

Sensational Citrus

Health and Nutrition
Overview 2022



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Introduction

There's nothing quite like citrus fruits. Vibrant, fresh and tangy, they add a splash of colour and zest to so many meals, from the simplest glass of freshly-squeezed orange juice, to that hint of lime in a perfectly-spiced curry. Life would be so much duller without lemon meringue or sweet mandarins to snack on, or your slice of breakfast grapefruit.

In Australia, we are fortunate enough to enjoy a range of delicious seasonal citrus fruit all year round including oranges, lemons, limes, grapefruit, mandarins and 100% orange juice. These vibrant fruits are packed with a range of nutrients and antioxidants, thereby playing an important role in helping Australians to enjoy a nutritious diet that promotes health and protects against chronic diseases.

Everyone knows citrus fruits are jam-packed with Vitamin C, but did you know they're also a good source of fibre, are low in kilojoules and are rich in a range of polyphenol antioxidants? When enjoyed as part of a healthy and varied diet, citrus fruits can play a crucial role in combatting lifestyle diseases and supporting optimal health.

This report highlights the many health benefits of five types of popular citrus fruits (orange, lime, lemon, grapefruit and mandarin) and orange juice, as well as considerations for novel opportunities to reap the health attributes of all components of these delicious whole foods.

So go ahead and enjoy some Australian citrus fruit today. Whether it's sliced, juiced, baked, candied, zested or just enjoyed fresh from nature, it's the year-round fruit that helps keep you healthy inside and out.

Bon Appetit !

Teri Lichtenstein, Accredited Practising Dietitian (APD)



Sensational Citrus

Citrus fruits are a rich source of powerful polyphenol antioxidants. These polyphenol flavonoids are so plentiful in citrus fruits (some are only found in citrus fruits), that they are referred to as 'citro-flavonoids'.

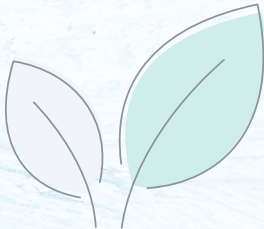
Citro-flavonoids

Heart health
Healthy ageing
Brain health
Anti-carcinogenic
Anti-inflammatory
Anti-microbial

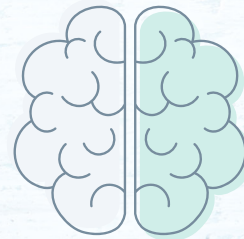


Good Mood Food: Citrus fruits contain folate and vitamin C. These essential nutrients support optimal brain function and help to minimise fatigue.

Heart Health: Citrus fruits are naturally low in sodium and contain soluble fibre and antioxidants that contribute to heart health by helping to lower blood pressure and blood cholesterol and reduce oxidative stress.



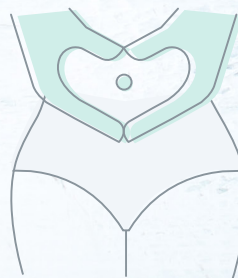
Plant Power: Citrus fruits deliver a unique bundle of vitamins and antioxidants (folate, vitamin C, citroflavonoids), protecting cells from free radical damage and inflammation, as well as keeping the immune system strong to reduce the risk of developing chronic disease.



Brain Health: Just half a daily serve of citrus fruits (e.g. half a medium orange) contains a high quantity of flavonoids. Flavonoids have been linked to decreasing cognitive decline by up to 38% - the equivalent of being three to four years younger in age!¹



Cancer Management: Polyphenols found in citrus fruits have been shown to have anti-cancer activity and may decrease growth of a number of different types of cancer cells.



Gut health: Citroflavonoids may contribute to the maintenance of intestinal health by preserving microbial balance. They stimulate the growth of beneficial bacteria and inhibit pathogenic bacteria.

Super Citrus

All citrus fruits and juices contain a wide range of nutrients including natural sugars, fibre, vitamin C, potassium, folate, calcium, thiamine, niacin, vitamin B6, vitamin A (as beta-carotene), phosphorus, magnesium, copper, riboflavin, pantothenic acid and a variety of phytochemicals.

Citrus fruits and juices are also a major contributor of polyphenol flavonoids, also called citroflavonoids, in the Australian diet ^{2,3}.

Citroflavonoids have been shown to be highly bioavailable, likely due to the 'food matrix effect'; the physical structure of citrus helps the digestion and absorption of nutrients and bioactives⁴.

Citrus fruits have been shown to reduce the risk of:

- metabolic syndrome (high blood pressure, high blood sugar, excess body fat around the waist and abnormal cholesterol levels)
- cardiovascular disease
- improved blood lipid profiles

There is also growing interest and emerging research regarding the role of citrus fruit components (i.e. flesh, juice, peel and seeds) and their role in reducing inflammation, treating depression, fighting infections and reducing the risk of numerous cancers.

When it comes to health, these brightly coloured pink, yellow and orange fruits are mighty powerful indeed, and what's even better is they are delicious and available all year round!

Citrus fruits are famous for flavour and enjoyed as part of many cuisines, meals and drinks. Everything from a glass of freshly squeezed orange juice with breakfast, lime wedges served alongside a curry dish, a slice of lemon in a G&T, a mandarin cake, grapefruit segments in a savoury salad or the classic chocolate and orange sweet dishes. The versatility of the fruit, juice and peels is endless.

natural sugars
fibre
vitamin C
potassium
folate
calcium

copper
riboflavin
pantothenic acid
phytochemicals
niacin
thiamine

vitamin B6
vitamin A
(as beta-carotene)
phosphorus
magnesium

Oranges

Nutrition information

Serving size: 150g (1 orange)

	Av QTY Per serve	% DI*	Av QTY per 100g
Energy	263kJ	3%	176kJ
Protein	1.5g	3%	1g
Total fat	0g	0%	0g
Saturated fat	0g	0%	0g
Total Carbohydrates	12.6g	4%	8.4g
Sugars	12.6g	14%	8.4g
Dietary fibre	3.2g	11%	2.1g
Sodium	2mg	0%	1mg
Potassium	270mg	N/A	180g
Thiamin	0.14mg	10%	0.07mg
Folate	83ug	42%	56ug
Vitamin C	71mg	179%	48mg
Total polyphenols~	104mg	N/A	69mg
Anthocyanins* (in Blood orange only).	21ug	N/A	14ug
Beta carotene eq	39ug	N/A	26ug
Glycemic Index (GI)^	42 (low) (av. of 6)		
Glycemic Load	5g (low)		

Sources: Analytical data 2021, Horticulture Innovation

~ Measured as Gallic Acid Equivalents (GAE)

^ glycemindex.com

*Based on an average adult diet of 8700 kJ

¥ Cebadera-Miranda L et al. Food Chem 2019

- ✓ Excellent source of vitamin C
- ✓ Rich in folate
- ✓ Source of fibre
- ✓ Source of thiamine
- ✓ Contains potassium
- ✓ Contains polyphenol antioxidants
- ✓ Contains beta-carotene
- ✓ Blood oranges contain anthocyanins
- ✓ Low glycemic index (GI)



There are two main varieties of oranges (species - *Citrus sinensis*) grown in Australia; sweet navel oranges, which are the preferred table fruit, and the less sweet, more tart-tasting Valencia which produce great juice. These varieties have complementary seasons – navel trees bear fruit from June to October and Valencia bear from November to February. Australia really is the lucky country to have tasty and nutritious oranges available all year round to give you zest for life!

Double your Vitamin C

One orange provides nearly twice the daily recommended amount of vitamin C.

Vitamin C is essential for:

- ✓ Iron absorption
- ✓ Antioxidant effects

- ✓ Building strong bones and teeth
- ✓ Healthy teeth and gums
- ✓ Healthy skin
- ✓ Brain function
- ✓ Healthy immune system

Super hesperidin

Oranges contain over 100mg of polyphenols in every serve. These citro-flavonoids help break down fats and have been used in the development of dietary supplements to treat obesity⁵. Hesperidin is one of the natural phenolic compounds in high concentrations in oranges⁶. Hesperidin may promote brain health by providing protection against neurodegenerative diseases⁷.

Super powerful polyphenol hesperidin has shown the following effects:

- anti-inflammatory
- anti-oxidative
- anti-cancer
- cholesterol lowering
- blood pressure lowering⁸
- anti-obesity⁹

Peel-good, feel-good

Orange peels account for about 44% of the actual fruit¹⁰. Mother nature's own biodegradable packaging is usually discarded as waste, but **there is a lot of goodness in the peels – they're a rich source of Vitamin C, fibre, and many nutrients phytochemicals including antioxidants¹¹**. Orange peel has been used as a traditional medicine in parts of the world for relieving stomach discomfort, skin inflammation, ringworm infections, neuroprotection and improving heart health^{12,13}.

So don't toss the peel into the bin or compost pile – taste it, don't waste it! There are so many ways to use this phytonutrient-rich component of the fruit to zest up your meals and get extra nutritional benefits.

Add some peel to your meal

- Dried orange peel gives a wonderful flavour to beef and game stews and is excellent added to a bouquet garni in tagines, soups and casseroles

- Add peel to tea or coffee for an extra flavour dimension in your daily cuppa
- Because so many beneficial phytochemicals are found in the skin of oranges, marmalade with peel is a 'superfood'
- Finely grated orange skin (coloured part only) is called zest and elevates savoury and sweet dishes with a tangy aromatic boost. It can be added to ice cream, cakes or sprinkled over roasted vegetables or salads
- Invest in a microplane (very fine grater) to make light work of zesting
- Microplane the skin before eating the fruit and save the zest for later. You can keep citrus zest in your freezer for a quick and easy flavour bomb.
- Give your olive oil a phytochemical flavour hit by adding in thick slices of orange peel and allow to infuse the oil. It's great in salads or drizzled over cooked vegetables
- Candied orange peel will give your Christmas pudding an amazing flavour. To make the candied peel, simply simmer in sugar syrup, leave to dry and store in an airtight container
- For an indulgent, antioxidant-rich treat any time of the year, dip candied peel in melted dark chocolate and chill until set

Orange peels
account for about

44%

of the actual fruit.



Orange Juice

Nutrition information

Serving size: 125ml (½ cup) 100% orange juice

	Av QTY Per serve	% DI*	Av QTY per 100g
Energy	204kJ	2%	163kJ
Protein	0.6g	1%	0.5g
Total fat	0g	0%	0g
Saturated fat	0g	0%	0g
Total Carbohydrates	11.4g	4%	9.1g
Sugars	11.4g	13%	9.1g
Sodium	1.5mg	<1%	1.2mg
Folate eq	52.4ug	26%	41.9ug
Vitamin C	43mg	108%	34.5mg
Total polyphenols	72mg	N/A	58mg
Hesperidin^	2.5mg	N/A	1.97mg
Beta carotene eq	12.5ug	N/A	10ug
Moisture	116g		93g
Glycemic Index (GI)^	48 (LOW)		
Glycemic Load (GL)~	5g (LOW)		

Sources: Analytical data, Horticulture Innovation

^ USDA flavanone database

^^GI average of 3 From Atkinson FS, Brand-Miller JC, Foster-Powell K, Buyken AE, Goletzke J. International tables of glycemic index and glycemic load values 2021

~ calculated using GI 48 and 125ml serve size

*based on an average adult diet of 8700 kJ

< means less than

- ✓ Rich in vitamin C
- ✓ Rich in folate
- ✓ Contains polyphenol antioxidants
- ✓ Contains beta-carotene
- ✓ Contain low Glycemic Index (GI)
- ✓ Contains natural fruit sugars
- ✓ Contains fluids



Nutrient rich

100% orange juice is a source of natural sugars, micronutrients and plant bioactives. It is recognised as a valuable way to help achieve nutrient targets, specifically vitamin C, folate and polyphenols including beta-carotene¹⁴. **Just half a cup of orange juice provides more than 100% of daily Vitamin C needs and over a quarter of daily folate needs.** Both vitamin C and folate support psychological well-being, help to reduce stress and boost mood. We can all raise a glass of fresh orange juice and drink to that!

The range of plant bioactive compounds provided by orange juice is broad. It is rich in hesperidin, naringin, carotenoids and hydroxycinnamic acids, while blood orange juice is also a source of anthocyanins¹⁵⁻¹⁷.

Bioavailability studies show that the absorption of nutrients and polyphenols from citrus juice is higher than from whole fruits. This could be due to the higher fibre content of whole fruits, which acts as a barrier in the gut¹⁵, or the carotenoids, which are in a more easily absorbed form.¹⁸

An excellent reason to include some fresh orange juice with your morning brekkie!

100% orange juice - A great way to improve diet quality

Dietary research has shown that drinking 100% orange juice is associated with healthier eating habits in general¹⁹, better diet quality²⁰, improved nutrient adequacy and improved biomarkers of health in adults^{21,22}.



Orange juice represents a good source of dietary flavonoids, which is important for population groups who don't eat enough fruit for optimal growth and health, such as Australian adolescents. A 2019 study found that **fresh fruit juice is a major food source of dietary flavonoids for Australian adolescents, providing 44% of total flavonoid intake in this population**²³. It's a similar story in other parts of the world also. Citrus fruit and juices combined are the greatest contributors to flavanone intake (a type of flavonoid) in all regions of Europe studied²⁴.

Orange juice in preventive health

100% orange juice and the nutrients it contains have been shown to play a protective role in a range of health conditions including:

1) Metabolic disease prevention – daily consumption of orange juice has been associated with a reduction in the onset of chronic diseases, improved lipid profiles, lower total cholesterol and reduced inflammatory markers²⁵⁻²⁸.

2) Gut health – orange juice may be considered a health drink for its prebiotic effects. It contains flavonoids, carotenoids, vitamin C, folate, and other phytochemical compounds that may affect systemic and intestinal metabolism²⁹⁻³⁶.

3) Healthy ageing and cognition – a number of studies have shown improvements in global cognitive function from orange juice consumption in middle-aged and elderly populations^{34,37-39}. A study published in 2021 found people who eat at least half a serving per day of foods high in flavonoids have a 20% lower risk of cognitive decline. Yellow or orange fruits and vegetables had the strongest protective qualities, and were associated with a 38% reduction in risk of cognitive decline- the equivalent of being three to four years younger in age¹.

Dietary intakes from national health surveys have shown that both adults and children who drink orange juice have higher intakes of bioactive flavonoids, lower added sugars, and higher-quality diets overall²⁰.

100% Orange Juice In the Australian Diet

A serve of 100% fruit juice (no added sugar) is 125ml (half a cup) and is part of the fruit group within the Australian Dietary Guidelines. Fruit juices are recommended to be consumed occasionally due to their lack of fibre, and acidity that may increase the risk of dental erosion if consumed in excess⁴⁰. However, some orange juices have some fibre retained (pulp), whereas soft drinks are the biggest culprit in dental erosion (see **Myth busting – What about dental erosion?**).

Orange Juice Myth Busting

Isn't orange juice full of sugar?

Dietary guidelines around the world deal with 100% fruit juice, such as orange juice, inconsistently, because it represents a source of sugar, albeit natural sugars. However, 100% fruit juice provides bioavailable micronutrients and plant bioactives at levels similar to whole fruits.

Studies show that hesperidin, a polyphenol in oranges, slows the absorption of the natural sugars, which explains why both orange juice and whole oranges have a low glycemic index³⁴. This is supported by two systematic reviews that found 100% fruit juice such as orange juice has a neutral effect on glycemic and insulin control, despite being a source of natural sugars^{41,42}.

Does orange juice contribute obesity?

Concerns have been raised about the link between fruit juice consumption and increased risk of obesity, specifically amongst children^{43,44}, but the evidence is described as 'insufficient' to form a conclusion⁴⁵. Research into this association has concluded that 100% fresh fruit juice can be a healthy part of the diet of children older than one year, when consumed as part of a well-balanced diet⁴³. A comprehensive review of

21 studies investigating the relationship between 100 % fruit juice intake and body measurements in children and adolescents concluded there was no association between 100 % fruit juice intake and body weight in children or adolescents⁴⁵.

Whilst there is research that supports a link between high sugar intake and obesity, the evidence to date suggests that the adverse effects (i.e. obesity and associated co-morbidities) from excess added sugar are not observed with respect to the consumption of 100 % fruit juice in typical amounts⁴⁶.

100% orange juice is associated with nutritional benefits and with diets that are of higher quality or more nutritionally complete. The amount of 100% orange juice consumed should be balanced with overall energy intake and expenditure.



What about dental erosion?

Frequent consumption of carbonated beverages (soft drinks) is the main dietary factor associated with dental erosion⁴⁷. Erosion is caused by demineralisation of the dental hard tissues (enamel, dentine and cementum). While the natural citric acid content of 100% orange juice has the potential to erode teeth if consumed frequently, a systematic review of the literature found the evidence for this inconclusive. This review also found no association, or an inverse association, between 100% orange juice and dental caries (decay)³⁴.

There are several reasons why orange juice may pose less risk of dental erosion than soft drinks. Calcium concentration in 100% fruit juices is protective against tooth surface hardness loss⁴⁸, and 100% orange juice contains some calcium. In addition, polyphenol content can modulate dental erosion⁴⁹ and 100% orange juice is rich in polyphenols.

There are also some things that can be done to reduce the risk. Dilution of orange juice with water (60:40) can reduce its erosive effect, according to an in-vitro study⁵⁰, and consuming juice with meals reduces dental erosion risk by diluting the acidity, reducing tooth exposure time, and the pH buffering effects of saliva and other foods⁵¹.

Tips for enjoying 100% orange juice as part of a healthy diet

- Dilute 100% Orange Juice with water for young children
- Enjoy 100% orange juice as part of a meal with other foods; this may help negate the effects of dental erosion
- Avoid brushing teeth for 30 minutes after drinking 100% orange juice as the tooth enamel may still be soft. Time will allow the acid to be neutralised by saliva first. You can speed this up by chewing on sugar free gum^{53,54}
- Fruit Juices are not recommended for infants under 12 months of age⁵²



Mandarin

Nutrition information

Serving size: 150g (2 small mandarins)

	Av QTY Per serve	% DI*	Av QTY per 100g
Energy	300kJ	3%	200kJ
Protein	1.2g	2%	0.8g
Total fat	<1g	0%	<1g
Saturated fat	0g	0%	0g
Total Carbohydrates	14.6g	5%	9.7g
Sugars	14.6g	16%	9.7g
Dietary fibre	2.3g	8%	1.5g
Sodium	4mg	0%	3mg
Potassium	240mg	N/A	160mg
Folate eq [^]	39ug	20%	26ug
Vitamin C	44mg	108%	29mg
Total polyphenols~	84mg	N/A	56mg
Beta-carotene eq	186ug	N/A	124ug
Moisture	130g		86g
Glycemic index#	52 (Low)		
Glycemic Load†	8g (Low)		

Sources: Analytical data 2021, Horticulture Innovation

[^] Australian Food Composition Database

~ Measured as Gallic Acid Equivalents (GAE)

From Atkinson FS, Brand-Miller JC, Foster-Powell K, Buyken AE, Goletzke J. International tables of glycemic index and glycemic load values 2021.

† Calculated based on GI 52 and 150g serve

*Based on an average adult diet of 8700 kJ

< means less than

- ✓ Excellent source vitamin C
- ✓ Source of folate
- ✓ Contains potassium
- ✓ Contains polyphenols antioxidants
- ✓ Contains beta-carotene
- ✓ Has a low glycemic index (GI)
- ✓ Source of fibre

Mandarin marvel

Mandarins are famous for being easy-to-peel and mess-free to eat making them ideal for packed lunches.

Did you know?

The ease of peeling a mandarin results from the gradual loosening of the rind from the pulp that normally occurs during ripening⁷⁵.

Aside from being easy to eat, mandarins (*Citrus reticulata*) are a symbol of wealth and good fortune in Chinese culture, especially during Lunar New Year⁵⁵. Mandarins are the most diversified category of citrus fruits, with more than ten varieties grown in Australia – Imperial being the most common. Mandarins are a popular citrus fruit thanks to their unique, delicate and enticing flavour and aroma, consisting of a blend of sweet, sour, fruity, fresh and earthy notes⁵⁶. **Just two small mandarins (150g) provide your entire days recommended intake of vitamin C.** Mandarins are also a source of folate, an important nutrient for energy production, reducing tiredness and fatigue and supporting psychological functioning.

β-cryptoxanthin antioxidants

Among citrus species, mandarins have the highest carotenoid antioxidant content. The predominant group are the β-cryptoxanthin carotenoids that provide the deep orange colour and distinguish mandarins from oranges^{57,58}. β-cryptoxanthin has been repeatedly shown to reduce the risk of diabetes, obesity, oxidative stress, and carcinogenesis (cancer formation) in human and rat studies⁵⁹⁻⁶¹.

In addition to carotenoids, **mandarin fruit and peels are packed with organic acids, amino acids, pectins (soluble fibre), minerals and volatile organic compounds⁶²⁻⁶⁶, all of which provide nutritional value and protect against chronic disease⁶⁷.**

Wonder fruit

Mandarins are a true wonder fruit. The fruit and peels have been reported to possess the following effects:

- neuropharmacological (brain and nervous system) benefits
- Hepato-protective (liver protection)
- anti-cancer
- antimicrobial
- antigenotoxicity (DNA protection)
- antioxidant activities
- cholesterol-lowering
- cardiovascular benefits⁶⁸

In traditional medicine the fruit also has been used for its laxative, aphrodisiac, anti-emetic (anti-nausea), astringent and tonic properties^{69,70}. So many reasons to enjoy the many mandarins available from April all the way through to October.

Mandarins for skin care

Mandarins may be the next big thing when it comes to skin care. The fruit could help to treat skin conditions such as psoriasis and vitiligo (skin pigment loss), as it contains coumarin compounds including bergapten, which sensitize the skin to absorb more sunlight⁷¹. Mandarin peel also regulates skin moisture – it can soften hard and rough skin and cleanse oily skin⁷².

Mandarin peels contain volatile oils with anti-bacterial properties⁷³. The essential oils, juice and peel extracts have been investigated for the treatment of skin disorders and incorporated into cosmetic formulations⁷⁴.

So many ways to enjoy mandarins

Whilst the mandarin fruit is mainly eaten fresh, it can be incorporated into sweet and savoury dishes such as salads and cakes. And don't throw out the peels as mandarin peel is deliciously versatile in cooking. It can be finely grated and added to roasted root vegetables or mixed into butter and slathered over hot corn, or added to oil drizzled over steamed greens. It may also be finely chopped, sprinkled with icing sugar and slow roasted to produce sweet mandarin peel chips that can be used in baking, sprinkled on yoghurt or ice cream, or added to a trail mix or enjoyed with dark chocolate for a wonderful bitter-sweet mandarin flavour.

Skincare tip

Mix finely grated mandarin peel with honey for a quick and easy DIY face mask. Leave on for 15 minutes and then rinse with water for a fresh glow.



Lemon

Nutrition information

Serving size: 100g (1 medium lemon)

	Av QTY Per serve	% DI*
Energy	107kJ	1%
Protein	0.7g	1%
Total fat	0g	0%
Saturated fat	0g	0%
Total Carbohydrates	1.9g	<1%
Sugars	1.9g	2%
Dietary fibre	1.5g	5%
Sodium	2mg	0%
Folate	47ug	24%
Vitamin C	35mg	88%
Total polyphenols~	42mg	N/A

Source: Analytical data 2021, Horticulture Innovation.

< means less than

~ Measured as Gallic Acid Equivalents (GAE)

*Based on an average adult diet of 8700 kJ

- ✓ Rich in vitamin C
- ✓ Source of folate
- ✓ Contains polyphenol antioxidants

Tip

Lemon juice reduces browning of fruits and vegetables so squeeze lemon over cut apple and avocado to slow oxidation.

When life gives you lemons... get busy and eat the lot... juiced, zested, preserved...

Australians are lucky enough to have lemons available all year, and many home gardens proudly display a lemon tree. *Citrus limon* is popular not only for its culinary use, but also many medicinal and household uses. Lemons contain many important natural chemical components, including phenolic compounds (mainly flavonoids), as well as other compounds including vitamins, minerals, dietary fibre, essential oils and carotenoid antioxidants.

Oh my, goodness!

The polyphenols and alkaloid extracts of all parts of the plant (including the leaves, stem, root and flower) have immense therapeutic potential because of their anticancer, anti-tumour, anti-inflammatory and anti-bacterial effects⁷⁶.

The anti-bacterial properties make lemons good for treating various throat infections, including tonsillitis, sore throat and colds⁷⁷. In Romanian traditional medicine, lemon essential oil was administered with sugar for suppressing coughs⁷⁸, an ancient equivalent to the modern cough lozenge. Even in the present-day, sipping lemon juice in water is recommended as a home remedy for sore throats⁷⁹. Lemon oil is used in pharmacy and cosmetic formulations for flavour and aroma, as well as a natural preservative due to its antibacterial and antifungal effects⁸⁰.

Lemon's health benefits also extend to relieving the symptoms of respiratory diseases such as asthma⁸¹, alleviation of fatigue⁸² and lowering blood lipid levels.⁸³ Aside from being rich in vitamin C, which assists in warding off infections, lemon juice has traditionally been used to treat rheumatism (painful joints), chest pain and even high blood pressure⁸⁴.

A study conducted in middle-aged women investigated lemon juice ingestion and exercise (measured by number of steps walked) over five months. The results indicated that daily lemon juice intake and walking were effective in reducing high blood pressure⁸⁵. These findings are supported by animal studies⁸⁶.

Lemons- an essential ingredient

Lemon is highly combinable and adaptable in sweet or savoury dishes as a seasoning or star ingredient in everything from aperitifs to petit-fours⁸⁸. Clever cooks find ways to use lemons everyday for their unique tang and qualities as a tenderiser, flavour enhancer and preserver of colour in fruit and vegetables. Lemon is a refreshing source of acidity for drinks and a major ingredient in cakes, tarts, biscuits and puddings. Lemon is mandatory with seafood, either as a squeeze of juice on fish or in a sauce. Lemon is delightful in poaching syrups and lemon peel can be candied for a delicious after-dinner sweet treat⁸⁹.

Lemon zest is aromatic, with notes of rose lavender and pine, and releases tiny drops of oil when cut or grated. The aromatic perfume of lemon zest adds a herbaceous note to dishes⁸⁸. Many recipes require both juice and zest for the full flavour experience. The white pith that surrounds the flesh contains pectin, which as well as being a soluble dietary fibre good for digestive health, is also necessary to ensure a good 'set' when making marmalade⁸⁹.

Lemons for kidney stones

Lemons are very rich in citric acid and may be useful in nutrition therapy for calcium urolithiasis (kidney stones)⁸⁷.

The intake of beverages containing citric acid, like lemon juice, increases the total volume of urine, reducing the saturation of calcium and other crystals, and may enhance urinary citrate excretion⁸⁷. Health professionals recommend that patients who suffer from kidney stones increase their intake of citric acid. Practical ways to do this include making lemon juice ice-cubes and using them to flavour water and other beverages, making homemade lemonade/cordial, and squeezing fresh lemon juice onto meals.

Peel Fabulous

Lemon peel represents between 50 and 65% of the whole fruit weight and contains most of the plant's dietary fibre⁹⁰. The presence of bioactive compounds (flavonoids and vitamin C) with antioxidant properties in the peel means it has even greater health-promoting effects^{91,92}.

Lemon around the house

The natural astringency of lemon, its antimicrobial effects and fresh natural aroma make it an excellent cleaning, sanitising and deodorising agent around the house. There are good reasons why many commercial household cleaning products contain lemon!

Try these ideas:

- Add lemon to the washing up water or in the top rack of your dishwasher (try the squeezed wedges leftover from your meal)
- To remove stains from fabric, soak in hot water and lemon slices for an hour before washing
- Rub a cut lemon over your chopping board after chopping garlic or seafood and leave for around 15 minutes before washing
- To clean and freshen your microwave, boil lemon juice and water in a microwave-safe bowl for a minute or so and then wipe down with a clean cloth
- Polish your tapware by rubbing them with lemon rind, rinse and polish with a dry cloth
- Remove stains from stone benchtops with half a lemon dipped in salt and rubbed on the stain. Rinse immediately

Did you know?

Lemon juice and other citrus fruits has been used as a cure for scurvy since ancient times. Modern science revealed the active ingredient to be vitamin C⁹³.

Grapefruit

(nutritional values are an average of both yellow and pink varieties)

Nutrition information

Serving size: 150g (1/2 a grapefruit)

	Av QTY Per serve	% DI*	Av QTY per 100g
Energy	242kJ	3%	161kJ
Protein	1.2g	2%	0.75g
Total fat	0g	0%	0g
Saturated fat	0g	0%	0g
Total Carbohydrates	10.7g	3%	7.1g
Sugars	10.7g	12%	7.1g
Dietary fibre	2.7g	9%	1.8g
Sodium	1.7mg	0%	1.1mg
Potassium	218mg	N/A	145mg
Folate eq	53ug	27%	35ug
Vitamin C	63mg	158%	42mg
Total polyphenols~	104mg	N/A	69mg
Beta-carotene eq (pink grapefruit)	675ug	N/A	450ug
Moisture	134g	N/A	89mg
Glycemic Index (GI)^	25 (low)		
Glycemic Load ‡	3g (low)		

Sources: Analytical data 2021, Horticulture Innovation

~ Measured as Gallic Acid Equivalents (GAE)

*Based on an average adult diet of 8700 kJ

^Glycemic.com

‡ Calculated using GI 25 and 150g serve size

- ✓ Excellent source of vitamin C
- ✓ Rich in folate
- ✓ Source of fibre
- ✓ Contains potassium
- ✓ Contains beta-carotene (pink grapefruit only)
- ✓ Contains polyphenol antioxidants
- ✓ Low glycemic index (GI)



Grapefruits (*Citrus paradisi*) are a hybrid of pomelos and sweet oranges; first discovered in the 18th century.

Different varieties of grapefruits vary in hue from white to red, depending on the presence or absence of lycopene, a phytochemical pigment⁹⁴. The two common varieties grown in Australia are pink and yellow fleshed grapefruits; both being an excellent source of vitamin C and folate.

Grapefruits are rich sources of vitamins, minerals, pectin, and many phytochemicals including citroflavonoids such as coumarins and limonoids – the latter being responsible for the bitter flavour associated with grapefruit⁹⁵. Thanks to these bioactive phytochemicals, **grapefruit possesses health-promoting anti-inflammatory, anti-cancer, and anti-obesity properties⁹⁶⁻⁹⁸.**

Pink grapefruit is rich in lycopene, has many protective effects including combatting atherosclerosis (hardening of the blood vessels), high blood pressure and the development of blood clots. Lycopene also has antioxidant and anti-inflammatory activity⁹⁹.

Grapefruit for weight loss and heart health

Grapefruit has been part of many weight-loss diets, including the original 'Hollywood' diet of grapefruit, hard-boiled eggs, green vegetables and 'melba' toast in 1930¹⁰⁰. This diet later became known as the "Grapefruit Diet", as grapefruit was reported to increase satiety due to its high fibre content and delayed gastric emptying^{101, 102}.

While this did not stand up to the scientific scrutiny of randomized controlled trials, a review did find grapefruit intake led to small but significant reduction in systolic blood pressure and waist circumference in overweight and obese adults¹⁰³.

Grapefruit may also promote cardiovascular health¹⁰⁴. Eating grapefruit has been associated with decreased fasting blood glucose and insulin levels, as well as decreased serum total cholesterol, low-density lipoprotein and triglyceride levels^{105, 106}.

Grapefruit and cancer

Furanocoumarins are a type of polyphenol found in grapefruit that exhibits potent anticancer activities against the growth of different types of cancer cells including skin cancer, breast cancer, leukemia, and neuroblastoma cells¹⁰⁷.

Bergamottin for example, suppresses breast cancer cell growth through inhibition of signal transducers¹⁰⁸⁻¹¹⁰. Treatment with bergamottin has also been shown to significantly reduce the proliferation of malignant blood cells in patients with leukemia¹⁰⁸.

Grapefruit for bone health

Bergapten is another grapefruit-derived furanocoumarin. It has been shown to help minimise osteoporotic activity and help to maintain bone strength in both in vitro and in vivo experiments,¹¹¹ and in rat studies ¹¹²⁻¹¹⁴. Bergapten is a bioactive polyphenol in grapefruit that may contribute to good bone health.

TIP

A sprinkle of sugar on fresh cut grapefruit helps to balance out the bitterness. The difference is amazing (thank you sensory science).

Lime



Nutrition information

Serving size: 100g (2 limes)

	Av QTY Per serve	% DI*
Energy	113kJ	1%
Protein	0.8g	2%
Total fat	0g	0%
Saturated fat	0g	0%
Total Carbohydrates	1.2g	<1%
Sugars	1.2g	1%
Dietary fibre	3g	10%
Sodium	3mg	0%
Vitamin C	31mg	78%
Folate	46ug	23%
Total polyphenols~	41mg	N/A

Source: Analytical data 2021, Horticulture Innovation

~ Measured as Gallic Acid Equivalents (GAE)

< means less than

*Based on an average adult diet of 8700 kJ

- ✓ Rich in vitamin C
- ✓ Rich in folate
- ✓ Contains polyphenol antioxidants

Limes (*Citrus aurantium*) are used in cooking, food industry, fragrance, and medical applications, they are generally not consumed as whole fruit due to their very sour taste. The preferred uses are as juice in drinks, or added to fresh and cooked foods for its characteristic tart, floral flavour.

Lime has been used as a traditional medicine over the ages for weight loss, skin care, eye care, treating scurvy, constipation, piles, peptic ulcer, respiratory disorders, gout, gum disease and urinary disorders. Limes are thought to aid digestion by their salivatory (mouth-watering) effect, their acids that help break down food, their flavonoids that stimulate digestive juices and bile acids, and by stimulating peristalsis. In age-old Indian tradition, lime (or lemon) pickle is served with meals for flavour and digestion¹¹⁵.

Limes, like all citrus fruit, are rich in vitamin C, flavonoids and limonoids. A study in overweight rats found limes (and lemons) reduced blood cholesterol and body weight, and the vitamin C reduced cholesterol oxidation¹¹⁶.

Lime a-peel

Lime peel extracts have been found to have the following helpful effects¹¹⁷⁻¹¹⁹:

- anticarcinogenic (reduce cancer formation)
- Antiproliferative (reduce cancer growth)
- Co-chemotherapeutic (boost impact of chemotherapy)
- Oestrogenic effects (contain phytoestrogens)

Similar to oranges, one of the dominant citroflavonoids in limes is hesperidin, which acts as an antioxidant by scavenging free radicals¹¹⁷⁻¹¹⁹.

Wanting to quit smoking? Try a lime

A randomised trial found fresh lime may work just as well as nicotine gum in helping smokers to quit. While it wasn't quite as good at reducing cravings, the researchers concluded limes could be used as a smoking cessation aid¹²⁰. What a fresh idea!



Selecting & Storing Citrus

Best pick

Citrus fruits stop ripening as soon as they are picked and they stay fresh for longer than many other fruits. Look for citrus fruits that feel heavy as they will be juicier. Fruit should be unblemished, firm to touch and give slightly when pressure is applied.

Storing citrus fruit

Citrus fruits tend to last longer at cooler temperatures and can deteriorate quickly at warmer temperatures. If you store fresh citrus in a fruit bowl, make sure to keep the bowl in a cool, well-ventilated spot. Keeping them refrigerated, especially during warmer months, will help keep fresh for a several weeks. Keep them covered to prevent drying out during prolonged cold storage.

TIP

Look for citrus fruits that feel heavy, as they will be juicier.



Tips to enjoy citrus every day

To get the most juice out of your lemons and limes, press firmly and roll around on the table or bench top before squeezing.



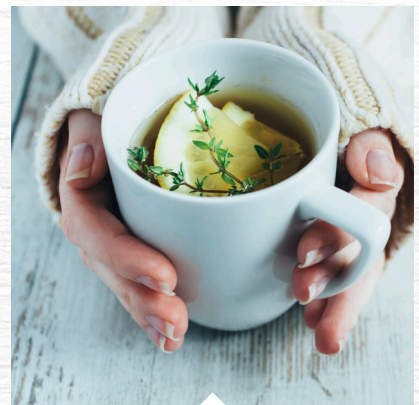
Squeeze lemon and lime juice into ice cube trays and freeze to always have on hand. Simply pop out a cube and melt to add to a range of savoury and sweet dishes.



Fresh or frozen citrus pieces are refreshing additions to fruit smoothies.



Frozen oranges are a refreshing snack through the summer. Cut in quarters (with skin on) and place in an airtight container in the freezer.



Fresh orange juice can be made into healthy popsicles – a Vitamin-C rich summer icy treat for the kids.



Freeze thin slices of citrus fruits by placing them on a baking tray in the freezer. Once frozen, store in an airtight container in the freezer. Use to flavour water, tea or cocktails.

Try home-made limoncello (Italian lemon liqueur); macerate fresh lemon peel in white spirit (e.g. vodka), water and sugar. A great way to re-use lemon peel that would normally be discarded.



Dried mandarin peel adds a sweet-spicy flavour to cakes and biscuits.



Lemon juice is a natural flavouring and preservative, adding an acidic and sour flavour in savoury dishes, drinks, salad dressings, sauces, desserts and baked dishes.



Peel an orange or mandarin and gently poach the segments in a sugar syrup with rosewater and cinnamon quills – delicious served with a scoop of Greek yoghurt or ice cream.



Turn your water jug into **a fancy party drink** by adding slices of orange, lime and lemon for a tangy and refreshing beverage that looks pretty too.

A quick way to pickle any citrus fruit is to make 4-6 deep cuts lengthways down the fruit with a sharp knife. Stuff each incision with sea salt, then place inside a sterilised airtight jar and cover with water. Add some herbs and spices to enhance the flavour, then seal the jar and leave in a cool dry place for at least three weeks before reopening. Pickled citrus fruits can be eaten with fish, poultry, salads and curries.



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