stroke.

Current recommendations from the Dietary Guidelines for Americans are to limit sodium intake to 2,300 mg/day, which amounts to about one teaspoon of salt. The American Heart Association recommends an ideal limit of 1,500 mg/day.

### **SALT VS. SODIUM EQUIVALENTS**

Sodium chloride or table salt is approximately 40 percent sodium. It's important to understand just how much sodium is in salt so you can take measures to control your intake. These amounts are approximate.

**1/4 teaspoon salt = 575 mg sodium**

**1/2 teaspoon salt = 1,150 mg sodium**

**3/4 teaspoon salt = 1,725 mg sodium**

**1 teaspoon salt = 2,300 mg sodium**

The majority of salt in most people's diets comes through processed foods and baked goods rather than added table salt. An estimated half of the sodium in the Western diet comes from eating bread and other baked goods. Although we are unaware of studies that definitively

tie high sodium intake to poor cognitive health, we feel confident saying that reducing high levels of salt is likely to have a positive benefit on brain health through its effects on blood pressure.

## COFFEE/CAFFEINE/TEA

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Several studies have found an association between drinking coffee and tea and decreased risk of cognitive decline and dementia. There is plausible reason to believe that compounds in tea and coffee called polyphenols may have antioxidant benefit. However, there is no consensus on whether, and at what amounts, tea and/or coffee may be beneficial or harmful for brain health. Short-term effects of caffeine consumption from coffee and tea have been shown to increase alertness and cognitive performance, but the long-term effects are less understood. There have been several studies suggesting that those who drink coffee have better cognitive function over time than those who drink less coffee. However, it is possible that the caffeine or compounds in coffee and tea may not be the cause of improved outcomes, but rather that people who drink tea and coffee are also more likely to have higher education levels or better health, which are tied to improved cognitive performance and lower risk of dementia. While we are not aware of moderate tea or coffee consumption causing harm to cognitive health, if you don't currently drink coffee and tea with caffeine, we don't recommend that you start to do so for your brain health.

## COCOA FLAVONOIDS

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In recent years, a growing body of evidence suggests that cocoa flavanols often found in dark chocolate can improve cognitive function, though the extent to which they can do so is an ongoing topic of research. Compounds widely present in plant-based foods, called flavonoids, may be associated with a lower risk of cognitive impairment and better cognitive function. Flavanols are a type of polyphenol, a chemical compound found in plant-based foods. A sub-class of flavonoids is found in cocoa, chocolate and a variety of fruits and vegetables, such as grapes, red wine, apples, tea and cocoa products. A limited number of experimental trials, primarily funded by industry, have demonstrated that short-term consumption of special preparations of cocoa flavanols boost cognitive performance. Nevertheless, clear-cut associations with cocoa flavanols and decreased risk for dementia and Alzheimer's disease have not been established.

## GRAINS

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There have been several well-done studies on the relationship of whole grains to conditions such as diabetes and coronary heart disease, suggesting benefit for increased consumption of whole grains. People in Scandinavian countries tend to consume whole grains in much higher quantities. Whole grains are rich in fiber and B vitamins, as well as vitamin E and some trace minerals, including iron, magnesium and zinc. However, while whole grains have been a topic of much research, we are unaware of a study examining the benefit or detriment of whole grains as compared to refined grains on brain health. While the typical Japanese diet contains high consumption of refined white rice, the Japanese population appears to have relatively good cognitive health. Therefore, currently there is insufficient evidence to make a recommendation in this area.

## PROCESSED FOODS

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There is considerable debate over the definition of "processed" foods, which technically means "any food that has been altered in some way during preparation." The typical pejorative use implies any industrial food that has added fats, sugars and salt designed to improve taste and encourage consumption of the product. Such foods often have a low ratio of essential nutrients to harmful components (e.g. energy, added sodium and sugar). However, this ratio can be manipulated by adding vitamins, minerals, food dye, and artificial sweeteners to highly processed food. The regulation of processed foods and food additives varies widely between countries. Public perception surrounding some additives, such as high fructose corn syrup used to sweeten many candies and sodas, has been so negative in places such as the United States that there was an unsuccessful petition a few years ago to change the name from corn syrup to "corn sugar."

Grains that are not hyper-enriched should be included in your diet. Some breakfast cereals are highly enriched with vitamins and minerals. There are several studies that suggest that a few of the vitamins and minerals in these products, considered supplements at these levels, are associated with higher all-cause mortality. This is one of the challenges posed by processed foods, but we do not have sufficient evidence to make a particular recommendation in this area.

Some researchers have taken a food systems approach. This means taking a broad view of how food affects the wider world and the lives of the people who grow, manufacture, and consume it. Studies have explored whether a higher proportion of industrialized food relates to the prevalence of chronic diseases in certain populations. However, as in the present document, there is considerable debate in how to use and precisely define the currently vague definition of processed foods. Some argue that the difficulty of defining whether processed foods contribute to negative health outcomes focuses too much on the processing itself rather than the nutrient density of the food.

## COOKING AND QUALITY OF DIET

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Research has found that frequently cooking at home results in better diet quality and improved health and weight in adults. Cooking methods can affect nutritional benefit of foods. For example, there are benefits of low temperature cooking as compared to high temperature cooking such as grilling or frying. Cooking methods such as barbecuing, frying and grilling can generate harmful chemical compounds that may promote inflammation and harm brain health. Although there is no conclusive evidence to date, it may be prudent, when possible to replace high-temperature cooking methods with boiling, poaching, steaming, or baking.

## GLUTEN-FREE DIET

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In recent years there has been growing interest in how a gluten-free diet might affect brain health. Gluten is the main protein component of wheat, rye, and barley. Common foods containing gluten include breads and pastas, cookies, muffins, and breakfast cereals. A gluten-free diet is the only proven treatment for celiac disease, an immune-based disease affecting nearly 1% of the United States population. In people with celiac disease, dietary gluten triggers an immune reaction that results in intestinal damage. The symptoms of celiac disease include intestinal symptoms such as abdominal pain and diarrhea, but can also include non-intestinal symptoms including headache, osteoporosis, and fatigue. Anecdotally, many patients with celiac disease report that when they are unintentionally exposed to gluten they develop recurrent symptoms that often include transient cognitive problems, including word finding and memory difficulties. This phenomenon, often referred to as “brain fog,” is not well understood, and the mechanism by which gluten triggers these

cognitive symptoms is unknown. One small study of 11 people newly diagnosed with celiac disease found that verbal fluency scores improved one year after starting a gluten-free diet.

Most studies show that that the majority of individuals in the United States with celiac disease have not been diagnosed, though undiagnosed celiac disease is unlikely to be a common cause of cognitive impairment, since celiac disease is present in less than 1% of the population. In addition to those with celiac disease, there are also people who describe symptoms including “brain fog” that improve on a gluten-free diet, and yet do not have celiac disease. These people are said to have non-celiac gluten sensitivity. Because there is no test to diagnose this condition, this diagnosis is usually made after a test for celiac disease produces a negative result. Despite popular claims that gluten contributes to cognitive problems in the general population, there is no evidence to suggest that gluten has an effect on mental function in people without celiac disease or non-celiac gluten sensitivity. Given the principle that “what is good for the heart is good for the brain,” it is relevant to note that diets high in gluten have not been linked to heart attack risk. In fact, a low-gluten diet, if it is low in beneficial whole grains, could pose an increased risk of coronary heart disease.

## RELATIONSHIP TO OTHER CHRONIC DISEASES

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Many adults aged 50 and older have more than one chronic health condition such as heart disease or diabetes that are affected by diet. There are similarities between the diet recommended here for reducing risks for cognitive decline as a person ages and diets that are often recommended for several other chronic health problems. For example, the Mediterranean and DASH diets described above have been recommended by the American Diabetes Association for the management of diabetes and the DASH diet was developed to treat or prevent high blood pressure. Large, long-running clinical trials have established that the Mediterranean diet protects from heart disease and stroke, and as we have said earlier, heart health and brain health are intricately tied together. It is always a good idea to consult your health care provider about changes in your diet, particularly if you taking medications for chronic conditions.

## WEIGHT LOSS

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Many people are interested in the relationship between weight and cognitive health. A number of studies have linked obesity in midlife with an increased risk for future cognitive decline, and some studies suggest that a reduction in obesity could contribute to preventing or delaying dementia. Other studies have cautioned, however, that lowering weight may not be protective in older age. If you want to lose weight, one effective method is controlling portion sizes by using smaller plates. And if you want to optimize your diet for brain and heart health at the same time, another method is to eat lower calorie nutritious foods with unsaturated fats instead of foods with higher calories and saturated fats. For example, instead of putting butter on bread, try dipping the bread in extra virgin olive oil, or sprinkle a few nuts instead of cheese on your salad. The key, however, is to have moderate intake of food and calories. As the practical tips point out, the ideal diet should provide the nutrients and energy you need to maintain a good balance between energy intake from food and energy expenditure from physical activity, so that you maintain a healthy weight throughout your lifespan.

# KNOWLEDGE GAPS: WHERE MORE RESEARCH IS NEEDED

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In addition to the areas mentioned in the discussion section above, there are many other areas where more research is needed to better understand the impact of nutrition on brain health in adults.

## THE RELATIONSHIP BETWEEN HEART HEALTH, DEMENTIA AND DIET

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The FINGER study (The Finnish Geriatric Intervention Study to Prevent Cognitive Impairment and Disability) a two-year, randomized, controlled trial of 1,260 Finnish men and women, found that a combination of healthy lifestyle factors, including diet, may be crucial to preventing dementia and maintaining memory and thinking skills. Researchers found a group that participated in a program that included exercise, nutritional counseling, computer-based brain training, social activity, and management of heart health risk factors had improved scores on cognitive tests and a decreased risk of cognitive decline, compared to the control group. Nutritionists counseled participants to follow the Finnish nutritional recommendations that includes include fruits and vegetables, whole-grain cereals, low-fat milk, margarine and rapeseed oil (similar to canola oil) and fish at least twice a week.

As noted in the introduction, there have been several large studies in Western Europe and the United States suggesting that there is a relationship between decreasing prevalence of dementia and improved heart health. This lends support to the notion that diets that can lower your risk for cardiovascular disease might also lower your risk for neurodegenerative disorders such as dementia. For example, results from the Framingham Heart Study in Massachusetts in the United States, show that participants studied over a 30 year period experienced a decline in the age-specific incidence of dementia at the same time that they showed decreases in their cardiovascular risk factors and improvements in many indicators of their cardiovascular health.

These studies are encouraging in that they have identified a trend over time showing that there may be ways to reduce risk for dementia or delay its onset. But these studies do not establish cause and effect, nor are they meant to be conclusive. The many possible

factors responsible for this trend must be studied more extensively to better understand what contributed to the decline.

This report does not suggest that eating a heart-healthy diet will prevent dementia. While we do not yet know what causes dementia, there are many contributing risk factors leading to the development of the disease, and managing your diet to lower cardiovascular risk factors is only one part of the equation. Unfortunately, having good heart health will not guarantee good brain health. Despite knowing the strong relationship existing between a healthy heart and a healthy brain, we know it's not a one-to-one relationship. So while the GCBH is confident a heart healthy diet is also good for brain health, the relationship between diet and prevention of cognitive decline and dementia needs further research.

## EFFECTIVE APPROACHES TO PROMOTE ADOPTION OF HEALTHY DIETS

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Many barriers exist to practicing healthy dietary behaviors. Consumers face a deluge of advertisements every day promoting unhealthy foods that tend to be inexpensive and have large portions.

To counter these barriers, researchers recommend that behavioral improvements be approached incrementally and with the support of others. Nutritional counseling and input from healthcare providers are a few ways to increase awareness among patients of the positive steps they can take to change their diet. A report released in 2017 by the Office of Disease Prevention and Health Promotion in the United States estimated that only 12% of health-care related office visits included counseling about diet, leaving much room for progress in this area. Nutritional interventions designed to integrate clinical care and community resources can make a big impact.

There is great need for research into the most effective approaches to promote the adoption of a well-balanced diet and better lifestyle choices. More work in this area will help health care professionals, public health officials, and policy makers better understand how to influence the quality of our food system as a whole and habits at an individual level.

There are significant knowledge gaps around how to best work together to encourage better lifestyle choices and habits of individuals, including how to encourage better diets. Most evidence around effective dietary interventions comes from relatively short-term trials. As the World Health Organization has pointed out, there is scant scientific literature on the long-term effects, sustainability, and cost-effectiveness of changing dietary patterns in public health and there is “still a lack of information on interventions in low- and middle-income countries, and thus an urgent need for further research in these settings, and for scaling up the monitoring and evaluation of interventions.”

## **NUTRITIONAL NEEDS DIFFER ACROSS THE LIFESPAN**

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Nutritional needs vary across the lifespan. Just as nutritional needs during childhood are distinct, so too are the needs of people in later life. As people age, nutritional deficiencies pose a challenge as difficulties absorbing nutrients becomes more common. Deficiencies in some micronutrients, such as vitamin B12, have been linked cognitive dysfunction in older adults. In cases of individuals with Alzheimer’s disease, studies have highlighted lower plasma levels of Vitamin A, B12, C, E, folate and other nutrients. In individuals who may be struggling to maintain normal serum vitamin B12 levels, healthcare professionals must tailor nutritional advice given to those patients. For example, advice to limit red meat may be widely given to other patients, but consumption may actually be encouraged in patients with B12 and iron deficiency if the healthcare provider deems this to be appropriate.

These considerations underscore the many decisions that together make up an individual’s diet. Additional research is needed to better understand the tradeoffs that exist when swapping different types of foods in place of others. For example, clinical trials have been conducted that showed a reduction in the incidence of cardiovascular disease when replacing saturated fats with polyunsaturated fats. Yet, by contrast, other studies reported no reduction in cardiovascular disease

when carbohydrates replace saturated fats. There have not been any large, definitive studies researching the potential health benefits of substituting saturated fats with healthy carbohydrates as part of a lower fat, higher fruit, vegetable and grain diet.

The GCBH plans to focus on individual micronutrients and supplementation in an upcoming report. More research on the effect of diet over the course of a lifetime needs to take into account different nutritional needs as people age.

## **HYDRATION AND WATER**

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As people age, their ability to perceive thirst diminishes. Dehydration is common in older people due in part to these reduced thirst mechanisms, and dehydration is a leading cause for admission to emergency rooms and hospitals for older individuals. The link between hydration status and cognitive ability and mood is increasingly being recognized. Dehydration often leads to cognitive problems in older people, which can be assessed by examining changes in short-term memory, numerical ability, psychomotor function, and sustained attention. Researchers have found that even moderate dehydration is associated with confusion, disorientation and cognitive deficits. The degree to which thinking skills are affected is dependent on the severity of dehydration. The extent to which observed cognitive performance and associated neural activity is reversible with rehydration is a topic of ongoing investigation. Additional water intervention studies are therefore needed to understand how hydration status may affect cognitive health in the long-term, particularly in vulnerable populations prone to dehydration (e.g. nursing home residents). Research in this area can lead to new intervention programs and may have widespread public health implications.



# CONCLUSION

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With the diversity in cultural practices and lifestyle habits around the world, there are many ways to approach dietary choices. There is no one formula to healthy living, but prioritizing a well-balanced diet will put you on a path to optimizing both your overall health and brain health.

As further developments occur in the study of the impact of nutrition on brain health, the GCBH will periodically revisit these recommendations and provide updates when appropriate.

# APPENDICES

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- 1. PARTICIPANTS, WITH PARTICIPANTS' AND LIAISONS' LIST OF ADDITIONAL RESOURCES**
- 2. GLOSSARY**
- 3. DISCUSSION QUESTIONS FRAMING THE DELIBERATIONS**
- 4a. MyPLATE DIETARY RECOMMENDATIONS**
- 4b. SELECT DIETARY RECOMMENDATIONS FROM GOVERNMENTS REPRESENTED BY GCBH ISSUE EXPERTS ACROSS THE GLOBE**
- 5. DIFFERENCES, STRENGTHS AND LIMITATIONS OF TWO STUDY TYPES IN HUMANS**
- 6. DISCLOSURE STATEMENT OF POTENTIAL CONFLICTS OF INTEREST**
- 7. FUNDING**
- 8. SELECTED REFERENCES**
- 9. FIGURES**

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## PARTICIPANTS AND LIAISONS' LIST OF ADDITIONAL RESOURCES

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- The American Heart Association. See: <http://www.heart.org/brainhealth>
- The Brain Health Resource from the Administration on Community Living (ACL). See: <https://www.acl.gov/node/293>
- Center for Disease Control and Prevention (CDC) website on:  
  
Added sodium (salt). See: [https://www.cdc.gov/salt/pdfs/sodium\\_role\\_processed.pdf](https://www.cdc.gov/salt/pdfs/sodium_role_processed.pdf)  
  
Sugars. See: <https://www.cdc.gov/nutrition/data-statistics/know-your-limit-for-added-sugars.html>
- Dietary Guidelines. See: <https://health.gov/dietaryguidelines/2015/guidelines/>
- Monterey Bay Aquarium's Seafood Watch. See:  
  
<http://www.seafoodwatch.org/consumers/seafood-and-your-health>  
  
<http://www.seafoodwatch.org/resources/seafood-and-human-health-resources>
- Resources from the National Institutes of Health (NIH):  
  
National Institute on Aging (NIA) Go4Life Resource. See: <https://go4life.nia.nih.gov/>  
  
National Institute on Aging (NIA) Healthy Eating Resource. See: <https://www.nia.nih.gov/health/healthy-eating>

National Institute of Health (NIH) – What’s A Standard Drink? See: <https://www.rethinkingdrinking.niaaa.nih.gov/How-much-is-too-much/What-counts-as-a-drink/Whats-A-Standard-Drink.aspx>

- United Kingdom National Health Service (NHS) website on eating processed foods. See: <https://www.nhs.uk/Livewell/Goodfood/Pages/what-are-processed-foods.aspx>

## 2. GLOSSARY

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The glossary highlights how the GCBH used these terms within the context of their discussions and in this document.

### **BRAIN HEALTH**

A state of having good underlying neural mechanisms to support high functioning mental processes of cognition and that supports well-being.

### **COGNITIVE DECLINE**

The Institutes of Medicine (IOM) in 2015 defined a similar term, cognitive aging, as the lifelong process of gradual and ongoing, yet highly variable, change in cognitive functions that occur as people get older. Cognitive decline is a term used by the experts to describe losing cognitive abilities over time as people age absent a specific disease or condition.

### **CONFOUNDER**

A situation in which the effect or association between an exposure and outcome is distorted by the presence of another variable.

### **DEMENTIA**

Dementia isn’t a specific disease. Instead, dementia describes a group of symptoms related to memory, thinking and social abilities and affecting them severely enough to interfere with daily functioning. Though dementia generally involves memory loss, memory loss has different causes. So memory loss alone doesn’t mean you have dementia. Alzheimer’s disease is the most common cause of a progressive dementia in older adults, but there are a number of causes of dementia. Depending on the cause, some dementia symptoms can be reversed.

### **DIET**

A specific, habitual pattern of food, drink, and nutrient choices. Some diets are tied to health goals, such as cognitive health, weight-loss, or heart health, but diets can also reflect a regional culture.

### **DIETARY FATS**

One of the six nutrient groups utilized by the body.

#### **UNSATURATED FATS**

Unsaturated fats, have one or more double bond in the fatty acid chain. Polyunsaturated fats have more than one carbon bond in the molecule, while monosaturated fats have one carbon bond in the molecule. Vegetable oils, such as olive oil, contain unsaturated fats. They are typically liquid at room temperature.

#### **SATURATED FATS**

A group of fats that have no double bonds between carbon molecules because they are “saturated” with hydrogen molecules; often found in animal byproducts, such as red meat and whole dairy products. They are usually solid at room temperature.

#### **TRANS FATS**

Naturally occurring trans fats are found in small amounts in meat and dairy products. Artificial trans fats are formed during the hydrogenation of vegetable oils into solids. Often called “partially hydrogenated oils” on food packages. They are found in doughnuts, cookies, pastries and vegetable shortening.

## **EPIDEMIOLOGICAL STUDIES**

(which can be cross-sectional or longitudinal). In these studies, which are observational in nature, scientists try to establish a link between lifestyle activities over time (e.g., education) and long-term outcomes (brain health with aging).

## **INTERVENTION**

Any measure whose purpose is to improve health or alter the course of disease.

## **LONGITUDINAL STUDIES**

In longitudinal research, scientists observe changes over an extended period of time to establish the time-sequence in which things occur or the effect of a factor over time.

## **NUTRIENTS**

A food or biochemical substance used by the body that must be supplied in adequate amounts from foods consumed. There are six classes of nutrients: water, proteins, carbohydrates, fats, minerals, and vitamins.

## **PROCESSED FOODS**

Food processing is any deliberate change in a food that occurs before it's available for us to eat. The International Agency for Research on Cancer (IARC) classified processed meat as "meat that has been transformed through salting, curing, fermentation, smoking or other processes to enhance flavor or improve preservation."

## **RANDOMIZED CONTROLLED TRIAL (RCT)**

In a typical randomized controlled trial, people are randomly selected to receive either the intervention or a control condition. In a double-blind trial, both the participants and the researchers are unaware of (or "blinded" to) which person received the intervention until after the results are analyzed.

## **RISK**

Risk is the chance or probability of a particular event happening in a group of people with similar characteristics or traits, compared with those not having that characteristic or trait. Making up an individual's overall risk of having a condition is the cumulative effects of factors that increase the chance of developing the condition (risk factors) as well as factors that decrease the chance of developing the same condition (protective factors).

## **RISK REDUCTION**

Reducing risks for cognitive decline or impairment in the abilities to think, reason, and remember means lowering your chances of experiencing loss in those abilities. A person's overall risk may also be reduced by increasing factors that protect against cognitive decline or dementia. Dementia (due to Alzheimer's disease or another related disorder) is one condition, and cognitive decline (the slowing of thinking and memory in the absence of a major brain disease) is another condition. When scientists study risk reduction strategies for cognitive decline, they are looking for factors that can reduce the risk of impairment to cognitive functions in the population in general. Therefore, some activity or intervention that reduces risk for a particular condition or disease means that a smaller proportion of people who engage in that activity are likely to have the condition or disease. However, risk reduction strategies are not the same as preventing any one individual from getting the condition or suffering from disease. For example, research has long shown that wearing a seatbelt reduces – but does not eliminate – the chance of injuries among people who are involved in automobile accidents, but we nevertheless now recommend people wear seatbelts while they are driving.

## **WHOLE FOODS**

Foods that are as close to their natural form as possible and are free from additives or other artificial substances.

### 3. DISCUSSION QUESTIONS FRAMING THE DELIBERATIONS

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The GCBH did not address supplements, nutraceuticals or specific vitamins at this meeting.

1. Does diet impact brain health?
2. What is the best evidence that a diet rich in the following dietary components can lead to better brain health?
  - a. Fish and seafood
  - b. Nuts
  - c. Beans
  - d. Whole grains
  - e. Fruits
  - f. Vegetables
3. What is the best evidence that different diet patterns such as the Mediterranean diet, DASH (Dietary Approaches to Stop Hypertension), and MIND (a hybrid of the two - Mediterranean-DASH Intervention for Neurodegenerative Delay), can lead to better brain health? Does a person's age impact the efficacy of any of these diets?
4. How do you encourage behavior change with respect to nutritional choices among middle age and older individuals?
  - a. What kind of messages and or activities might encourage sustained habits of positive dietary choices?
  - b. How do we most effectively convey messages regarding portion size?
5. Is there evidence that specific nutrients/dietary components can lead to the delay or potentially the prevention of neurodegenerative diseases?
6. What is the evidence surrounding alcohol consumption and cognitive function? Does the advice differ from recommendations surrounding wine consumption and cardiac health?
7. Does the consumption of cocoa flavonoids impact cognitive function?
8. What is the evidence base surrounding polyphenols in olive oil and their impact on cognitive function?
9. Should adults eat less (a) meat or (b) monosaturated fats to preserve cognitive health?
10. What food recommendations can you make to older adults who are seeking ways to improve cognitive function through dietary choices?
11. On what basis should people decide to commit to different diets? For example, juice cleanses have gained a great deal of attention in recent years as a diet of choice for many. How does one evaluate whether a particular diet is the best one for them?
12. What foods should people limit? Much has been written, for example, about limiting sodium consumption. How does one strike the appropriate balance?
13. Do we know anything about whether food handling and storage (i.e. canned, frozen or fresh) impacts the nutritional benefit to the brain?

# 4a. MyPLATE DIETARY RECOMMENDATIONS

**MyPlate for Older Adults**

### Fruits & Vegetables

Whole fruits and vegetables are rich in important nutrients and fiber. Choose fruits and vegetables with deeply colored flesh. Choose canned varieties that are packed in their own juices or low-sodium.

### Healthy Oils

Liquid vegetable oils and soft margarines provide important fatty acids and some fat-soluble vitamins.

### Herbs & Spices

Use a variety of herbs and spices to enhance flavor of foods and reduce the need to add salt.

### Fluids

Drink plenty of fluids. Fluids can come from water, tea, coffee, soups, and fruits and vegetables.

### Grains

Whole grain and fortified foods are good sources of fiber and B vitamins.

### Dairy

Fat-free and low-fat milk, cheeses and yogurts provide protein, calcium and other important nutrients.

### Protein

Protein rich foods provide many important nutrients. Choose a variety including nuts, beans, fish, lean meat and poultry.

**Remember to Stay Active!**

**MyPLATE FOR OLDER ADULTS OFFERS A MEMORABLE, EASY-TO-UNDERSTAND NUTRITION GUIDE.**

## 4b. SELECT DIETARY RECOMMENDATIONS FROM GOVERNMENTS REPRESENTED BY GCBH ISSUE EXPERTS ACROSS THE GLOBE

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Numerous, general dietary recommendations exist across the world. There are many features which are common to them all, and many of them are similar to the recommendations put forward by the GCBH for helping to optimize brain health. Some countries provide far more detailed guidance than others. We have provided the major recommendations from governments represented by GCBH Issue Experts below in order to provide a sample of these recommendations world-wide.

AARP is most familiar with the United States' guidelines.

### DIETARY GUIDELINES FOR AMERICANS 2015-2020, A HEALTHY EATING PLAN:

- Emphasizes fruits, vegetables, whole grains, and fat-free or low-fat milk and milk products
- Includes lean meats, poultry, fish, beans, eggs, and nuts
- Is low in saturated fats, trans fats, cholesterol, salt (sodium), and added sugars
- Stays within your daily calorie needs

U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Dietary Guidelines for Americans. 8th Edition. December 2015. Available at <https://health.gov/dietaryguidelines/2015/guidelines/>.

The United States Department of Agriculture introduced the new food icon, MyPlate, to replace the MyPyramid image as the government's primary food group symbol in order to help consumers adopt healthy eating habits. While the food pyramid is something many older Americans are familiar with, the new MyPlate icon shows that the diet recommendations have changed now and are consistent with the new Dietary Guidelines for Americans.

### MyPLATE FOR OLDER ADULTS

An additional healthy eating resource was created by nutrition scientists at Tufts University with support from AARP Foundation. It is based on the 2015-2020 Dietary Guidelines for Americans. The MyPlate for Older Adults Nutrition Guide can be seen in appendix 4a.

### MyPLATE 10 TIPS CHOOSING HEALTHY EATING TIPS FOR PEOPLE AGE 65+

1. Drink plenty of liquids
2. Make eating a social event
3. Plan healthy meals
4. Know how much to eat
5. Vary your vegetables
6. Eat for your teeth and gums
7. Use herbs and spices
8. Keep food safe
9. Read the Nutrition Facts label
10. Ask your doctor about vitamins or supplements

### CANADA

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- Eat at least one dark green and one orange vegetable each day.
  - » Go for dark green vegetables such as broccoli, romaine lettuce and spinach.
  - » Go for orange vegetables such as carrots, sweet potatoes and winter squash.
- Enjoy vegetables and fruit prepared with little or no added fat, sugar or salt.
  - » Have vegetables steamed, baked or stir fried instead of deep fried.
  - » Have vegetables and fruit more often than juice.
- Make at least half of your grain products whole grain each day.
  - » Eat a variety of whole grains such as barley, brown rice, oats, quinoa and wild rice.
  - » Enjoy wholegrain breads, oatmeal or whole-wheat pasta.
- Choose grain products that are low in fat, sugar or salt.
  - » Compare the Nutrition Facts table on labels to make wise choices.
  - » Enjoy the true taste of grain products. When adding sauces or spreads, use small amounts.



- Drink skim, 1% or 2% milk each day.
  - » Have 500 ml (2 cups) of milk every day for adequate vitamin D.
  - » Drink fortified soy beverages if you do not drink milk.
- Select lower fat milk alternatives.
  - » Compare the Nutrition Facts table on yogurts or cheeses to make wise choices.
  - » Have meat alternatives such as beans, lentils and tofu often.
- Eat at least two food guide servings of fish each week.\* Health Canada provides advice for limiting exposure to mercury from certain types of fish
  - » Choose fish such as char, herring, mackerel, salmon, sardines and trout.
- Select lean meat and alternatives prepared with little or no added fat or salt.
  - » Trim the visible fat from meats. Remove the skin from poultry.
  - » Use cooking methods such as roasting, baking or poaching that require little or no added fat.
  - » If you eat luncheon meats, sausages or pre-packaged meats, choose those lower in salt (sodium) and fat.
- Enjoy a variety of foods from the four food groups.
- Satisfy thirst with water!
- Drink water regularly. It's a calorie-free way to quench your thirst. Drink more water in hot weather or when you are very active.
- Include a small amount (30–45 ml, 2–3 tbsp) of unsaturated fat each day. This includes oil used for cooking, salad dressings, margarine and mayonnaise.
  - » Use vegetable oils such as canola, olive and soybean.
  - » Choose soft margarines that are low in saturated and trans fats.
  - » Limit butter, hard margarine, lard and shortening.

## CHINA

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- Eat a variety of foods, mainly cereals, including appropriate amounts of whole grains.
- Consume plenty of vegetables, fruits and tubers.
- Consume milk, beans, or dairy or soybean products every day.
- Consume appropriate amounts of fish, poultry, eggs and lean meat.
- Reduce the amount of cooking oil; choose a light diet which is also low in salt.
- Do not overeat, exercise every day, and maintain a healthy body weight.
- Logically divide the daily food intake among the three meals, and choose suitable snacks.
- Drink a sufficient amount of water every day, and select suitable beverages.
- If you drink alcoholic beverages, do so in limited amounts.
- Consume fresh and hygienic food.

## ITALY

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- Watch your weight and be active.
- Eat more cereals, vegetables, tubers and fruit.
- Choose high-quality fats and limit the amount you eat.
- Consume appropriate amounts of sugars, sweets and sugar-sweetened beverages.
- Drink plenty of water every day.
- Eat only small amounts of salt.
- Alcoholic drinks – only if in limited amounts.
- Choose a wide variety of foods.
- Pay attention to specific advice for special people.
- The safety of your food depends also on you.

## ISRAEL

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- Eat a variety of foods.
- Choose different foods from each of the five major food groups every day.
- Ideally every main meal should contain at least three food groups.
- Choose fibre-containing foods such as whole grains, legumes, fruits and vegetables.
- Drink plenty of water throughout the day, including during meals.
- Choose low-fat dairy products and lean meats. Use less oil in food preparation.
- Limit your consumption of foods high in saturated fats and trans fats such as cakes and biscuits.
- Maintain a healthy body weight. Do regular physical activity.

## GREECE

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- Eat eight servings of non-refined cereals and products daily.
- Eat six servings of vegetables (including wild greens) daily.
- Eat three servings of fruit daily.
- Use olive oil as the main added lipid.
- Eat two servings of dairy products a day.
- Practice physical activity on a daily basis.
- Drink wine in moderation.
- Eat five or six servings of fish a week.
- Eat four servings of poultry a week.
- Eat three or four servings of olives, pulses and nuts a week.
- Eat three servings of potatoes a week.

- Eat three servings of eggs a week.
- Eat a maximum of three servings of sweets a week.
- Eat four servings of red meat a month.
- Drink plenty of water.
- Avoid salt and replace it by herbs (e.g. oregano, basil, thyme, etc.).

## SWEDEN

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- More vegetables and fruit - Eat lots of fruit, vegetables and berries! Ideally, choose high fibre vegs such as root vegetables, cabbage, cauliflower, broccoli, beans and onions.
- More seafood - Eat fish and shellfish two to three times a week. Vary your intake of fatty and low-fat varieties, and choose eco-labeled seafood.
- More exercise - Exercise for at least 30 minutes every day! Take brisk walks, for example, and reduce the amount of time you sit still by taking brief, active breaks.
- Switch to wholemeal - Choose wholegrain varieties when you eat pasta, bread, grain and rice.
- Switch to healthier fat - Choose healthy oils when cooking, such as rapeseed oil or liquid fats made from rapeseed oil, and healthy sandwich spreads. Look for the Keyhole symbol.
- Switch to low-fat dairy products - Choose low-fat, unsweetened products enriched with vitamin D.
- Less red and processed meat - Eat less red and processed meat, no more than 500 grams a week. Only a small amount of this should be processed meat.
- Less salt - Choose food with less salt. Use less salt when you cook, but choose salt with iodine when you do use it.
- Less sugar - Hold back on the sweets, pastries, ice creams and other products containing lots of sugar. Cut back on sweet drinks in particular.
- Maintain a balance - Try to maintain energy balance by eating just the right amount.

## UNITED KINGDOM

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- Eat at least 5 portions of a variety of fruit and vegetables every day.
- Base meals on potatoes, bread, rice, pasta or other starchy carbohydrates; choosing wholegrain versions where possible.
- Have some dairy or dairy alternatives (such as soya drinks); choosing lower fat and lower sugar options.
- Eat some beans, pulses, fish, eggs, meat and other proteins (including 2 portions of fish every week, one of which should be oily).
- Choose unsaturated oils and spreads and eat in small amounts.
- Drink 6-8 cups/glasses of fluid a day.

## 5. DIFFERENCES, STRENGTHS AND LIMITATIONS OF TWO STUDY TYPES IN HUMANS

	<b>EPIDEMIOLOGICAL (OBSERVATIONAL) STUDIES</b>	<b>RANDOMIZED CONTROLLED TRIALS (RCTS)</b>
PURPOSE	To observe a group of people in their natural surroundings (often over extended periods of time), and to identify personal characteristics, behaviors, and conditions which predict someone's chance of developing a condition or a disease.	To determine, in a controlled setting, whether implementing a change (in behavior, diet, medication, etc.) can definitively lead to a specific outcome. This compares those engaging in an activity with those not engaging in the activity.
EXAMPLE	Researchers who survey and follow women living in Metropolis show that women who run weekly have fewer incidents of heart attack in their 60s.	Researchers at University Medical Center wish to recruit 500 women in their 60s to determine whether having them run weekly can reduce their chance of heart attack during the one year study compared to those who don't run.
STUDY DURATION	Years to decades	Weeks to months, sometimes years
STRENGTHS	<ul style="list-style-type: none"> <li>• Usually larger number of people.</li> <li>• Can take into account influences from many more factors and personal characteristics and disease states.</li> <li>• Can assess many dose levels and durations of behavior.</li> <li>• Can detect slow or cumulative changes over time.</li> <li>• Where observational studies are representative of the population, they have greater external validity which means that the findings can be applied to a wider range of people.</li> </ul>	<ul style="list-style-type: none"> <li>• Helps to prove causal link and to better understand mechanisms.</li> <li>• Randomization can eliminate many competing hypotheses as why the change actually happened (because confounding factors have an equal probability of occurring in all groups).</li> <li>• Can test whether different dose of the intervention (e.g., exercise frequency, drug dose) can lead to different outcomes.</li> <li>• Uses detailed and objective measurements and assessments.</li> </ul>

## LIMITATIONS

- Does not prove any specific causal link.
- May not capture all characteristics which influence health.
- Any characteristic may reflect another more important factor (e.g., people who take expensive medications may have better access to health care).
- Selective drop-out of those less socially advantaged and less healthy.
- Difficult to generalize from one region to another due to differences in diet, environment, healthcare, etc.
- Often cannot collect detailed information due to the large numbers of participants and measures.
- Expensive to set up and run, especially over long periods.
- Some studies rely on self-reported behavior which may be inaccurate.
- People who partake in a study to be followed for long periods of time might bias inclusion.
- Usually smaller number of people.
- While an RCT attempts to control for confounding factors, it may not capture all characteristics which influence health.
- The study may be too limited in size or duration to detect subtle effects.
- Difficult to test conditions which scientists cannot change (e.g., gender, genetics, past exposure).
- Difficult to generalize from one region to another due to differences in diet, environment, healthcare, etc...
- In smaller RCTs, outcomes can be biased by accidental inclusion of people who are much more or much less likely to respond to the intervention.
- Effects are restricted to defined dose and intervention type.
- RCTs usually have very strict inclusion and exclusion criteria so the samples are often unrepresentative and results cannot be as widely generalized.
- Attrition rate during the course of the RCT could bias the results.
- Outcome reporting bias can influence results in which primary outcomes are changed, introduced or omitted since the original protocol.
- Short time frame limits capacity to examine long term interventions, which is particularly relevant for lifestyle changes that may lead to small, cumulative effects over years and decades such as cognitively stimulating activity.

## 6. DISCLOSURE STATEMENT OF POTENTIAL FINANCIAL CONFLICTS OF INTEREST

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All of the twenty-four GCBH experts participating in the formulation of this paper were asked to disclose potential conflicts of interest. Twenty of the experts who participated in the meeting and contributed to the formulation of the recommendations attested they had no conflicts of interest. Four of the experts disclosed ongoing relationships which have the potential to raise perceived financial conflicts of interest involving for-profit companies. Dr. Petersen declared part-time consultation with several pharmaceutical companies. Dr. Troen is coinventor on a patent for a neuroprotective natural extract product. Dr. Okereke disclosed publishing royalties for a book on late-life depression prevention. Dr. Estep is the founder and equity stakeholder in Veritas Genetics. These disclosures are available upon request by contacting staff of the Global Council on Brain Health.

## 7. FUNDING

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## 8. SELECTED REFERENCES

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American Heart Association (2017). "Monounsaturated Fat." Retrieved 20 December 2017, from <https://healthyforgood.heart.org/eat-smart/articles/monounsaturated-fats>.

American Heart Association (2017). "Saturated Fat." Retrieved 20 December 2017, from <https://healthyforgood.heart.org/eat-smart/articles/saturated-fats>.

Appel, L. J., et al. (1997). "A clinical trial of the effects of dietary patterns on blood pressure. DASH Collaborative Research Group." *N Engl J Med* 336(16): 1117-1124. <https://doi.org/10.1056/nejm199704173361601>

Appel, L. J., et al. (2001). "Effects of reduced sodium intake on hypertension control in older individuals: results from the Trial of Nonpharmacologic Interventions in the Elderly (TONE)." *Arch Intern Med* 161(5): 685-693. <https://doi.org/10.1001/archinte.161.5.685>

- Ball, M. P., et al. (2012). "A public resource facilitating clinical use of genomes." *Proc Natl Acad Sci U S A* 109(30): 11920-11927.
- Barnard, N. D., et al. (2014). "Dietary and lifestyle guidelines for the prevention of Alzheimer's disease." *Neurobiol Aging* 35 Suppl 2: S74-78. <https://doi.org/10.1016/j.neurobiolaging.2014.03.033>
- Brickman, A. M., et al. (2014). "Enhancing dentate gyrus function with dietary flavanols improves cognition in older adults." *Nat Neurosci* 17(12): 1798-1803. <https://doi.org/10.1016/j.trci.2017.06.002>
- de Wilde, M. C., et al. (2017). "Lower brain and blood nutrient status in Alzheimer's disease: Results from meta-analyses." *Alzheimers Dement (N Y)* 3(3): 416-431. <https://doi.org/10.1016/j.trci.2017.06.002>
- Dyall, S. C. (2015). "Long-chain omega-3 fatty acids and the brain: a review of the independent and shared effects of EPA, DPA and DHA." *Front Aging Neurosci* 7: 52. <https://doi.org/10.3389/fnagi.2015.00052>
- Kahan, S. and J. E. Manson (2017). "Nutrition Counseling in Clinical Practice: How Clinicians Can Do Better." *JAMA* 318(12): 1101-1102. <https://doi.org/10.1001/jama.2017.10434>
- Lauretti, E., et al. (2017). "Extra-virgin olive oil ameliorates cognition and neuropathology of the 3xTg mice: role of autophagy." *Ann Clin Transl Neurol* 4(8): 564-574. <https://doi.org/10.1002/acn3.431>
- Lebwohl, B., et al. (2017). "Long term gluten consumption in adults without celiac disease and risk of coronary heart disease: prospective cohort study." *BMJ* 357: j1892.
- Lehtisalo, J., et al. (2016). "Association of Long-Term Dietary Fat Intake, Exercise, and Weight with Later Cognitive Function in the Finnish Diabetes Prevention Study." *J Nutr Health Aging* 20(2): 146-154. <https://doi.org/10.1007/s12603-015-0565-1>
- Lichtwark, I. T., et al. (2014). "Cognitive impairment in coeliac disease improves on a gluten-free diet and correlates with histological and serological indices of disease severity." *Aliment Pharmacol Ther* 40(2): 160-170. <https://doi.org/10.1111/apt.12809>
- Lotan, R., Troen, A.M., and Berri, M. (2017). *The role of advanced glycation end-products in cognitive decline and dementia*, CRC Press.
- Masento, N. A., et al. (2014). "Effects of hydration status on cognitive performance and mood." *Br J Nutr* 111(10): 1841-1852. <https://doi.org/10.1017/s0007114513004455>
- Mastroiacovo, D., et al. (2015). "Cocoa flavanol consumption improves cognitive function, blood pressure control, and metabolic profile in elderly subjects: the Cocoa, Cognition, and Aging (CoCoA) Study—a randomized controlled trial." *Am J Clin Nutr* 101(3): 538-548. <https://doi.org/10.3945/ajcn.114.092189>
- McEvoy, C. T., et al. (2017). "Neuroprotective Diets Are Associated with Better Cognitive Function: The Health and Retirement Study." *J Am Geriatr Soc* 65(8): 1857-1862. <https://doi.org/10.1111/jgs.14922>
- Mehegan, L., et al. (2017). "2017 AARP Brain Health and Nutrition Survey." Available at [www.aarp.org/2017FoodandtheBrain](http://www.aarp.org/2017FoodandtheBrain) <https://doi.org/10.26419/res.00187.001>
- Miura, K. (2011). "Epidemiology and prevention of hypertension in Japanese: how could Japan get longevity?" *EPMA J* 2(1): 59-64. <https://doi.org/10.1007/s13167-011-0069-y>
- Monteiro, C. A., et al. (2017). "The UN Decade of Nutrition, the NOVA food classification and the trouble with ultra-processing." *Public Health Nutr*: 1-13. <https://doi.org/10.1017/s1368980017000234>
- Monteiro, C. A. (2009). "Nutrition and health. The issue is not food, nor nutrients, so much as processing." *Public Health Nutr* 12(5): 729-731. <https://doi.org/10.1017/s1368980009005291>
- Moorthy, D., et al. (2012). "Status of vitamins B-12 and B-6 but not of folate, homocysteine, and the methylenetetrahydrofolate reductase C677T polymorphism are associated with impaired cognition and depression in adults." *J Nutr* 142(8): 1554-1560. <https://doi.org/10.3945/jn.112.161828>
- Morris, M. C. (2016). "Nutrition and risk of dementia: overview and methodological issues." *Ann N Y Acad Sci* 1367(1): 31-37. <https://doi.org/10.1111/nyas.13047>

Morris, M. C., et al. (2003). "Consumption of fish and n-3 fatty acids and risk of incident Alzheimer disease." *Arch Neurol* 60(7): 940-946. <https://doi.org/10.1001/archneur.60.7.940>

Morris, M. C. and C. C. Tangney (2014). "Dietary fat composition and dementia risk." *Neurobiol Aging* 35 Suppl 2: S59-64. <https://doi.org/10.1016/j.neurobiolaging.2014.03.038>

Moubarac, J. C., et al. (2014). "Food Classification Systems Based on Food Processing: Significance and Implications for Policies and Actions: A Systematic Literature Review and Assessment." *Curr Obes Rep* 3(2): 256-272. <https://doi.org/10.1007/s13679-014-0092-0>

Ngandu, T. et al. (2015). "A 2 year multidomain intervention of diet, exercise, cognitive training, and vascular risk monitoring versus control to prevent cognitive decline in at-risk elderly people (FINGER): a randomized controlled trial." *Lancet* 385(9984): 2255-2263. [https://doi.org/10.1016/s0140-6736\(15\)60461-5](https://doi.org/10.1016/s0140-6736(15)60461-5)

Ohlhorst, S. D., et al. (2013). "Nutrition research to affect food and a healthy lifespan." *Adv Nutr* 4(5): 579-584. DOI: <https://doi.org/10.3945/an.113.004176>

Panza, F., et al. (2015). "Coffee, tea, and caffeine consumption and prevention of late-life cognitive decline and dementia: a systematic review." *J Nutr Health Aging* 19(3): 313-328. <https://doi.org/10.1007/s12603-014-0563-8>

Popkin, B. M., et al. (2010). "Water, hydration, and health." *Nutr Rev* 68(8): 439-458.

Reicks, M., et al. (2017). "Impact of Cooking and Home Food Preparation Interventions Among Adults: A Systematic Review (2011-2016)." *J Nutr Educ Behav*.

Reicks, M., et al. (2014). "Impact of cooking and home food preparation interventions among adults: outcomes and implications for future programs." *J Nutr Educ Behav* 46(4): 259-276. <https://doi.org/10.1016/j.jneb.2017.08.004>

Rosenberg, I. H. (2012). "A history of the isolation and identification of folic acid (folate)." *Ann Nutr Metab* 61(3): 231-235. <https://doi.org/10.1159/000343112>

Sacks, F. M., et al. (2017). "Dietary Fats and Cardiovascular Disease: A Presidential Advisory From the American Heart Association." *Circulation* 136(3): e1-e23. <https://doi.org/10.1161/cir.0000000000000510>

Scarmeas, N., et al. (2006). "Mediterranean diet and risk for Alzheimer's disease." *Ann Neurol* 59(6): 912-921.

Shlisky, J., et al. (2017). "Nutritional Considerations for Healthy Aging and Reduction in Age-Related Chronic Disease." *Adv Nutr* 8(1): 17-26. <https://doi.org/10.3945/an.116.013474>

Solfrizzi, V., et al. (2017). "Relationships of Dietary Patterns, Foods, and Micro- and Macronutrients with Alzheimer's Disease and Late-Life Cognitive Disorders: A Systematic Review." *J Alzheimers Dis* 59(3): 815-849. <https://doi.org/10.3233/jad-170248>

Tanaka, H., et al. (1982). "Secular trends in stroke mortality and morbidity in rural Japan: the Shibata stroke study." *Nihon Eiseigaku Zasshi* 37(5): 811-819.

Vauzour, D., et al. (2017). "Nutrition for the ageing brain: Towards evidence for an optimal diet." *Ageing Res Rev* 35: 222-240.

Veronese, N., et al. (2016). "Adherence to the Mediterranean diet is associated with better quality of life: data from the Osteoarthritis Initiative." *Am J Clin Nutr* 104(5): 1403-1409. <https://doi.org/10.3945/ajcn.116.136390>

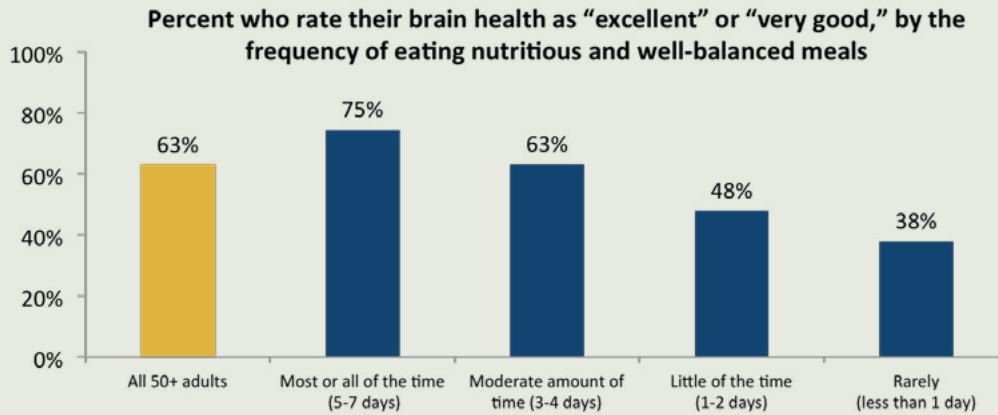
Wu, Y.-T., et al. (2017). "The changing prevalence and incidence of dementia over time — current evidence." *Nature Reviews Neurology* 13: 327.

Zamroziewicz, M. K., et al. (2016). "Parahippocampal Cortex Mediates the Relationship between Lutein and Crystallized Intelligence in Healthy, Older Adults." *Front Aging Neurosci* 8: 297. <https://doi.org/10.3389/fnagi.2016.00297>



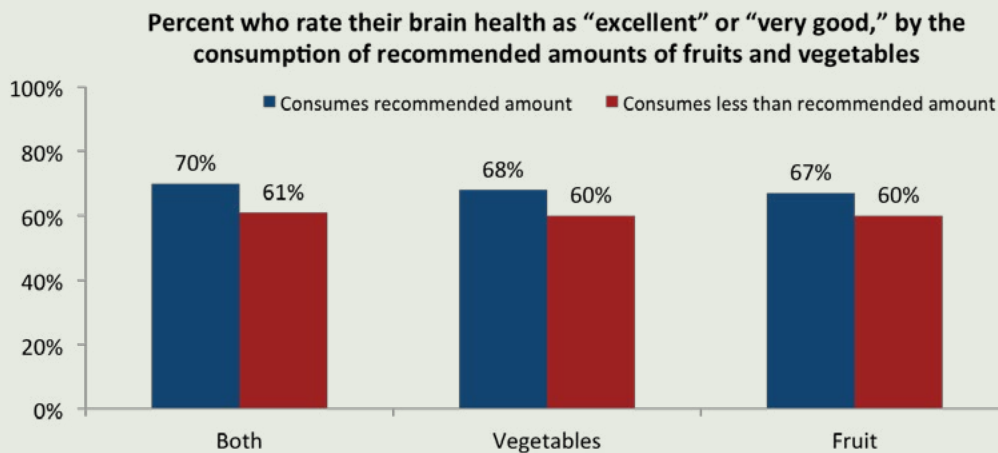
# 9. FIGURES

FIGURE 1



Those who report eating a healthy diet report better brain health. Adults age 50 and older who eat healthy are twice as likely to report their brain health as "excellent" or "very good" compared to those who said they do not eat a healthy diet. (75% vs. 38%).

FIGURE 2

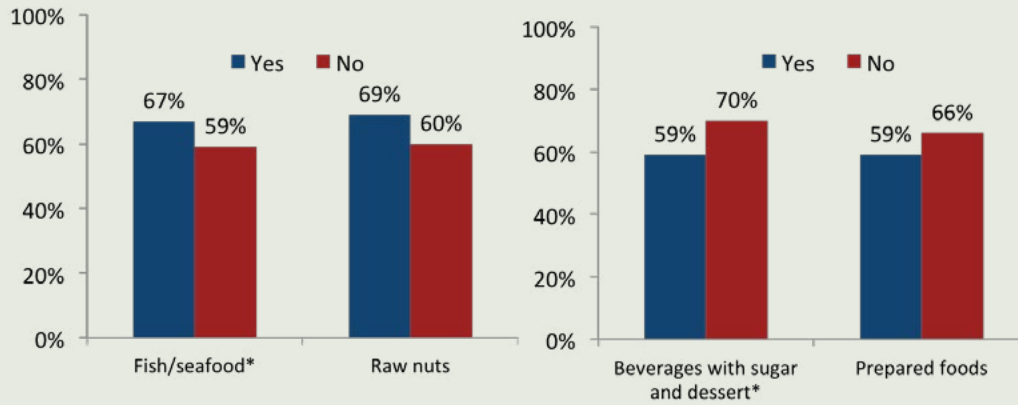


Significantly more adults age 50 and older who eat the recommended\* amounts of fruits and vegetables report better brain health.

\*Recommended amount per day is based on USDA recommendations ([www.myplate.gov](http://www.myplate.gov)). Recommendations vary by age and gender.

FIGURE 3

**Percent who rate their brain health as “excellent” or “very good,” by the consumption of certain foods in a typical week**



Adults age 50 and older who eat healthier foods are significantly more likely to report their brain health as “excellent” or “very good.” Conversely, adults who consume less-healthy foods are less likely to report their brain health as “excellent” or “very good.”

*\*Items were combined.*



