Nutrition & Brain Health

Centre for Healthy Brain Ageing (CHeBA)

UNSW SYDNEY

CHeBA Healthy Brains Positive Ageing

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Knowing that poor control of glucose can harm the brain means doing all we can to keep glucose levels healthy with the right food and exercise to give us a better chance of avoiding dementia.

Better Brain. Better Life

Nutrition and Weight Summary

Research Rating	Research Message	Possible Strategies
	A good diet is important for brain health, both for its development and the maintenance of cognitive function in later life.	• Eat a healthy, balanced diet which is rich in micronutrients (essential vitamins and minerals), proteins, essential oils and complex carbohydrates. • Eat a diet that is low in saturated fats and trans fats and high in antioxidants. • Reduce salt intake. • Monitor and address dietary deficiencies that may result in compromised brain function, such as iodine, B12 or thiamine deficiency. • Monitor and reduce obesity, high blood pressure and high cholesterol. • Shift to healthier bevarage choices such as water or green tea.
	A dietary pattern is more important than a single nutrient approach.	• Diets rich in fruits, vegetables from all subgroups, vegetable oils, legumes, cereals (at least half of which are whole grains) and fish provide folate, vitamins C and E, carotenoids, polyphenols and long-chain omega-3 polyunsaturated fatty acids, and with a low glycemic index. Focus on variety, nutrient density and amount.
	The Mediterranean diet may slow cognitive decline, and reduce the risk of progression from mild cognitive difficulties to Alzheimer's disease.	• Eat a diet with abundant plant foods, fresh fruit for dessert, grains and pulses, plenty of fish, some poultry and only a small amount of red meat. Use olive oil and drink red wine in moderation.
	Obesity is a risk factor for dementia.	• Seek professional advice as appropriate to monitor your weight and improve your diet, e.g. from a GP, nutritionist and/or personal trainer. • Maintain a healthy BMI through diet, caloric control and physical exercise.

Low quality evidence

Medium quality evidence

Good quality evidence

Excellent quality evidence

Research Rating	Research Message	Possible Strategies
	Folate and B12 are necessary to maintain brain health and keep homocysteine levels low.	• Include folate-rich foods in your diet, such as green vegetables (spinach, broccoli and asparagus), legumes, nuts and fruits (oranges, bananas and strawberries). • Include foods high in B12 in your diet, such as eggs, dairy products, meat, fish or poultry. • If deficient, folate and/or B12 supplementation is needed.
	Flavonoid polyphenols help prevent cardiovascular diseases, reduce dementia risk and reduce the risk of some cancers.	• Red wine contains flavonoid polyphenols. Limit yourself to no more than two standard drinks per day (less than 100mls per serve) and ensure you have alcohol-free days. • Other sources of flavonoids include all citrus fruits, berries, Ginkgo biloba, onions, parsley, pulses, tea (especially white and green tea), and chocolate with a cocoa content of 70% or greater.

Low quality evidence

Medium quality evidence

Good quality evidence

Excellent quality evidence

The brain consumes almost 25% of the energy your body produces from food in order to perform its routine functions.

American Medical Association guidelines:

1. Consume <10% of calories per day from added sugars
2. Consume <10% of calories per day from saturated fats
3. Consume <2300mg/d of sodium
4. If alcohol is consumed, it should be consumed in moderation – up to 1 drink per day for women and up to 2 drinks per day for men – and only by adults of legal drinking age

Nutrition and Brain Function

The brain consumes almost 25% of the energy your body produces from food in order to perform its routine functions. For optimal cognitive functioning, the brain requires a healthy diet high in micronutrients (essential vitamins and minerals), proteins, essential oils and carbohydrates. Diet, exercise and the maintenance of a healthy weight are important to prevent age-related decline in mental functions and the development of dementia.

Research investigating brain health clearly supports the need to address any dietary deficiencies that may result in compromised brain function, such as iodine or thiamine deficiency. However, all brain functions such as concentration, information processing speed, new learning capacity and cognitive tolerance become reduced when the diet is chronically nutritionally poor.

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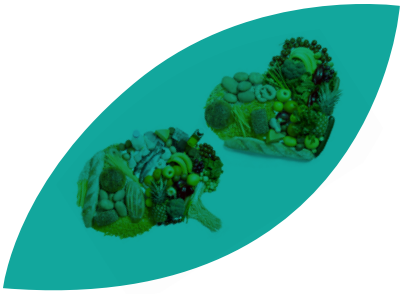
Research Findings

Studies of mid-life dietary patterns found that adults with a healthier diet had significantly higher cognitive performance, especially on memory tasks.

All brain functions such as concentration, information processing speed and new learning capacity become reduced when the diet is chronically nutritionally poor.

1. ***Diet influences brain function.*** Research in the last decade has provided exciting evidence regarding the influence of nutrition on brain health and the maintenance of mental functions. Diet affects brain health through a number of mechanisms, including maintaining artery health, keeping brain cells functioning properly, promoting growth of new nerve cells and connections between cells, and influencing the health of gut microbes, which are also important for health.

2. ***A balanced diet is essential for brain health and the prevention of dementia.*** Previous research focused on examining the effects of single nutrients. We are now discovering the potential synergistic effects when multiple nutrients are provided in optimal quantities and proportions (that is, in a balanced diet). A holistic dietary pattern should therefore be considered, without exclusive focus on any single nutrient. A healthy diet should ideally be rich in fruits, vegetables, vegetable oils, legumes, whole grain cereals and fish. It should provide essential nutrients such as folate, other B vitamins, vitamins C and E, carotenoids, polyphenols and long-chain omega-3 fatty acids. It should have a low glycemic index to avoid producing a strong insulin response in the body. The amount of calories consumed should be adequate to maintain normal body weight.



A diet including these components leads to lower inflammation, oxidative stress and homocysteine concentration, improves vascular status and insulin sensitivity, and maintains brain structure and functioning. It also lowers the risk of dementia.

The Mediterranean diet

The Mediterranean diet is a largely plant-based, antioxidant-rich dietary pattern known for its many health benefits, including cardiovascular and brain health and the possible prevention of dementia. Key features of the Mediterranean diet include consumption of:

- Abundant vegetables
- Fresh fruit (usually for dessert)
- Grains and pulses (containing complex carbohydrates)
- Protein from fish and poultry, with low amounts of red meat
- Olive oil
- Low to moderate amounts of wine, usually red wine.

The Okinawan diet

Research also indicates the Okinawan diet has benefits for brain health and longevity, and the possible prevention of dementia.

Rule 1: Eat until you feel 80% full.

Rule 2: Eat healthy foods, mostly plant-based. Okinawans eat more vegetables (particularly green and yellow vegetables) than most people, as well as whole grains, tofu, fish and other legumes. They eat very little sugar, red meat, dairy or eggs. Okinawans combine a healthy diet with regular physical activity.

3. ***Specific nutrients have been shown to help brain function. As part of a balanced diet for brain health, a number of specific nutrients have been shown to help brain function.***

Nutrient	Purpose	Sources
Antioxidants (e.g. Vitamins C and E)	Antioxidants help protect the brain and the rest of the body, as they inhibit the process of oxidative damage caused by free-radicals. Antioxidants work in a number of ways but essentially they have the ability to 'donate' electrons to free-radicals, meaning that the unpaired electron is paired up and the free-radical is effectively neutralised. This is often referred to as 'mopping up' or 'free-radical scavenging'. A simple way to think of the process is that antioxidants 'take out the garbage'.	Vitamin E: leafy greens, asparagus, avocado, nuts, peanuts, olives, red palm oil, seeds, vegetable oils and wheatgerm. Vitamin C: citrus fruits, several plants and vegetables and liver. There has been some research on the beneficial effects of curcumin (from turmeric). Berries also have strong antioxidant properties.
B vitamins (in particular, folate and B12)	B vitamins are important for many metabolic actions in the body, and in particular for DNA synthesis and repair. Folate and B12 are important to keep levels of homocysteine low, since homocysteine can produce toxic effects on arteries and the brain.	Folate: broccoli, brussels sprouts, liver, spinach, asparagus, peas, chickpeas and fortified breakfast cereals. In many countries, including Australia, flour is fortified with folic acid, which is converted to folate. B12 is not available in plants and good sources include meat, salmon, cod, milk, cheese, eggs, and some fortified breakfast cereals.
Omega 3 polyunsaturated fatty acids (PUFAs)	Omega 3 fatty acids are important for normal physiology, and they are found in high abundance in the human brain. The human body cannot generate them, so they can only be obtained via diet. Omega 3 fatty acids have been linked to improved mood and memory performance, and reduced risk of dementia. A deficiency in omega 3 is associated with impaired learning and reduced cognition. Omega 3 fatty acids also have anti-inflammatory properties. Omega 6 fatty acids are pro-inflammatory, and the two types compete with each other.	Increase Omega 3 by eating eggs, oily fish, walnuts, dark leafy greens, grass-fed beef, chia seeds and flaxseeds. Olive and canola oils have a good balance of Omega 3 and Omega 6. Reduce Omega 6 by restricting the consumption of some vegetable oils (e.g. sunflower, corn, soybean and cottonseed oils), fried processed foods like chips, and grain-fed beef.

Nutrient	Purpose	Sources
Vitamin D	Vitamin D is essential for healthy bones and research now indicates that it is also vital for our heart and brain. Symptoms of bone pain and muscle weakness may indicate a vitamin D deficiency, and low blood levels of the vitamin have been associated with cardiovascular disease and cognitive impairment in adults.	Sunlight: exposing your arms and legs to the sun between 10am and 2pm for 10-15 minutes a day is a good option. In Australia, longer exposure is not necessary and also increases the risk of skin cancer. Dietary sources include eggs, oily fish, and full-fat dairy foods.
Polyphenols	Polyphenols are a group of chemical substances found in plants, with flavonoids being the most abundant. Tannins in red wine contain flavonoid polyphenols which help prevent cardiovascular diseases, reduce dementia risk and reduce the risk of some cancers. An Australian meta-analysis found that moderate drinkers halved their risk for dementia.	Limit yourself to no more than two standard drinks per day if you are male and one standard drink per day if you are female and ensure you have alcohol-free days. Dietary sources of flavonoids include all citrus fruits, berries, Ginkgo biloba, onions, parsley, pulses, tea (especially white and green tea), and chocolate with a cocoa content of 70% or greater.

Further research into nutrition

Clinical trials are continuing for a number of other nutrients and supplements, such as the Chinese herb Huperzine A. Although results from animal trials have been encouraging, application in humans has yet to show promise. For example, resveratrol (a natural plant polyphenol) is found in the skins of grapes, raspberries and mulberries and has been found to have powerful antioxidant properties. In animal studies it has been shown to slow the ageing process and improve body and brain health, however the data from human studies are so far not encouraging.

Some older people have difficulty in absorbing B12 and may need injections of the vitamin, however this will be determined by your doctor.

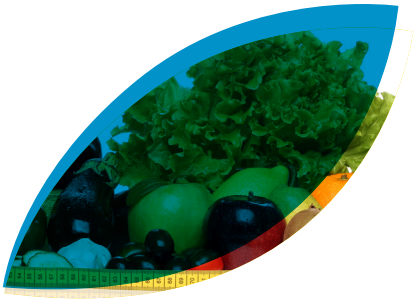
Calculating your alcohol intake

While a standard glass of wine with 11% alcohol would be 100mL, most red wines have 14% alcohol so a standard serve is about 70mL. Measure it so you know how much you are consuming. Limit yourself to no more than two standard drinks per day if you are male and one standard drink per day if you are female and ensure you have alcohol-free days.

With changes in the human diet over time, the ratio of Omega 6: Omega 3 has increased from 1:1 to the modern Western diet with a ratio of 15:1, which has an increased risk of heart disease.

4. ***Water helps our brain perform its functions.*** We often confuse hunger for thirst, and when we feel thirsty we are already partially dehydrated. Dehydration causes mood difficulties, fatigue, impacts brain function as thinking requires more energy, and causes brain shrinkage. It is recommended that you drink at least 1.5 litres of water throughout the day to stay well hydrated. You have a built-in hydration test simply by checking the colour of your urine: aim for a very pale straw colour by mid-day (although note that some medications and supplements may change the colour of your urine).

Dehydration impacts brain function. Aim to drink at least 1.5 litres of water per day.



5. ***Obesity is a risk factor for dementia.*** According to 2011/12 figures from the NHMRC, 60% of adult Australians are classified as being overweight or obese. On current trends, by the year 2025 this will increase to 80% with one-third of these people developing Type 2 diabetes. Recently, a new medical concern has been identified - termed 'fat-malnourished' – which applies to individuals who are obese but have a nutritionally poor diet and are lacking in essential micronutrients. Obesity is a risk factor for dementia and other medical conditions, with increased risk of heart disease, vascular disease, diabetes, stroke and hypertension. Maintaining a healthy body weight is important for improving your brain health.

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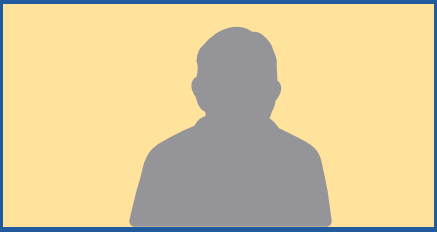
Advertisement of "brain supplements" and "super foods"

There are many products on the market which claim to improve memory function and brain health. Check whether valid, scientific research has been conducted on the medical food or drink advertised. A randomised control trial provides the best evidence. The existing data show mixed results, and there is no clear evidence that these products offer an advantage over a balanced nutritious diet. Rather than focussing on one type of food, ensure that all necessary micronutrients are consumed on a regular basis. When researchers examine specific nutrients in isolation the results are often conflicting. One explanation is that foods play a synergistic role and it may be the balance between different nutrients that is important.

Case studies

Megan weighed 112 kilograms when she was diagnosed with diabetes at age 57. She had a family history of diabetes, cardio-vascular disease and stroke. She was horrified! Megan did not want to take medications and wanted to be healthy for her children and future grandchildren. The first thing she did was lose weight by switching from soft drinks to plain tap water, and stopping her sweet afternoon snacks. She immediately felt more energetic and her blood sugar levels started to stabilise. The next step was to consult a nutritionist who provided education regarding healthy fats, the importance of small amounts of protein at each meal and the need to eat more vegetables (5-7 serves each day). Megan started slowly losing weight, but importantly within one month her glucose reading went down from 10 to 6.2, and she felt fantastic!

John 45, was 20 kilograms overweight, having trouble with his knees as a result and could not play sport with his kids. He did not have breakfast and sometimes did not have lunch because work was busy. Often he worked late so bought take-away consisting of highly processed foods with high levels of bad oils, fats and salt, and low nutritional value. He often felt lethargic and sleepy. John went to his doctor who suggested he start by having breakfast to kick-start his metabolism to lose weight and help with his energy levels. John also started to make his own meat and salad sandwiches at the same time he made the kids' school lunches. He stopped eating take-away and took left-overs from home to heat up at work. These small changes meant he started to lose weight and had more energy. John was able to look at his food choices more critically and concentrate on really healthy choices – which the whole family has benefited from.



Brain Health Checklist

- [ ] Eat only the amount of calories you need.
- [ ] Consume good fats high in **Omega 3** such as olive, avocado, flaxseed and nut oils.
- [ ] Eat foods high in **antioxidants** such as dark coloured berries and coloured vegetables.
- [ ] Eat oily fish – mackerel, sardines, salmon.
- [ ] Consume at least 5 serves of vegetables per day, especially dark green.
- [ ] Drink plenty of water to keep hydrated.
- [ ] Check you have the right balance of vitamins and minerals.
- [ ] Limit sugars, refined flour and salt.
- [ ] Limit your intake of processed foods.
- [ ] Eat plenty of protein as it reduces feelings of hunger and provides essential amino acids.
- [ ] Eat low GI foods to keep insulin levels and energy levels consistent and balanced.
- [ ] Stop stress / emotional eating.
- [ ] Combine a good diet with regular physical exercise.

Glossary of Research Terms

BMI (body mass index): is a value derived from the mass (weight) and height of an individual , calculated as weight (in Kg) divided by the square of the body height (in metres) and expressed as Kg/m2. Normal BMI ranges from 18.5 to 25, and >30 is obese.

Brain metabolism: The set of life-sustaining chemical activities in the brain cells. The brain is the most metabolically active organ in the body and uses glucose as its primary source of energy.

Carotenoid: These are organic pigments found in plants and some other organisms. Humans cannot synthesis them and must obtain them from the diet. Diets rich in carotenoids are protective against cancer and some other diseases.

Clinical trial: A clinical trial is a study examining the benefits and risks of a specific intervention or treatment in a specified group of people, like a drug trial.

Cognitive decline: Refers to reduced ability in cognitive functions such as memory, language ability, etc. When this is severe and affects the ability to function independently, it is referred to as dementia.

Cognitive function (or cognition): The set of mental abilities and processes related to thinking and knowledge. The various abilities (or domains) commonly referred to are attention, memory, language, spatial ability, executive ability (problem solving, decision making, task switching) and regulating social behaviour. A sum of these abilities is usually referred to as global cognitive ability.

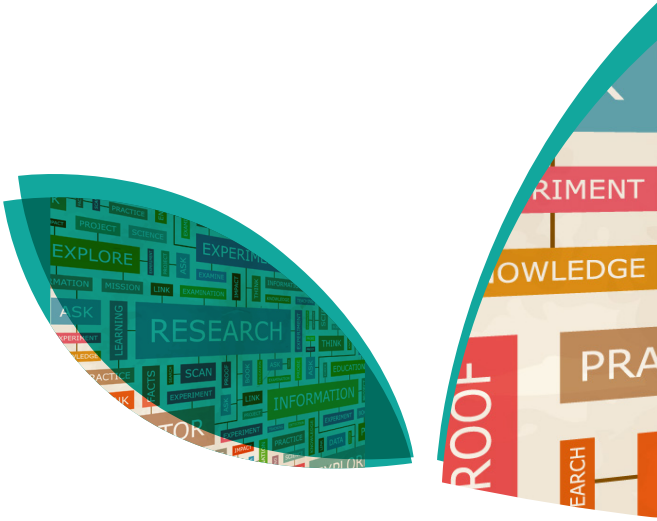
Dementia: A disorder of the brain that leads to a decline in cognitive function from a previously higher level to the extent that the individual is unable to live independently. There are many causes of dementia, with Alzheimer's disease being the commonest in older people.

Glycemic index: A number associated with a particular food which indicates the food's effect on a person's blood sugar level. A value of 100 is the standard, and refers to an equivalent amount of pure glucose.

Homocysteine: It is an amino acid not present in protein (or diet) and synthesised in the body from another amino acid, methionine. High levels of homocysteine have been linked to heart attacks, stroke and dementia. Levels can be lowered by taking folic acid and B12.

Meta-analysis: A meta-analysis is a type of systematic review which involves using special statistical techniques to synthesise the data from several studies into a single quantitative estimate of the effect of a treatment or a risk factor.

Oxidative stress: This is an imbalance between the production of free radicals by the body (as by-products of normal metabolism) and the ability of the body to neutralise their harmful effects by anti-oxidants. Oxidative stress has been implicated in ageing and dementia as well as a number of diseases.



Further Reading

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