


Nutrition & Brain Health

An In-Depth Look at Alzheimer's, Depression, and Anxiety

NUTRITION CONNECTION



This is the second installment in a two-part article on how nutrition impacts the brain

In the previous issue of *Edge* (March-April 2021), we explored the connection between nutrition and overall brain health. Now, we'll take a deeper dive into three common clinical conditions: Alzheimer's disease, depression, and anxiety. Discover how food, nutrients, and dietary patterns may impact the development or symptoms of each condition.

ALZHEIMER'S DISEASE

Alzheimer's disease is a progressive brain disorder characterized by dementia. Patients lose memory and cognitive abilities, and these effects become more prominent over time. Experts estimate up to 5.5 million Americans over the age of 65 are suffering from Alzheimer's disease.

No specific food, nutrient, or diet will conclusively prevent or treat Alzheimer's. However, research suggests certain dietary patterns are linked to cognitive health, and may delay disease development or progression.

Here are the three main dietary patterns that have been investigated:

1. The Mediterranean Diet

This diet emphasizes fruits, vegetables, whole grains, beans, lentils, nuts, fish, and olive oil. Poultry and dairy are consumed regularly too, though in smaller amounts. Red meat, sweets, and highly processed foods are limited.



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Research has suggested this type of eating pattern may attenuate structural or chemical changes that occur in the brain before symptoms of Alzheimer's develop.

For example, several MRI studies have shown brain cortical thinning in regions of the brain susceptible to Alzheimer's before symptoms occur. A study in *BMJ Open* found that a Mediterranean diet was positively associated with brain cortical thickness, potentially suggesting it could affect brain structure.

Another study in *Neurology* did not find any differences in MRI scans related to dietary habits. However, they did note that

2. The MIND Diet

The MIND diet is a hybrid between the Mediterranean Diet and the DASH (Dietary Approaches to Stop Hypertension) Diet.

Compared to the Mediterranean diet, the MIND diet places less emphasis on fish and fruit (though berries are specifically recommended). More emphasis is placed on specific types of vegetables; in particular, leafy green vegetables should be consumed at least six times per week.

Research on the MIND diet is limited, but fascinating. One study looked at older adults over a 4.5-year time frame. Those whose diets

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lower adherence to a Mediterranean diet was associated with Alzheimer's biomarker differences in the brain. They estimated that high adherence to a Mediterranean diet could provide 1.5 to 3.5 years of protection against Alzheimer's.

Similarly, another study found that high adherence to a Mediterranean diet was correlated with a 54 percent reduction in risk of developing Alzheimer's over a 4.5-year period among older adults.

The evidence from limited randomized trials has not been as strong, so it's unclear exactly how much of an impact this diet plays in delaying Alzheimer's development. Regardless, the Mediterranean diet is still an excellent choice for overall health promotion.

most closely matched MIND guidelines were estimated to have a 53 percent lower risk of developing Alzheimer's during that period. Those whose diets were moderately close were associated with a 35 percent lower risk.

Since the MIND diet encourages nutritious foods like leafy green vegetables, nuts, whole grains, olive oil, and berries, these are easy choices that foodservice professionals can include on a menu to support brain health.

3. Ketogenic Diet

Less studied than the other two dietary patterns, the ketogenic diet has gained attention lately. This is a high-fat, very low-carbohydrate diet. Carbohydrate intake is generally restricted to less than 5 to 10 percent

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of calories so that glucose is not used as the primary source of fuel. Instead, the body must rely on the metabolism of fatty acids, which provide ketone bodies as energy for the brain.

Some of the metabolic changes that occur in the brain with Alzheimer's disease include abnormal glucose metabolism and altered mitochondrial activity as it relates to energy production. Some experts believe that a ketogenic diet (which forces the brain to use ketone bodies rather than glucose for fuel) could address these changes.

A study in *Neurobiology of Aging* looked at older adults who already had mild cognitive impairment. The adults who followed a very low carbohydrate diet improved verbal memory performance. Another study in the same journal found that a combination Mediterranean-keto diet led to improved Alzheimer's biomarkers.

However, implementing this diet at a broad scale is not desired or recommended in older age. Resident rights are a major concern, as is the fact that many elderly patients are already at risk for malnutrition. The high intake of animal fats common on a keto diet could also increase the risk of cardiovascular disease.

As such, even though some research points to possible benefits for brain health, the risks (like malnutrition and other health concerns) are currently far greater.

DEPRESSION

Depression is a mental health condition characterized by persistent sadness, loss of interest, or withdrawal.

It's not clear exactly what causes depression, but researchers believe it could be related to structural differences in the brain, improper mood regulation, chemical or hormonal imbalances, genetic vulnerability, substance abuse, certain medications, or triggering life events.

An overall healthy diet may play a role in prevention of depression. Several studies have linked healthy diet patterns (like the Mediterranean diet, as well as other diets rich in fruits, vegetables, whole grains, and nuts) to a reduced risk of depression.

There are also many individual nutrients or food categories which have been studied for their role in depression. Let's look at four of them:

1. Zinc

Research indicates low dietary zinc intake and/or low zinc levels are correlated with a higher risk of depression. In addition, a meta-analysis in the *Journal of affective disorders* concluded that zinc as an adjunct to antidepressants helped lower depressive symptoms.

It's unclear exactly how zinc may impact depression, but some theories include regulation of neurotransmitters or involvement in the formation of new neurons in the brain. Zinc may also affect the endocrine system, with a deficiency leading to higher levels of cortisol, which could impact depression risk.

Offering zinc-rich foods is an excellent way to increase intake among your clients.

2. Selenium

Selenium is a surprising nutrient when it comes to depression, because too much or too little can be harmful.

Cross-sectional data indicate that people who meet daily requirements for selenium, copper, and zinc have lower odds of experiencing depression.

Similarly, a study in *BMC Psychiatry* looked at a group of elderly adults, and found that better selenium levels were linked to less depressive symptoms. Interestingly, this correlation was no longer significant once cognitive function was factored in. This led authors to believe that perhaps selenium exhibits some effect on



CULINARY TREND

Serve superfoods that enhance a person's overall well-being when possible.

BRAIN-BOOSTING FOODS & NUTRIENTS

ZINC

- Legumes
- Nuts
- Poultry
- Red meat
- Seeds
- Shellfish

PROBIOTICS

- Fermented vegetables
- Kefir
- Kimchi
- Sauerkraut
- Yogurt

ANTIOXIDANT-RICH FOODS

- Berries
- Beets
- Leafy green vegetables
- Nuts
- Red grapes

- Tomatoes
- Spices (turmeric, cinnamon, etc.)
- Watermelon

VITAMIN C

- Broccoli
- Kiwi
- Orange
- Red bell pepper
- Strawberries

MAGNESIUM

- Almonds
- Black beans
- Oats
- Peanut butter
- Pumpkin seeds
- Spinach

OMEGA-3 FATTY ACIDS (EPA/DHA)

- Anchovies
- Herring
- Salmon
- Sardines
- Flax*
- Chia*
- Walnuts*

* These contain an omega-3 called ALA that can be converted in the body to DHA/EPA, however this process isn't very efficient.

TEA

- Green
- Black
- Herbal

cognitive function itself, indirectly impacting depression risk.

However, supplementation studies with selenium have proven controversial. Some led to improvements in depressive scores, while others did not affect mood at all.

Too much selenium can be risky too—individuals with the highest levels are at greater risk of depression, just like those with poor levels. There is a careful balance that requires preventing excess and deficiency.

The connection between selenium and depression is not yet clear, but could be related to selenium's impact on certain neurotransmitters or enzymatic activity that affects brain cells.

Luckily, selenium deficiency is uncommon in the United States, as most food sources are grown in soil that is rich in selenium. However, in other countries, this is not the case, and deficiencies are far more common.

3. Probiotics

More and more, we're finding connections between the gut microbiome and other

aspects of health, including depression. For example, a meta-analysis in *Nutrients* concluded that probiotics reduced the risk of developing depression among those who were not depressed, and helped reduce depressive symptoms among those diagnosed with depression.

However, these effects were only significant among individuals younger than 60 years. The authors postulate that probiotics may have different effects depending on age, or that the analysis may not have included adequate data on those over 65 years.

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Research is still emerging on this topic, and hopefully in the future there are more studies on older populations. Regardless, it's worth considering adding probiotic foods to your menu, even if solely for their potential benefits for gut health.

4. Antioxidant-Rich Foods

Research has shown that oxidative stress is increased in depression. Oxidative stress occurs when there are many free radicals (oxygen-containing compounds that are unstable), and not enough antioxidants to combat them. Free radicals can damage cells.

Antioxidant-rich foods can theoretically help combat such oxidative stress. Certain vitamins (like Vitamin E and C) act as antioxidants, so foods with these vitamins are useful to include regularly.

But there are also many other antioxidants like resveratrol (found in red wine and grapes), lycopene (found in tomatoes

and grapefruit), anthocyanins (found in berries), plus many more!

ANXIETY

Anxiety is a feeling of fear or nervousness in response to stress. Some anxiety can be completely normal – for example, when starting a new job, or going through a divorce.

Consistently high levels of anxiety are not healthy for the body, though. And for people with anxiety disorders, that sensation can occur regularly and interfere with everyday life activities. According to the National Institute of Mental Health, about 19 percent of adults suffer from an anxiety disorder.

The medical community is not sure exactly what causes anxiety, though many of the potential causes of depression could also be involved in the development of anxiety.

When it comes to nutrition, overall dietary patterns have been linked to anxiety, just like depression.

For example, dietary patterns rich in vegetables, fruit, fish, and whole grains have been connected to a lower risk of anxiety. On the flip side, high intakes of saturated fat and added sugar were correlated with higher anxiety levels. These types of foods may be linked to anxiety via alterations in blood sugar regulation and inflammation.

Numerous individual nutrients and foods may play a role in anxiety. Here are five examples:

1. Vitamin C

Several studies have linked Vitamin C supplementation to reduced anxiety symptoms – for example, these results were shown in populations like adults with diabetes, high school students, and adult women.

Because Vitamin C is such a potent antioxidant, it may help combat oxidative stress in the brain which could be connected to anxiety. Other scientists believe Vitamin C may help regulate the activity of neurotransmitters.

2. Magnesium

Studies have shown that low dietary magnesium is associated with increased subjective anxiety. Similarly, increasing magnesium intake may have a beneficial effect on anxiety (though the current quality of evidence is sub-par).

Proper magnesium intake may impact anxiety risk by affecting protein receptors in the brain, affecting neurotransmitter

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levels, or modulating other factors involved in the body's stress response. Magnesium deficiency may also alter the gut microbiome, indirectly impacting the brain and anxiety.

In the United States, up to half of adults don't meet magnesium needs through their diet. Plus, stressful conditions can increase urinary magnesium losses, as well

as impact cellular magnesium regulation. For these reasons, it's important for foodservice directors to incorporate magnesium-rich choices on the menu.

3. Probiotics

Similar to depression, some research has supported the use of probiotics to reduce anxiety.

There have even been a few food-based studies in this realm. For example, one study among young adults found that eating fermented foods rich in probiotics was linked to less social anxiety. In another study, consumption of a probiotic yogurt reduced depressive and anxiety scores.

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HOW CLINICAL CONDITIONS IMPACT DIET

In addition to the role nutrition plays in the delay or prevention of brain health issues, the conditions themselves may affect dietary intake.

ALZHEIMER'S DISEASE

People with Alzheimer's may forget to eat or drink at mealtimes and may forget how to use utensils. Medications can affect appetite. As the disease progresses, a lack of ability to communicate preferences and desired foods can also impact the diet.

As a foodservice professional, here are some strategies you can use for these concerns:

- Provide high-calorie food options that pack ample nutrition into smaller portions.
- Offer finger foods that allow residents to eat without utensils, like sandwiches or egg rolls.
- Consult with occupational therapy if you notice residents struggling with utensils, as they may be able to help the resident with specially designed options.
- Show kindness and patience for residents who may forget what they want to eat, or become angry due to their confusion. Explain the foods that are available. Recognize that resident preferences may change quickly.
- Avoid patterned tablecloths and plates, which may make it difficult to distinguish the difference between those items and the food.

DEPRESSION AND ANXIETY

Depression and anxiety can also cause a change in eating habits, but the exact impact varies from person to person.

Some people overeat in an attempt to use food to cope with a depressed mood. Others struggling with sadness and fatigue may be too exhausted to prepare food or attend meals, leading to poor nutrient intake. Residents suffering from social anxiety may be less inclined to eat in the communal dining area, which could impact their total food intake (as well as social health).

In addition, some studies suggest depression or anxiety may be linked to cravings for sweet foods, perhaps as connected to emotional eating.

Providing a pleasant mealtime for residents, offering nutrient-enhanced sweet treats, and offering in-room dining as an alternative to congregate meals may help ensure nutrient intake for those with these conditions.

Further research will continue to investigate if there are specific strains of probiotics connected to anxiety (and depression).

4. Omega-3s (Seafood)

Omega-3s may play a role in anxiety through anti-inflammatory actions, or through their interactions with different chemicals and cells in the brain. Several supplementation studies have found a connection between omega-3s and reduced anxiety.

Research specifically on food has been more limited. In one large Brazilian study, those who had the highest dietary intake of EPA/DHA (the omega-3 fatty acids in fish) had a lower risk of anxiety. That said, the associations lost significance after adjusting for confounding variables, making it unclear if there was a true benefit.

In another study on pregnant females, though, those eating no omega-3-rich seafood in their diet had higher anxiety levels compared to those eating more fish.

Other studies suggest that omega-3 intake may need to be quite high to achieve anxiety-reducing benefits, and that lower intakes may not provide clinically significant changes.

Seafood is the best dietary source of omega-3s, which makes it excellent to include on a menu. Even outside of anxiety, omega-3s in seafood may improve cardiovascular and overall cognitive health. At a minimum, it's wise to meet the Dietary Guidelines' recommendation to eat seafood at least twice a week.

5. Tea

Perhaps most interesting, tea may be connected to anxiety. A cross-sectional study found that long-term tea consumption was correlated with reduced anxiety symptoms.

Green tea in particular has been linked to a reduced stress response, which may lead to less anxiety. For example, a small trial in humans found that consumption of matcha green tea among college students led to less anxiety in response to a stressor.

The benefit from green tea may be due to L-theanine, an amino acid. Caffeine may counteract the effect of green tea on stress, so lower-caffeine versions are recommended for this particular benefit. As a bonus, research has suggested a lower-caffeine version may also improve sleep among the elderly.

Other research suggests different types of tea, like certain herbal teas, may also be linked to lower anxiety levels. This research is rather sparse – but for many individuals, drinking tea may be a pleasant addition to their meal regardless.

FINAL THOUGHTS

When it comes to nutrition and brain health, there is a lot to think about (pun intended!). Rest assured, providing an overall balanced menu will satisfy many of these needs.

It's smart to periodically review the menu in relation to these latest nutrition updates, and see if there are small ways to tweak it. For example, do you only serve tea at breakfast? Maybe you can start to offer it at all meals. Or perhaps yogurt, a healthy source of probiotics, can be offered regularly as a snack.

You know your residents better than anyone else, so consider their preferences as you think about ways to implement nutrition strategies for Alzheimer's, depression, and anxiety. ■

REFERENCES: This Level III article contains a lengthy list of References. If reading the digital Edge, click the following link for these References. For print readers, type the following in your browser: www.ANFPonline.org/docs/default-source/edge/references.pdf

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This Level III article assumes that the reader has a thorough knowledge of the topic. The desired outcome is to integrate analysis and application of knowledge, incorporating continuous quality improvement into best practice.

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- Which diet would be the *least appropriate* choice to implement at broad scale in a long-term care facility?
 - Mediterranean diet
 - MIND diet
 - Ketogenic diet
- Which nutrient has been correlated with depression when levels are both too low and too high?
 - Vitamin C
 - Zinc
 - Selenium
- Which of the following is *not* an example of an antioxidant?
 - Resveratrol
 - Calcium
 - Vitamin C
- Of the following foods, which would be *most likely* to impact anxiety and depression risk through the gut microbiome?
 - Fermented vegetables
 - Orange juice
 - Chicken breast
- What component in green tea may be responsible for possible anxiety-reducing benefits?
 - Caffeine
 - L-theanine
 - Zinc
- Which breakfast would be the *best* source of the nutrients linked to anxiety reduction?
 - Cream of wheat, banana, breakfast sausage
 - Salmon patty breakfast sandwich, yogurt with pumpkin seeds, berries
 - Pancakes with butter and maple syrup, turkey bacon, pear, coffee
- Which dinner would *most closely* align with the diets that may play a role in Alzheimer's prevention?
 - Cheeseburger, roasted potatoes (cooked with canola oil), steamed carrots, apple pie
 - Roasted chicken thigh, mashed butternut squash, white rice, pear, brownie
 - Stir fry with brown rice, kale, broccoli, and chicken (cooked with olive oil and spices); berries with pound cake

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