AUSTRALIAN onions

Health and Nutrition Report

Introduction

Beneath the layers of this humble hero lie many nutrition benefits. With just 7% of Australian adults and 5% of children meeting the daily recommended intake for vegetables,[1,2] it's important to find ways to help Aussie families reach this daily goal. A staple in most shopping trolleys, onion is added to a variety of common dishes across many cuisines, but many of us don't think of it as part of our daily recommended five serves of vegetables. Just half an onion, eaten over a number of meals during the day, can help us reach our five-a-day.

Whilst the onion may not be the standout ingredient of many meals, it definitely stands out in terms of its health attributes. From supporting gut, heart and brain health to fighting free radical damage, onions are a reliable, versatile and affordable pantry staple. It's time to elevate the status of this 'nutrition ninja' in your everyday favourite family meals.

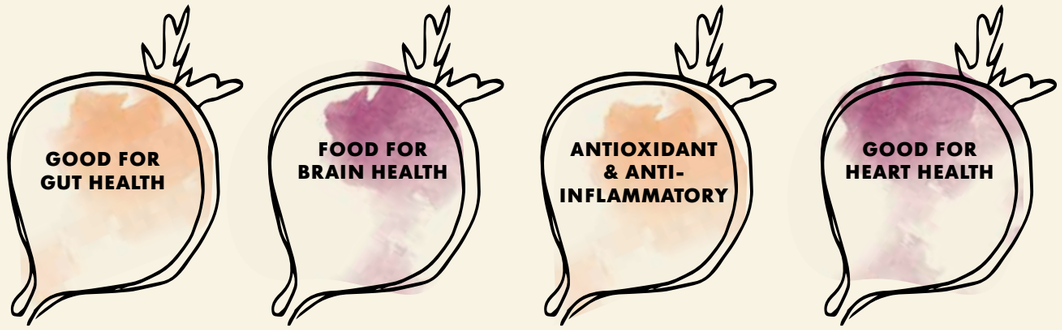
From young children to older adults, onions can be enjoyed across a variety of dishes from breakfast to dinner. This report includes the latest onion nutrition research, along with usage tips, so all Australians can reap the benefits of adding more onions to their diet.

So go ahead, grab an onion today and try it blended, sautéed, baked or caramelised. It's the everyday veggie that helps keep your mind and body healthy on the inside and out.

Bon Appetit!

The nutrition ninja

Statement: Onions are a natural source of folate, vitamin C and antioxidants and have many health benefits[3,4]



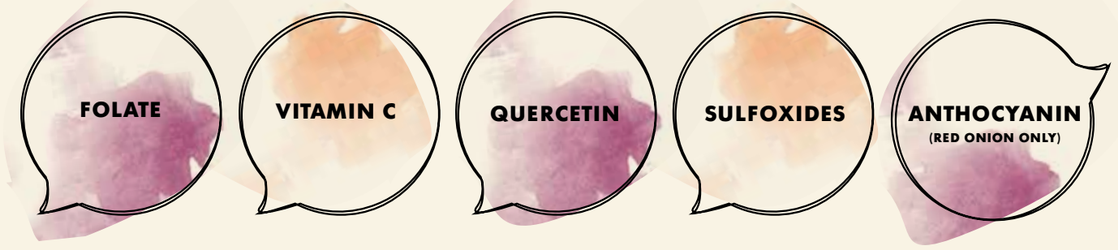
Onions contain folate and vitamin C. These essential nutrients support optimal brain function and help to minimise fatigue*

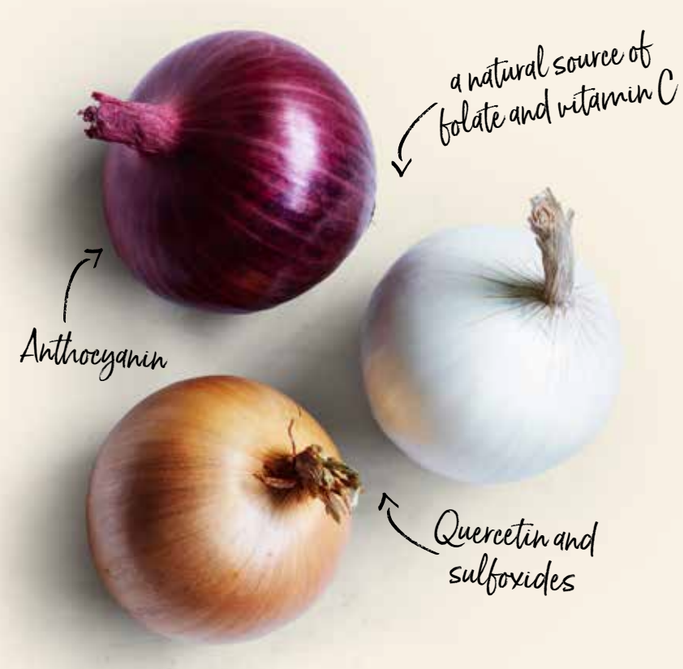
Good for the gut

Onions are a natural source of fructans, a prebiotic fibre that helps support good gut health*

Plant power

Onions deliver a unique bundle of vitamins and antioxidants,[5] protecting cells from free radical damage and inflammation, as well as keeping the immune system strong to reduce the risk of developing chronic disease*





Heart health

Onions are naturally low in saturated fat and sodium and contribute to heart health by helping to lower blood cholesterol and blood pressure*

Weight management

Onions are low in kilojoules, sugars and saturated fat, making them an ideal vegetable for weight management. Quercetin antioxidant has also been shown to assist in reduction of visceral fat[6]

Emerging research indicates onions may have positive benefits for bone health, fertility, cancer prevention and healthy ageing[7,8]

*as part of a healthy varied diet

How much and how often?

This report refers to brown, white and red onions, which are members of the *Allium Cepa* family of plants and similar to garlic, leeks, green onions and shallots.

The Australian Dietary Guidelines define a serve of vegetables as 75g or ½ cup (diced) or ½ a medium onion.[2] The recommended amount of vegetable serves for adults is 6 serves for men and 5 serves for women. Young children (aged 1-3 years) need 2½ serves a day and older children (aged 4-18 years) need between 4½ and 5½ serves a day.

Did you know?

- Onions are low in energy with about 100kJ or 25kcal in ½ onion (75g)
- Onions are naturally low in sugars, saturated fat and sodium
- Onions, like all fresh fruits and vegetables, score 5 health stars
- Onions flavour and aroma are due to natural sulfoxide compounds. These compounds can prevent chronic diseases due to their various potential effects, such as anti-oxidant, anti-obesity, anti-diabetic, anti-hypertensive, anti-atherosclerotic, anti-cancer, anti-fungal, anti-bacterial, and anti-parasitic
- Onions are one of the top common food sources of polyphenol flavonoids, specifically quercetin. These naturally occurring phytonutrients act as antioxidants and anti-inflammatories to help protect against free radical damage and inflammation, which can contribute to ageing and chronic disease

What's in an onion?

NUTRITION INFORMATION
Servings per package: 2 serves per onion. Serving size: ~75g or ½ an onion

	Average Quantity per Serving	Average Quantity per 100g
Energy	106kJ (25kcal)	141kJ (33kcal)
Protein, total	1.0g	1.3g
Fat, total	<1.0g	<1.0g
– saturated	0g	0g
– trans	0g	0g
– polyunsaturated	0g	0g
– monounsaturated	0g	0g
Carbohydrate	4.8g	6.4g
– sugars	3.8g	5.0g
Dietary fibre, total	1.6g	2.1g
Sodium	5.5mg	7.3mg
Potassium	124mg	165mg
Folate	22.3ug DFE (11% RDI)	29.7ug DFE
Vitamin C	5mg (13% RDI)	6.7mg
Polyphenols	30mg GAE	41mg GAE
Quercetin	30mg	39.4mg
Anthocyanins	7.2mg	9.6mg
Fructans	1.4g	1.9g
Cysteine sulfoxide	41mg	55mg
Gluten	0mg	0mg

Sources:

- FSANZ Australian Food Composition Database 2019
- USDA ORAC of Selected Foods, Release 2 2010 (total polyphenol content only)
- USDA Flavonoid Content of Selected Foods Release 3.1
- Phenyl Explorer database
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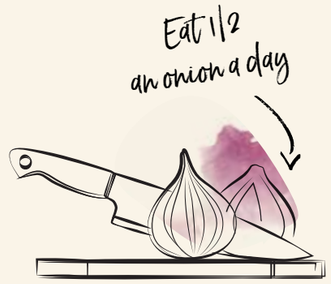
Anthocyanins in red onions only

Eat onions every day



Onions contribute a range of distinctive flavours to a variety of cuisines. Thanks to the versatility of the *Allium Cepa* family, you can easily include ½ onion in your everyday meals to help increase your family's vegetable intake. Onions are a truly global food and can be enjoyed for breakfast, lunch and dinner and everything in between.

Start off your day by adding some chopped onions to an omelette or breakfast frittata. Salad onions are great for lunch, so try spicing up a wrap or roll with a few red onion rings. When it comes to dinner, onions are a staple for so many family meals. Whether it's the base ingredient in soups, stews and casseroles, or more of a feature ingredient such as an onion sauce for a classic roast lamb, it really is quite easy to eat at least ½ an onion during the day and reap the nutrition and health benefits of this humble vegetable.

Tips to enjoy onions every day

Blood orange and **Spanish onion** make a pretty pair on a salad plate

Fresh **spicy onion** tomato salsa goes well with chicken, fish or meat

Throw in a few small onions when making roast vegetables.The succulent sweetness will add a unique taste dimension

Raw onions lend a sharp, crisp edge to dips and salads

Add **onions** to your kids' **favourite meals**, whether it's spag bol, mac 'n cheese or shepherds pie

Savour the flavour of an **onion and beetroot chutney.** When cooked, the onion takes on a sweetness of its own to be enjoyed with homemade sausage rolls or in cheese sandwiches

Try a **Tuscan Bruschetta** – gently fry some chopped onion in olive oil, add a drained 400g tin of cannellini beans and a couple of finely chopped sage leaves and tomatoes. Cook for 5 minutes, mash lightly and serve on toasted ciabatta

Slow cooked onions turn a basic sausage sizzle into something special

Onion antioxidants

Onions are one of the top common food sources of polyphenol flavonoids, specifically quercetin.[8] These naturally occurring phytonutrients act as antioxidants and anti-inflammatories to help protect against free radical damage and inflammation, which can contribute to ageing and chronic disease.

½ an onion (75g) contains on average 30mg quercetin; a flavonoid antioxidant[8]. Quercetin in onions has a higher bioavailability compared to quercetin found in apples or quercetin supplements[9-14]

Onions contain over 25 phytonutrient compounds including quercetin, sulfoxides and anthocyanins (in red onion only). They are one of the highest sources of quercetin for Australian adults and quercetin from onions is more bioavailable compared to apples (another common food source) or supplements.[10-15] Quercetin has antioxidant and anti-inflammatory properties,[14] which may explain its positive effects on heart health (anti-platelet aggregation, improved endothelial function and blood pressure lowering); diabetes (glucose absorption, blood glucose levels and insulin sensitivity), and gut microbiome (boosting good bacteria).[16-18]

Spanish or red onions contain quercetin but they have extra phytonutrients responsible for the purple colour known as anthocyanins. With at least 25 different **anthocyanins** in onions,[21] anthocyanin intake similarly has benefits for cardiovascular disease (blood cholesterol and blood pressure lowering).[22,23] Its anti-inflammatory effects can help to reduce low-grade inflammation linked to insulin resistance,[24] and anthocyanins appear to improve blood glucose levels through inhibiting intestinal carbohydrate enzymes and improving glucose uptake into cells.[25]

Onions are one of the few plant foods that contain organosulfur compounds called amino acid **sulfoxides.** These are largely responsible for onions' distinct flavour and aroma. Sulfoxides also have antioxidant, anti-cancerous, anti-hypertensive and anti-atherogenic properties (through reducing blood cholesterol and inhibiting platelet aggregation).[26]

Did you know?

Quercetin is metabolised in 24 hours so it is necessary to consume quercetin daily to maintain the body's antioxidant capacity.[19] Another reason to enjoy onions on a daily basis

Onion health benefits

To date, research shows onions have positive benefits for gut and heart health, and possibly diabetes, weight management and cancer. A surprising finding is the potential positive effects on bone. So many healthy reasons to enjoy a daily portion of onions.

Gut health

The organosulfur compounds in onions have been widely studied for their biological properties and beneficial effects on intestinal health. Studies have shown that these compounds have a positive impact on the gut microbiome composition, increasing the beneficial bacterial populations[27]

Like all vegetables, onions contain dietary fibre (1.6g in ½ onion or 75g) and contribute to an adult's fibre needs of 30g a day. However, it's onions' fructans, a prebiotic fibre or fermentable carbohydrate resistant to digestion, that is of interest. Onions contain 1.4g fructans in ½ onion.[28] For most of us, fructans are food for the gut microbiome and promote the growth of healthy bacteria such as bifidobacteria.[29,30] Whereas for others with Irritable Bowel Syndrome (IBS), fructans can cause undesirable gut reactions. People with IBS are told to avoid onions during the elimination phase of the low FODMAP diet since fructans are a FODMAP*[31] and they end up in the large intestine where they ferment causing bloating, gas and pain.[32]

Those with IBS may still be able to enjoy the flavours of onion in meals by simply cooking larger pieces of onion which can be more easily removed prior to eating. Fructans are water soluble, so it's best to avoid adding onions to soups and casseroles. However, since fructans are not fat soluble, large onion pieces can be added to stir fries and other oil based dishes for flavour, and then removed before eating. Alternatively, an onion-infused cooking oil can be used for flavour.[33]

***F**ermentable
Oligosaccharides
Disaccharides
Monosaccharides
And
Polyols

HEART HEALTH

Onions have heart health benefits such as effects on total and LDL cholesterol and blood pressure. Onions' natural phytochemicals have antioxidant and anti-inflammatory properties, which impact platelet aggregation and endothelial function.

Epidemiological evidence suggests onion eaters have a reduced mortality and reduced risk of developing heart disease and hypertension. A Finnish study of 5133 men and women found those eating over 5g of onion a day reduced their risk of total mortality and death from coronary heart disease by 29% and 35% respectively, compared to those who did not eat onion.[34] Italians who ate more than one 80g portion of onion a week had a 22% reduced risk of myocardial infarction compared to non-onion eaters (P<0.05).[35] Another large study following 3052 adults for 6 years, found those who habitually ate garlic and onion over this time had a significant 64% reduced risk of cardiovascular disease (P<0.05) and 26% decreased risk of developing hypertension (P<0.05).[36]

A number of **randomised controlled clinical trials** have found that onion supplementation helps **control dyslipidemia,** including improving plasma levels of HDL, LDL, and total cholesterol, as well as blood pressure.[37]

Fifty four women with Polycystic Ovarian Syndrome (PCOS) were randomly allocated to either a 'high-onion' diet (raw red onions: 80-100g/day if overweight and 100-120g/day if obese) or a control 'low-onion' diet (raw red onions: 20-30g/day) for 8 weeks. Results showed total and LDL cholesterol were both significantly reduced (P<0.05), more so in the high onion diet group. There was no change in HDL cholesterol or triglycerides.[38] Although another study found no change in cholesterol in those with diabetes.[39] This evidence is supported by studies investigating onion components such as onion juice (100ml/day for 8 weeks) which significantly decreased waist circumference, total and LDL cholesterol and protected against LDL oxidation (all P<0.05).[40] Seven animal studies investigating onions/ onion extracts/ dehydrated onion - including diabetic animal models - saw positive results on blood lipids.[41-47] Although another three animal studies found no difference in cholesterol.[48-50]

Further evidence links onion components with potential positive effects on **platelet aggregation and endothelial function.** An onion soup, rich in water-soluble quercetin (69mg), inhibited aspects of collagen-stimulated platelet aggregation soon after consumption.[51] Reduced platelet stickiness and blood pressure was also found in a group of healthy subjects 5 hours after consuming an onion-olive-oil maceration capsule.[52] When 4 capsules were taken daily over a week, this resulted in a drop in systolic blood pressure and improved blood viscosity.[53]

Onion extract supplements containing 51mg of quercetin (equivalent to approximately 100g of onions) for 30 days significantly improved postprandial endothelial dysfunction.[54] Overweight and obese women with high blood pressure, taking onion peel extract supplements, saw a reduction in blood pressure (P<0.05)[55] and improved endothelial function (P<0.05).[56] Although another study found no effect of onion peel extracts on blood pressure and endothelial function.[57]

Animal studies using onion extracts or onion juice have also shown improvements in endothelial dysfunction[58] and anti-thrombotic effects.[59,60]

Onion health benefits

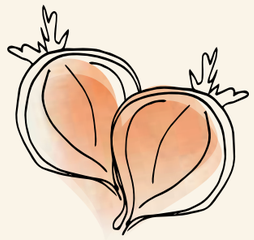
DIABETES

No association has been found between onion consumption and Type 2 diabetes risk,[36] however, clinical trials have investigated onions' effects on diabetes markers. For instance, 28 people with diabetes (14 Type 1 and 14 Type 2) consuming 100g of sliced onion had significantly **reduced blood glucose levels** four hours after the test meal in both groups ($P<0.05$).[61] Studies from the 1980s found similar results, including 20 people eating 3 x 20g portions of onion a day for a week achieving a 4% reduction in blood glucose ($P<0.05$)[39] and another where onion consumers were able to reduce their diabetes medications.[62] In a study published in 2020, onion juice extracted from fresh onion was used on rats for 14 days, which resulted in a significant decrease in blood glucose levels in the experimental group compared to the control group.[63]

A study of 56 breast cancer patients, following a round of chemotherapy, were randomised into groups consuming 100-160g a day of onion ("high onion" group) or 30-40g a day ("low onion" group) for 8 weeks. Daily high consumption resulted in a significant decrease in **fasting blood glucose** ($P<0.05$) and **insulin levels** ($P<0.05$) in comparison with the low onion group. **Insulin resistance** was also significantly reduced and **insulin sensitivity** improved.[64] The women's PCOS study noted above however saw no change in blood glucose levels in this non-diabetic population.[38]

These human studies are supported by 9 animal studies that also found (with consumption of onions, juice or extracts rich in quercetin), a reduction in blood glucose levels and/or improvements in insulin resistance through up regulation of **glucose transport** in cells and reduced oxidative stress.[65-73]

Specific onion compounds appear to reduce blood glucose and/or improve insulin secretion. For instance, allyl propyl disulphide (a volatile oil),[74,75] amino acid sulfoxides S-methylcysteine sulfoxide, S-allylcysteine sulfoxide,[76-78] flavonols quercetin[79] and kaempferol,[80] and diphenylamine[81] appear to affect glucose metabolism,[61,76] **carbohydrate enzymes** a-amylase and a-glucosidase,[78,79] **glucose cell utilisation** and transport[57,79,84,85] and even possibly **regeneration of pancreatic cells.**[71]



Healthy weight

½ onion (75g) provides around 100kJ - a good option for a veggie-rich, kilojoule-controlled diet

WEIGHT MANAGEMENT

Research into onions as a potential tool for obesity prevention and treatment is starting to emerge. A 2018 review found that a substantial number of studies have proven the efficacy of *Allium Cepa* in the treatment of conditions linked to obesity, including hyperlipidaemia, diabetes, hypertension, cardiovascular diseases and inflammatory state.[86]

A randomised, double-blind, placebo-controlled clinical trial with 70 subjects consumed an onion capsule or placebo for 12 weeks. Compared to the placebo, the onion capsule supplementation group had significantly reduced body fat and fat mass, with no significant effects on lean body mass. Triglyceride levels were also significantly lower after 12 weeks.[87] Clinical studies involving onion effects on obesity management show mixed results. A twin study, comparing the intakes of flavonoid antioxidants and their subclasses between the twins and their fat mass, found the twin that ate more flavonol rich foods including a 60g serve of onion had a **reduced fat mass** ($P<0.05$). Assessing all 2734 women; those with higher intakes of flavonols (found in onions) were associated with lower fat mass and **reduced central adiposity.**[88]

Quercetin and organosulfur compounds are associated with anti-obesity potential of *Allium Cepa* and therefore the most promising molecules for a therapeutic application. Quercetin has been shown to have a role to play in visceral fat reduction. A randomised double-blind placebo-controlled parallel-group study involving seventy healthy Japanese subjects analysed the effects of daily intake of quercetin-rich onion on visceral fat for 12 weeks. The subjects had a BMI ≥23 and <30 and were randomly to either the quercetin-rich onion group or placebo group. The subjects ingested 9g of onion powder per day for 12 weeks. No significant differences in visceral fat area were observed between the two groups. However, in subjects whose high-density lipoprotein cholesterol was lower, visceral fat was significantly lower in the quercetin-rich onion group. In addition, alanine aminotransferase was significantly lower in the quercetin-rich onion group than in the placebo group. These results suggest that quercetin-rich onion may be beneficial for preventing obesity and improving liver function.[5]

One quercetin-rich onion extract supplement study found significantly reduced weight and percentage of body fat,[89] although another study saw no change in anthropometrics in overweight people.[92] Two animal studies saw a drop in body weight and/or fat mass of the animals consuming onion and extracts.[67,73] Although a third study found no difference in weight of rats after consuming onion powder.[91]

Other compounds such as onions' volatile oils suppress high fat diet-induced body weight gain and tend to decrease fat mass in rats.[90] Similarly, amino acid sulfoxides reduce body weight in rats.[93] A 2020 study suggests that onion peel extract has beneficial effects on obesity by regulating erythrocyte n-6/n-3 ratio and preventing fat accumulation in various body regions.[94]

Onion health benefits

CANCER

High onion eaters generally have less cancer risk compared to no or low onions eaters:

Cancer	% risk reduction onion consumers versus no or low consumers
Head and neck	17% with 3 or more portions a week[95]
Oral cavity and pharynx	85%[96]
Laryngeal	83%[96] 30%[95]
Upper aerodigestive tract	28%[95]
Oesophageal	88%[96]
Gastric	45% with more than 2 portions a week[98] 9% with each 20g a day increase in Allium[99] 50% with ½ an onion a day[100]
Colorectal	79%[101] 56%[96] 15%[102] No association[103]
Breast	25%[93] Reduced risk[100] No association[101]
Ovarian	73%[96]
Endometrial	60% with more than 160g a week[104] 19% with 80g a week[105]
Prostate Prostate enlargement	71%[96] 60%[107]
Renal cell	38%[96]

The mechanisms to explain this are still being investigated. The natural chemical compounds in onions such as the amino acid sulfoxides and their breakdown derivatives appear to induce liver detoxification enzyme systems and influence cancer cell arrest cycles and apoptosis (cell death) in cancer cell models.[108]

Another hypothesis is that the Vitamin C in onions inhibits cell mutation, which contributes to the growth of tumours in the gastrointestinal tract.[101]

In addition to the benefits of eating onion to reduce cancer risk, there is also a benefit in consuming onions when undergoing cancer treatment. A systematic review of 19 studies sought to determine what food or beverages consumed during cancer treatment might prevent recurrence, subsequent malignancies, treatment-related toxicity, or death. Onions (as well as nuts and specific grape varieties) were shown to be modestly beneficial in lessening side effects and improving prognosis during cancer treatment.[109]

BONE HEALTH

Fascinating new research shows onions may help older women protect their bones. Women over 50 years of age, who were peri – or post-menopausal, and who ate onions at least once a day, had an overall **bone density** 5% greater than those who ate onions once a month or less ($P<0.05$). Compared to those that never ate onions, older women who ate onions the most frequently had a 20% **reduced risk of hip fracture.**[110] Animal studies have uncovered that quercetin and amino acid sulfoxides reduce the formation of osteoclasts (the cells that breakdown bone) thus helping to maintain bone density.[111-117] Quercetin also has phytoestrogen effects so may help form new bone.[117]

HEALTHY AGEING

Onions are one of the major flavonol-rich foods in the diet that can help minimise forgetfulness in advancing years. After accounting for factors that could affect cognition (such as age, weight, physical activity, alcohol intake, depression, and non-flavonoid nutrient intake), a study published recently in the journal Neurology found that people with the highest daily flavonoid intakes were 19% less likely to report trouble with memory and thinking, compared to people with the lowest daily flavonoid intakes. When the Harvard University researchers looked at specific flavonoids, they found flavones had the strongest protective qualities and were associated with a 38% reduction in the risk of cognitive decline, while anthocyanins (found in red onions) were associated with a 2% reduction. Strawberries, spinach and onions were among the specific flavonoid-containing foods that topped the list of scores in the memory questionnaire.[119] Quercetin has also been shown to dramatically improve cognition and memory deficits in rodent animal Alzheimer disease models,[120] and there is a growing body of evidence that suggests a protective role for quercetin in cognitive decline and neurodegenerative disease.[121-123]

Selecting and enjoying

BEST PICK

- Choose onions that are clean and firm with shiny tissue-thin skins
- The 'necks' should be tight and dry
- If they are overly dry, discoloured or have soft wet spots on them - they aren't fresh

STORE ALONE AND IN THE DARK

- Onions are best kept in a cool, dark, dry area. Keep them in a mesh bag (or similar) so they get good air circulation
- Storing onions and potatoes together accelerates the spoiling of each vegetable – store separately
- Don't keep onions in the refrigerator for long periods of time as the cold temperature softens them
- If you only use part of the onion, it can be wrapped and refrigerated for up to four days.

Why do onions make you cry?

Onions make you cry thanks to a chemical reaction that starts in the ground. Onions grow with the bulb partially in the ground, where the roots absorb sulfur from the soil and store it as an amino acid sulfoxide. When an onion is cut, it releases enzymes, which set off a chain reaction that releases volatile gasses into the air where it quickly finds its way into the eyes and the fumes mix with water there to form sulphenic acid. Nerves in the cornea react to the irritant sending a message to the brain to activate the tear glands. Tears form to wash the offending chemical out of the eye and that's why you cry.[124,125]

No more tears

To avoid tearing up while cutting onions, you could try one of the following methods:

- Put onions in the fridge or freezer a short time before cutting them
- Cut them under the stove hood/ vent
- Cut the onion with the centre tube aiming away from you, have a fan blow from behind the onion to keep blowing the irritating gas away
- Add vinegar to the chopping board – the acid denatures the enzymes
- Avoid cutting off the root section as the concentration of these chemicals is highest nearest the root.[126] Cut up to the root but otherwise leave intact
- Blanch the onions first or cut while under water, iced water or running water, but this increases likelihood of cutting yourself
- Wear sealed goggles!

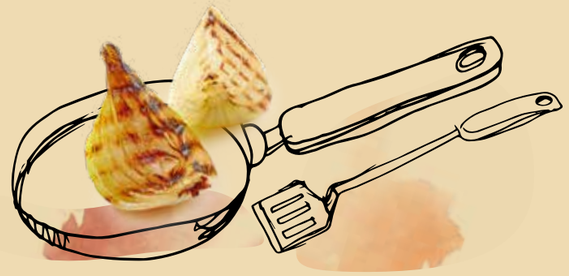
Cutting onions under water may also reduce the amino acid sulfoxide compounds responsible for onions, distinctive flavour. So, for a great tasting onion, a few minutes of tears may be worth it.

DOES COOKING ONIONS CHANGE THEIR NUTRITION?

Cooking does impact the nutrient content of onions. To maximise the levels of antioxidant compounds and water-soluble vitamins in onions and their availability for absorption:

- Avoid peeling too many layers off an onion as antioxidant levels are higher in the outer layer[20]
- Don't cut and store onions, cook onions soon after cutting
- Avoid cutting and soaking in water unless the water is included in the dish
- When cooking onions in liquids consume the liquid as well e.g. a stock, soup, stew or casserole, or steam and microwave instead
- Use a variety of cooking methods with quick cooking times e.g. stir fry, microwave and steam
- When frying stir fry to preserve nutrient content rather than deep fry[127]
- Try fermenting onions with other vegetables

Using a variety of cooking methods, as well as enjoying some onion raw, will help maximise nutrient levels available for absorption, and ensure antioxidant capacity is maintained.[128,129]



The secret to a good dice

1. Cut the onion in half lengthways

3. Peel off outer skin and make parallel cuts from end

2. Slice off one end

4. Make cuts across onion

For more usage tips and recipe ideas visit www.australianonions.com.au

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