Almonds

State of the science

The latest science on the health benefits of consuming almonds for human nutrition. The Australian Almonds 'State of the Science' document is an all-in-one resource for health professionals, providing a summary of the health benefits of consuming almonds.

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The nutrient profile of almonds

Almonds are a protein-rich, versatile tree nut packed with vitamins, minerals, antioxidants, and phytochemicals beneficial to health. The Australian Dietary Guidelines recommend 30 grams (a handful) of nuts, including almonds every day[1].

Key nutrients found in almonds include:

Healthy fats

Almonds contain healthy unsaturated fats, predominantly monounsaturated fat (66% of total fat), and have a low proportion of saturated fat (7% of total fat)[2].

Protein

Almonds contain around 6g of protein in every 30g handful[2] which makes them a good alternative to meat, poultry or fish for vegetarians or vegans. In particular almonds contain the amino acid L-arginine which helps increase the bioavailability or nitric oxide and improve endothelial dysfunction[3].

Calcium

Calcium is important for maintaining healthy teeth and bones and plays a vital role in maintaining the health and functioning of nerve and muscle tissue[4]. A 30g serve of almonds provides around 75mg, or 7% of daily calcium needs for adults between 18 to 50 years of age[2,5]. This makes almonds an alternative natural source of calcium for those who cannot or choose not to eat dairy.

Iron and Zinc

Iron is an important mineral involved in various bodily functions, including the transport of oxygen in the blood. This is essential for providing energy for daily life[6]. Similarly, zinc performs essential functions in the body, including the development of immune system cells[7].

Almonds contain plant iron and zinc, which are important minerals especially for those following a vegetarian or vegan diet. Vegetarians and vegans are at risk of iron and zinc deficiency if they are not consuming animal meats, fish and/or eggs[8]. Increase the absorption of plant iron from nuts by combining with vitamin C rich foods such as brightly coloured fruit and vegetables.

The Australian Dietary Guidelines recommend 30 grams (a handful) of nuts, including almonds every day[1].

Vitamin E

Almonds are high in vitamin E with a 30g serve providing over 70% of the daily requirements for adults[2,5]. Vitamin E is an important fat-soluble vitamin and antioxidant that can help maintain a healthy heart.

Plant sterols

Almonds contain 197mg of plant sterols per 100g[2]. Plant sterols can help lower cholesterol levels by reducing cholesterol reabsorption in the intestine.

The nutrient composition of almonds is linked to many positive health benefits for the human body, which will be explored in the next section.

Nutrient content of natural almonds[3]

Nutrient	Per 30g serve	Per 100g
Energy (kJ)	751	2503
Protein (g)5	.9	19.5
Fat, total (g)1	6.45	4.7
Fat, saturated (g)1	.1	3.7
Fat, monounsaturated (g)	10.8	35.9
Fat, polyunsaturated (g)	3.81	2.8
Carbohydrate, tota(g)	1.44	.8
Carbohydrate, sugars (g)	1.44	.8
Dietary fibre (g)	2.68	.8
Calcium (mg)	75	250
Copper (mg)	0.31	.1
Iron (mg)	1.23	.9
Magnesium (mg)	78	260
Manganese (mg)	0.82	.5
Molybdenum (g)	7.42	4.7
Phosphorus (mg)	144	480
Potassium (mg)	222	740
Sodium (mg)	25	.0
Zinc (mg)	1.13	.7
Folate (g)	92	9
Vitamin E (mg)	8.42	8.1
Arginine (g)[4]	0.82	.5
Plant sterols (mg)[4]	59	197
Polyphenols (mg)[5]	1254	18

Almonds for heart health

Cardiovascular disease (CVD) including heart disease is the major cause of death in Australia. The top three attributable risk factors for CVD relate to diet: high blood pressure, high body-mass index and high total cholesterol[9,10].

Dietary intervention is key to managing these risk factors and there is compelling evidence that consuming nuts, including almonds, offers protection against CVD.

How nuts protect against CVD?

The beneficial effects of nut consumption on CVD can be explained by an improvement in blood lipid and cholesterol levels. Almonds in particular are low in saturated fat, high in monounsaturated and polyunsaturated fats and contain fibre, phytosterols, plant protein and many other unique cardioprotective nutrients.

Their unique nutrient matrix is likely the reason for an observed reduction in LDL cholesterol in the body as they target the primary mechanisms behind LDL cholesterol reduction. These include decreased reabsorption of cholesterol and bile acid, increased bile acid and cholesterol excretion, and increased LDL-C receptor activity[11].

A 2018 published literature review looked at major cohort studies and small to large intervention trials on nut intake and impact on CVD[12]. It found that there was increasing evidence that nut consumption may help protect against CVD via lowering of oxidative stress and improvement in endothelial function.

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Almond crusted salmon. For recipe see page 15.

Almonds as part of a Mediterranean diet

The Mediterranean diet is an eating pattern emphasising certain foods based on the dietary traditions of Crete, Greece, and southern Italy during the mid-20th century[13]. It is primarily plant-based and includes wholegrains, olive oil, fruits, vegetables, beans and other legumes, nuts, herbs and spices. The emphasis is on healthy fats, with olive oil replacing butter or margarine, and the inclusion of foods that contain healthy fats, such as avocados, nuts, and oily fish[14].

The Prevention with Mediterranean diet, or PREDIMED study, is the largest dietary intervention trial to assess the effects of the Mediterranean diet on CVD prevention to date[15,16]. First published in 2013 and republished in 2018, it looked at the primary prevention of CVD in 7,447 older adults using a Mediterranean Diet supplemented with extra virgin olive oil or nuts[15,16]. The original study included older adults at high CVD risk who were given either a Mediterranean diet supplemented with extra virgin olive oil, a Mediterranean diet supplemented with mixed nuts, or a control diet (reduced dietary fat)[15]. Incidence of CVD in the Mediterranean diet groups was lowered by approximately 30 per cent compared to the control diet group[15,16].

Almonds for diabetes

Diabetes has overtaken heart disease and cancer as the fastest growing chronic condition in Australia[17]. Strong international evidence shows that type 2 diabetes can be prevented in almost two thirds of cases and the risk of type 2 diabetes can be reduced by maintaining a healthy weight, being physically active, managing blood pressure and cholesterol, and by following a healthy eating plan[18]. Over the last two decades a body of evidence has emerged from both epidemiological and controlled trials demonstrating the favourable effects of regular nut consumption, including almonds, on diabetes-related outcomes[19,20].

Almonds and managing the risk factors for diabetes

A systematic review and meta-analysis of randomised controlled trials was conducted in 2014 to assess the effect of tree nuts (including almonds) on markers of glycemic control in individuals with diabetes[20]. Pooled analyses showed an overall significant lowering of two markers of glycemic control: HbA1c and fasting glucose at a consumption level of 56 grams of tree nuts (including almonds) per day over eight weeks[20].

A 2018 literature review summarised the effect of almonds on measures of glycaemia and insulinaemia in people with diabetes or those at risk[21]. One study saw positive results on post-prandial glycaemia (post meal glucose levels) in participants with type 2 diabetes that consumed 28g of almonds with their breakfast[22]. Another study, conducted in Taiwan, saw a reduction in fasting blood glucose and fasting insulin in participants with type 2 diabetes who consumed 60g of almonds per day as part of the National Cholesterol Education Program step II diet for four weeks[23]. Although these studies are promising, the review concluded more research is needed to show a consistent effect of almond consumption on blood glucose control[21].

It is recommended that people with diabetes have moderate amounts of carbohydrate and include high fibre foods with a low glycaemic index (GI) to assist in managing blood glucose levels[24]. Adding almonds to carbohydrate-rich meals lowers the overall GI of that meal[25], which can help slow the rise in blood glucose levels when the food is consumed.

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Almond butter chicken curry. For recipe see page 16.

Almonds as part of a Mediterranean diet

The traditional Mediterranean diet is widely considered beneficial in the prevention and management of diabetes[26]. A prospective study in 2008 suggested a lower incidence of diabetes with increasing adherence to the Mediterranean diet in previously healthy individuals[27]. A clinical trial the following year showed that, compared with a low-fat diet, a Mediterranean diet allowed better glycemic control and delayed the need for anti-diabetes drug treatment in patients with newly diagnosed diabetes[28]. Similar results were found by a systematic review[29] and several individual randomised controlled trials[28,30,31,32] including people with type 2 diabetes. These studies showed that a Mediterranean dietary pattern emphasising nuts (including almonds) decreased HbA1c and fasting glucose in comparison to a conventional dietary pattern. A separate arm of the PREDIMED study tested the role of the Mediterranean diet in the prevention of diabetes in a clinical trial[33]. Results revealed diabetes rates were reduced by 51% and 52% with the consumption of Mediterranean diets supplemented with virgin olive oil or mixed nuts (including almonds), respectively, compared with a control diet.

Almonds for weight management

Gaining excess weight is mostly preventable by living a healthy lifestyle – primarily choosing healthier foods and being more physically active[34]. Almonds are a nutrient-dense food, rich in healthy monounsaturated fats, plant-based protein and fibre, and a myriad of different vitamins and minerals including vitamin E, calcium, iron and zinc[35]. Despite their healthy nutritional profile, people trying to lose weight often avoid nuts (including almonds) due to their high energy density. In fact, research shows that consumption of almonds in a balanced diet does not lead to weight gain and may enhance weight loss.

Evidence suggests that we may only absorb 70% of the total calories contained in almonds[50]

How almonds can help with weight management

Increased satiety and appetite control

Foods that generate strong sensations of satiety can help individuals control their appetite, eat more healthily and manage their weight[36]. It is well established that kilojoule-for-kilojoule not all foods deliver the same level of satiety[37]. For example, in satiety studies where comparison foods were matched for energy content, there is considerable evidence that high-protein foods are more satiating than those that are high in carbohydrate and/or fat[38]; and that fibre-rich foods are more satiating than low-fibre foods[39]. Whole almonds have a nutritional profile consistent with satiety, being one of the tree nuts highest in plant-based protein and fibre. Research indicates that consuming almonds can have positive effects on appetite control and does not lead to significant changes in body weight[40,41,42,43]. A 2015 randomised crossover study found that adding 28g or 42g of almonds to the diet as a mid-morning snack was likely to increase satiety responses in a portion-dependent manner, leading to reductions in subsequent food intake so that total energy intake over the day was not increased[44]. This supported the findings of a 2013 four-week randomised controlled trial, which assessed the outcomes of consuming 43g of almonds daily with meals or as snacks[42]. Results showed that overall daily energy intake was reduced to compensate for energy from the almonds and did not increase the risk of weight gain among participants.

Increased resting energy expenditure

A biological mechanism that may explain the ability of nuts (including almonds) to improve body weight measures is through having a greater thermogenic effect[45]. This means consuming nuts (including almonds) increases the amount of energy and fat used by the body at rest, leading to less fat accumulation, therefore potentially curbing weight gain. This could be because nuts (including almonds) are rich in healthy unsaturated fatty acids, which are more readily oxidized (or burned) by the body than saturated fatty acids[46].

Decreased fat absorption

The fat in almonds is stored within its cell walls, which has shown to impact the amount of fat available for digestion[47,48,49]. Research has shown that when whole almonds are consumed, not all cell walls are broken down when chewing, making the fat less bioaccessible and leading to incomplete fat absorption in the gut. Instead, some of the fat passes through the body and is excreted in faeces[47,48]. This decreased absorption of fat in the body may also be a reason why almonds do not contribute to weight gain. Further, evidence suggests that we may only absorb 70% of the total calories contained in almonds[50].

Green almond smoothie. For recipe see page 14.

Almonds for gut health

The Gut Benefits of Almonds

Interest in gut health has increased exponentially over recent years. Understanding what drives a healthy gut is still in its infancy, but current knowledge suggests a healthy gut is dependent on an abundant and diverse gut microbiota[51]. Lower gut microbiota diversity is associated with a range of disorders and disease states, including cardiovascular disease, type 2 diabetes and inflammatory bowel disease[51]. The nutrients that we get from food, in particular fibre, phytochemicals (particularly flavonoids and polyphenols) and unsaturated fatty acids, can positively impact the gut microbiota[52,53]. Almonds contain a unique nutrient package that includes all three, but what exactly is the evidence base for nuts and gut health?

Almonds are one of only a few foods that contain fibre, phytochemicals and unsaturated fat, nutrients that can positively affect bacterial abundance and microbiota composition, and support gut health.

Almonds and the gut microbiota

A 2020 SLR and meta-analysis of nine RCTs found strong evidence that both almonds (5 studies) and walnuts (3 studies) can improve the gut microbiota. There was an absence of evidence for other nut types[54]. Almonds had a dual effect, increasing the abundance of healthy short chain fatty acids producing bacteria, and decreasing potentially pathogenic bacteria[53,55,56,57]. In one study, even greater effects were found in children, where 42.5g and 85g of almonds per day over 3 weeks had a more pronounced effect on gut microbiota in four-year-old children compared with their parents[56].

Research has shown that whole and chopped almonds have a greater positive impact on the gut microbiota than almonds in butter form[52]. This may be because approximately 50% of the fibre content of almonds is found in the almond skin[58].

Creamy cauliflower and almond soup. For recipe see page 17.

Almonds and colorectal and colon cancer

The effect of nuts on colorectal (and colon) cancer risk remains inconclusive, across two systematic literature reviews (SLR) of case control and cohort studies, plus one additional cohort study not included in the SLRs published to date. A 2015 SLR of two cohort studies and one case control study reported a positive effect of nuts on colorectal cancer risk, while another 2018 SLR of six cohort studies found no association[59,60]. Differences may be attributed to sex, with larger risk reductions reported in women. In a large prospective cohort study involving ten European countries, eating at least 6.2g nuts per day was associated with a 31% and 19% lower risk of colon and colorectal cancers in women, respectively, with no association found in men[61]. A 2018 cohort study reported that eating at least two handfuls (>57g) of nuts per week was associated with a lower incidence of both colorectal cancer recurrence and death, compared to patients who abstained from nuts[57].

How are Almonds linked to gut health?

Nuts are one of the few foods that provide a nutrient package of fibre, phytochemicals (flavonoids, flavanones and polyphenols) and unsaturated fatty acids, which may explain their strong beneficial effects on bacterial abundance and microbiota composition. Fibre is well known to provide important fuel for colonic bacteria, and phytochemicals act like prebiotics, positively influencing the maintenance of healthy and diverse microbiota[53,55]. Unsaturated fatty acids have been shown to have antimicrobial properties and also benefit gut microbiota composition[52].

Amounts and frequency: What does the science say?

- One large handful (42g) of almonds or walnuts per day over 3-12 weeks had positive effects on the gut microbiota.
- Two or more handfuls (57g) of nuts per week.

Almonds for mood and cognition

The Brain Benefits of Almonds

A rapidly growing body of human research shows that nuts, including almonds, can have positive effects on the brain. This is highly relevant given Australia's growing mental health crisis and ageing population. Depression and anxiety are one of the largest contributors to the total burden of disease today, and dementia is the leading cause of disability among Australians over 65, and the leading cause of death in females[62,63]. In recent years the growing field of Nutritional Psychiatry has emerged, with a growing understanding on the important relationship between food and its impact on mood and cognition.

Cognitive Decline & Mental Illness – A Snapshot

Cognitive ageing is defined as a spectrum, moving from healthy functioning to mild cognitive decline to dementia[63]. Over 400,000 Australians are currently living with dementia[62], and cognitive disorders like dementia are predicted to double over the next 20 years[63]. One in 5 Australians are reported to suffer a mental health condition in any given year, with nearly 1 in 2 experiencing a mental illness at least once in their lifetime[63].

Almonds and cognition

Over the last 10 years there were 15 human studies investigating nut intake on cognition. Strong and consistent evidence from cohort studies suggests that nut intake reduces the cognitive decline associated with ageing[64-68]. In a Dutch study following over 2600 men and women over 5 years, an equivalent reduction in cognitive decline of 5-8 years was reported among individuals who consumed the highest nut intake, compared to those who consumed the lowest[65]. Recent evidence suggests that almonds may improve some aspects of memory. In a RCT of 86 American adults, approximately two handfuls of almonds (53g) as part of a high fat lunch reduced the dip in memory that occurs immediately after eating lunch[69]. In a recent RCT, nearly three handfuls of almonds (85g/day) were found to improve multiple aspects of memory such as visuospatial working memory, visual memory and learning, and special planning and working memory, over 6 months[70].

Almonds and mood

Research on the role of nuts and mood is still in its infancy, with four RCTs and one cohort study found over the last six years. Evidence from RCTs has shown that eating walnuts improved mood in young men[71], and that eating almonds as part of a low carbohydrate diet improved depression symptoms in type 2 diabetics[72]. More research is needed to firmly establish the role of almonds specifically on mood disorders and mental health.

How might almonds be linked to Brain Health?

Almonds may positively impact cognition by reducing inflammation and supporting endothelial function. Chronic inflammation has been linked to a loss of neuron function and brain regeneration[73]. The endothelium is important in regulating blood flow, and impaired blood flow is linked with cognitive decline[74]. Almonds contain a unique nutrient package (including arginine, vitamin E and polyphenols) that may improve endothelial function by increasing vasodilation[75]. Almonds potential impact on mood is thought to be mediated through improved brain nutrient status, reduced inflammation, and improved gut microbiota composition[76-79].

Amounts and frequency: What does the science say?

- At least 10g of nuts per day is associated with the reduction in age related cognitive decline[64-68].
- Two to three handfuls of almonds (53-85g) each day over 6 months was shown to improve some aspects of memory[69,70].
- Two large handfuls of nuts (56-60g) each day over 8-12 weeks had positive effects on mood[71,72].

Two to three handfuls of almonds (53-85g) each day over 6 months was shown to improve some aspects of memory[69,70]

Culinary uses

It's easy to make almonds part of their daily diet:

- Sprinkle flaked almonds on your breakfast.
- Toss a handful into a stir-fry.
- Use almond meal or ground almonds to make a flourless cake.
- Try almond butter as an alternative to butter or margarine.
- Mix natural yoghurt with berries and top with chopped almonds.
- Use slivered almonds as a crunchy topping for salads.

Recipes

Green almond smoothie

A delicious breakfast on the go

Serves 1
Preparation time: 5 minutes

- **1 cup almond milk (calcium fortified)**
- **1 tablespoon almond butter**
- **½ tablespoon chia seeds**
- **½ teaspoon vanilla extract**
- **¼ teaspoon cinnamon**
- **½ banana**
- **1 handful baby spinach**
- **¼ cup rolled oats**
- **1 handful ice cubes (optional)**

Method

Place all ingredients into a blender and blend until smooth. If smoothie is too thick, add more milk.

Almond crusted salmon with kale and fennel salad

A tasty meal packed with healthy fats

Serves 4
Preparation time: 20 minutes
Cooking time: 30 minutes

Ingredients

- **4 small salmon fillets (approx. 120g each)**

Almond crust

- **1 cup almonds, roasted and unsalted**
- **2 cloves garlic, crushed**
- **2 tablespoons extra virgin olive oil**
- **1 lemon**
- **Pepper, to taste**

Salad

- **2 tablespoons extra virgin olive oil**
- **1 tablespoon balsamic vinegar**
- **2 teaspoon honey**
- **2/3 cup quinoa**
- **1 cup baby kale, torn**
- **2 cups baby spinach**
- **½ fennel, chopped**
- **½ red onion, finely diced**
- **1 red capsicum, cut into strips**
- **1 tomato, diced**
- **1 apple, peeled and finely sliced**
- **½ cup reduced fat feta, crumbled**

Method

- Preheat oven to 200°C.
- Using a mortar and pestle or rolling pin, crush almonds into a crumble.
- In a small bowl, combine garlic, crushed almonds, oil and juice and zest of the lemon.
- Pat salmon dry with paper towel and season both sides with a pinch of pepper. Place salmon onto a lined baking tray.
- Spoon almond mixture over the top of the salmon and gently press down so the crust sticks.
- Bake salmon for about 10 minutes until cooked through and the crust is golden.
- Cook quinoa as per packet instructions.
- In a small bowl, combine oil, balsamic and honey and mix well.
- Place cooked quinoa and all other salad ingredients in a large bowl and toss well to combine.
- Dress the salad just before serving and season with pepper if desired.

Almond butter chicken with rice

A hearty low-GI meal full of flavour

Serves 4
Preparation time: 15 minutes
Cooking time: 45 minutes

Ingredients

- **4 tablespoons curry powder**
- **3 tablespoons almond butter**
- **400g skinless chicken breasts, diced**
- **¼ cup extra virgin olive oil**
- **1 tablespoon garlic, minced**
- **2 teaspoons ginger, minced**
- **3 tablespoons lemongrass, finely chopped**
- **1 small sweet potato, cut into chunks**
- **1 carrot, diced**
- **1 zucchini, diced**
- **1 bunch bok choy, roughly chopped**
- **200ml water**
- **1 tin coconut flavoured evaporated milk**
- **120g slivered almonds**
- **2/3 cup basmati rice**

Method

- Mix curry powder with a bit of water to make a paste. Slowly stir in almond butter to make a marinade.
- In a medium bowl, coat chicken breast with marinade, cover and leave in fridge for at least 1 hour.
- Heat oil in a frypan over medium heat and add garlic, ginger and lemongrass. Stir for 1-2 minutes until fragrant. Add chicken and cook for another 4-5 minutes until almost cooked through.
- Add sweet potato and carrot and approximately 2 tablespoons of water to ensure the ingredients don't stick to the pan. Cover with lid and simmer on low for 10 minutes, stirring occasionally, until the sweet potatoes and carrots are soft.
- Add zucchini, bok choy and water and simmer for another 5-10 minutes, stirring occasionally, until vegetables are all cooked through.
- Add coconut flavoured evaporated milk and 3/4 of the slivered almonds. Stir and heat through.
- While curry simmers, cook basmati rice as per packet instructions.
- Toast remaining slivered almonds on a small non-stick pan over medium-heat until browned.
- Divide rice equally into serving bowls and top with butter chicken and toasted slivered almonds.

Creamy cauliflower and almond soup

A delicious winter warmer

Serves 4
Preparation time: 15 minutes
Cooking time: 35 minutes

Ingredients

- **1 cup raw sliced almonds**
- **1 tablespoon extra virgin olive oil**
- **1 brown onion, chopped**
- **3 cloves garlic, crushed**
- **1 head cauliflower, cut into florets**
- **400g tin butter beans, drained and rinsed**
- **½ tablespoon dried herbs (e.g. thyme, oregano, basil)**
- **1 litre salt-reduced vegetable stock**
- **Pepper, to taste**
- **Handful fresh herbs, to serve**
- **4 slices wholegrain or sourdough bread, to serve**

Method

- Soak ¾ cup almonds in 1 cup water for at least 2 hours to soften (to save time, you can also microwave almonds in water for a few minutes). Drain and set aside.
- In a large pot, heat oil over a medium-high heat. Sauté onion and garlic for 3-4 minutes until soft. Add cauliflower and cook for a further 5 minutes.
- Add beans, dried herbs, stock and pepper. Stir and bring to the boil. Reduce heat to a simmer and cook semi-covered for around 3 minutes, until cauliflower begins to soften.
- Add soaked almonds to pot and simmer for 5 minutes.
- Remove pot from the heat. Using a blender, puree soup until smooth.
- In a small non-stick frypan heat the remaining ¼ cup almonds until lightly brown.
- Divide soup into bowls and garnish with fresh herbs, toasted sliced almonds, and a drizzle of oil if desired. Serve with crusty bread.

More information and resources

Visit the Australian Almonds website online. Here you will find lots of FREE resources:

- Health professional webinars
- Fact sheets for health professionals on heart health, diabetes, weight management, gut health, and mood and cognition.
- Client fact sheets for you to share with your clients
- Video content
- Subscription form so you can stay up to date.
- Virtual exhibition booth.

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