Prunes
- a fresh look at nutrition & health benefits
A HEALTH PROFESSIONALS REPORT
Aus Prunes
Introduction

If there’s one thing we know about prunes it’s their laxative effect – keeping bowel motions regular. But exciting new research shows prunes can positively affect bone too. Prunes contain lesser known bone-building nutrients – vitamin K, potassium, boron, sorbitol and polyphenols. They work together to improve bone mineral density by reducing markers of bone resorption while promoting markers of bone formation. Prunes may also play a role in improving metabolic syndrome markers by reducing blood cholesterol, blood pressure, blood glucose and insulin, and increasing satiety.

The following report takes a fresh look at the nutrition and health benefits of this traditional nutritious favourite. Reacquaint yourself with the sweet taste of prunes and be pleasantly surprised. Enjoy 50 grams or about 6 pitted prunes a day either as a snack or as a versatile ingredient in meals.

Delicious, healthy, nutritious prunes are perfect for the entire family. They’re an affordable dried fruit and available year round.

On behalf of the Australian Prune Industry, I hope you find this report as fascinating to read and share as I found to write. There’s always something new to learn about traditional whole foods.

Cheers

LISA YATES

Advanced Accredited Practising Dietitian & Consultant Dietitian to the Australian Prune Industry Association 2018
The Australian Prune Industry recommends 50 grams a day (about 6 pitted prunes or a ¼ cup packed). Clinical studies investigating the bone health benefits of prunes use 50-100 grams of prunes a day (see page 7 bone health). We acknowledge the Australian Dietary Guidelines recommend 30 grams of dried fruits in a serve\(^1\), however the Australian Prune Industry prefers to recommend the minimum serving size used in clinical trials that generates bone health outcomes.

Key Findings

- Prunes are a nutritious dried fruit with less than 100 kcal per 50 g serve (page 4)
- Around 6 prunes = 50 grams
- Prunes improve bone mineral density and reduce bone resorption in post-menopausal women (page 7)
- Prunes contain insoluble and soluble fibre plus sorbitol and chlorogenic acid to assist with a normal regular bowel function (page 4)
- Prunes have a Low Glycemic Index of 29 and also help increase satiety without causing weight gain (page 8)
- Prunes may help reduce blood cholesterol and blood pressure (page 9)

Serving Size & Frequency

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Carbohydrates and Sugars
As a dried fruit prunes are high in carbohydrates (20g/50g serve) and natural fruit sugars — fructose (7g/50g) and glucose (9g/50g). Prune varieties are specifically chosen for their high sugar content so they can be dried without fermenting. Prunes have a Low Glycemic Index rating of 29(2) and a 50g serve provides 395kJ or less than 100kcal of energy.(3) Prunes also contain sorbitol — a sugar alcohol (6g/50g).(3) Sorbitol has a number of interesting properties including as a stool softener, calcium absorption enhancer and as a prebiotic for gut bacteria.(4, 5)

Dietary Fibre and Soluble Fibre
Prunes are a source of dietary fibre (3.3g/50g serve — with around half each as insoluble fibre (1.5g/50g) and soluble fibre (1.8g/50g).(3) The type of soluble fibre in prunes is pectin. (6) Fibre’s water holding properties helps give stools their consistency and structure. Soluble fibre helps delay gastric emptying, signalling fullness. (7) Plus may reduce intestinal bile acid/cholesterol reabsorption — a mechanism to lower blood cholesterol.(8-10) For more see page 9 heart health.

Vitamins

VITAMIN K
Vitamin K is more commonly found in green leafy vegetables and herbs so it may be surprising to learn a purple fruit such as prunes also contains vitamin K (17ug per 50g serve).(3) Vitamin K is needed for normal blood clotting but also contributes to normal bone structure. It’s needed for osteocalcin, a protein involved in bone mineralisation.(11)

Minerals
BORON
Boron is a trace mineral essential for bone growth, maintenance and regeneration. Boron boosts magnesium absorption, reduces calcium excretion and positively effects the body’s use of vitamin D — all bone-building nutrients. Boron has antioxidant and anti-inflammatory properties as well.(12, 13) Prunes contain 0.9mg boron per 50gram serve.(3) An Australian study found an average daily boron intake in men was 2.23+/-1.23mg a day.(14) So a 50g serve of prunes would provide about 40% of this daily intake. The higher boron content of prunes is due to boron forming a complex with sorbitol for transportation through the plum tree.(15)

IRON
Vegetarians need to pay careful attention to their iron intake and prunes contain 1.2mg of plant iron per 50gram serve.(3) To boost plant iron absorption enjoy prunes with a vitamin C source such as citrus. Iron is needed for blood oxygen transport, for energy production, so helps reduce tiredness and fatigue.(16)

SODIUM AND POTASSIUM
Sodium and potassium are electrolytes needed for muscle and nerve function and are also involved in blood pressure regulation.(16, 17) A healthy diet, low in sodium that contains a variety of foods such as prunes, reduces blood

Key Nutrients
Fibre is the well-recognised nutrient in prunes but they contain bone-building: vitamin K, potassium, boron, sorbitol and polyphenols. The following nutrition information is based on a 50gram serve and a 33% moisture level. D’Agen plums from the tree contain ~70% moisture and are dried down to a low 18% moisture to prevent mould growing during bulk storage. Prior to packaging they are rehydrated to ~33% moisture giving prunes their characteristic soft, moist texture.

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pressure. A 50g serve or about 6 prunes is naturally low in sodium with just 1mg of sodium and contains 375mg of potassium.\(^{(16)}\) Potassium also plays a role in reducing bone resorption and improving bone mineral density.\(^{(18)}\)

**Antioxidants**

Like all fruits and vegetables prunes contain natural phytochemicals with antioxidant and anti-inflammatory properties. There are over 40 different compounds in prunes\(^{(4)}\) and while drying does degrade some of them, prune antioxidant activity is still higher than most fruits.\(^{(19-21)}\)

Phytochemicals in prunes include:

**CAROTENOIDS**

Beta carotene, lutein, zeaxanthin are colourful orange and yellow antioxidant pigments which protect the eye from the damaging effects of sunlight.\(^{(22, 23)}\) A 50g serve of prunes contain 130ug of beta carotene and 90ug of lutein and zeaxanthin.\(^{(3)}\)

**POLYPHENOLS**

Prunes contain 470mgGAE/50g of total polyphenols — higher than many other dried fruits.\(^{(4,20)}\) These phenolics also influence bone with prune’s most common antioxidant — chlorogenic acid.\(^{(4)}\)

**CHLOROGENIC ACID**

Commonly found in coffee, prunes contain 22mg/50g.\(^{(3)}\) Chlorogenic acid from prunes has been found to: inhibit LDL cholesterol oxidation in vitro\(^{(24)}\) and increases peristalsis in the intestines aiding bowel function.\(^{(4)}\) It may help improve calcium absorption\(^{(4)}\) and reduce markers of bone resorption\(^{(25, 26)}\) thus preserving bone mineral density.\(^{(26)}\)

**MELANOIDINS**

Generated through the prune drying process, they contribute to prunes’ antioxidant protection against oxidative stress.\(^{(27)}\)

**Low Saturated Fat**

A 50g serve or about 6 prunes contains less than 1g of unhealthy saturated fat. Healthy, varied diets low in saturated fat and high in fruits and vegetables, help reduce blood cholesterol and contribute to heart health.\(^{(16)}\)
HEALTH STAR RATING

Health stars are commonly found on processed packaged foods from as low as ½ star to as high as 5 stars. The Health Star Rating system was not designed for natural produce items such as prunes yet they score 4.5 stars. Almost all fruits score 4.5 stars including fresh plums. Fruits lose ½ star due to their naturally higher sugar content. Regardless of the star rating health authorities recommend two serves of fruit a day which could include dried fruits such as prunes.⁽¹⁾

**Nutrition Information**

Servings per package: 5 serves (250g pack weight)
Serving size: 50g or ~6 prunes

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<th>Average Quantity per Serving</th>
<th>% Daily Intake*(per serving)</th>
<th>Average Quantity per 100g</th>
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<tr>
<td>Energy</td>
<td>395kJ (94kcal)</td>
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<td>Protein, total</td>
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<td>Fat, total</td>
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<td>&lt;0.2g</td>
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<td>− saturated</td>
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<td>&lt;1%</td>
<td>&lt;0.1g</td>
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<tr>
<td>− trans</td>
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<td>&lt;1%</td>
<td>&lt;0.1g</td>
</tr>
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<td>&lt;1%</td>
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<td>&lt;1%</td>
<td>&lt;0.1g</td>
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<tr>
<td>Carbohydrate</td>
<td>20g</td>
<td>6%</td>
<td>41g</td>
</tr>
<tr>
<td>− sugars</td>
<td>16g</td>
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<td>31g</td>
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<tr>
<td>Sorbitol</td>
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<td>3.3g</td>
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<td>− Soluble fibre</td>
<td>1.8g</td>
<td>3.6g</td>
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<tr>
<td>Vitamin K</td>
<td>17ug</td>
<td>21%</td>
<td>35ug</td>
</tr>
<tr>
<td>Sodium</td>
<td>1.1mg</td>
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<tr>
<td>Potassium</td>
<td>375mg</td>
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<tr>
<td>Boron</td>
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<td></td>
<td>1.8mg</td>
</tr>
<tr>
<td>Iron</td>
<td>1.2mg</td>
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<td>Total Polyphenols^</td>
<td>469mgGAE</td>
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<tr>
<td>Beta carotene</td>
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<tr>
<td>Lutein zeaxanthin</td>
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* Percentage daily intakes are based on the average adult diet of 8700kJ. “<” means less than Glycemic Index rating is 29 (Low)
^Source: reference 20
Remaining data from National Measurement Institute results 2018

4.5 HEALTH STAR RATING

ENERGY 790kJ
SAT FAT <0.1g
SUGARS 31g
SODIUM 2.2mg
FIBRE 6.6g

PER 100g

Aus Prunes
Latest Research

PRUNES FOR BONE HEALTH

A new area of investigation is the effect of prunes on bone. Prunes reverse bone loss and promote bone formation in post-menopausal women — a time when women are prone to accelerated bone loss and osteoporosis.(28, 29) Currently clinical trials have studied effects on post-menopausal women only, where they consumed 50-100g of prunes a day for time frames of 6-12 months. In general, researchers found prunes:

- Prevented a loss of total body bone mineral density(30) — this study also determined a 50g dose of prunes was as effective as a 100g serve,
- Significantly increased bone mineral density of the ulna bone and spine,(31, 32)
- Significantly increased markers of bone formation such as insulin like growth factor(33) and bone specific alkaline phosphatase which increase osteoblast formation to generate bone,(33, 34)
- Significantly reduce or suppress markers of bone resorption such as TRAP-5b(30, 32) and RANKL pathway,(31)
- Significantly reduced markers of inflammation which can encourage osteoclast formation leading to bone resorption.(32)

These mechanisms are supported by animal and cell studies which found prunes/prune polyphenol extracts:

- Enhance and/or restore bone density(35-42), bone volume/mass and architecture,(35-38, 40-43)
- Effect gene expression and cell signalling pathways that:
  - Influence osteoblasts (bone formation), (37, 39, 42-44)
  - Reduce or suppress osteoclasts (bone resorption), (37-39, 44, 45)

In addition prunes appear to decrease erosion of joint cartilage common in arthritis(45), and may reduce the effects of radiation exposure on bone - of interest to astronauts and those undergoing radiation therapy.(46) Clearly prunes’ impact on bones is an exciting new area of interest for bone researchers with more research to come.
PRUNES FOR BOWEL HEALTH

Prunes’ laxative effect is due to their fibre, sorbitol and antioxidant content. Together they help prunes to: aid laxation through activating peristalsis in the intestines (antioxidant chlorogenic acid)\(^4\) increasing stool frequency\(^{9, 47, 48}\), softening stools (sorbitol and soluble fibre) and improving stool structure and consistency, \(^{9, 40, 47}\) and finally prunes help increase stool weight (fibre).\(^{9, 48, 49}\) Low stool weight and prolonged gut transit time are risk factors for constipation and diverticular disease. Clinical studies use 80-120g prunes a day to improve bowel function,\(^{50}\) and appear well tolerated with few undesirable gastrointestinal symptoms \(^{9, 49-50}\) — loose stools and flatulence were only reported by some.\(^{33, 48}\)

Prunes also contain diphenyl isatin a natural compound similar to a laxative medication.\(^{52, 53}\) Prunes, prune extracts and sorbitol appear to act as prebiotics increasing gut bacteria including bifidobacteria.\(^{4, 48, 54}\) Faecal bile acids do increase with prune consumption\(^{9, 55}\) and these have anti-cancerous properties. It may explain how prune extracts can induce cell death in a human colon cancer cell line.\(^{56}\)

PRUNES FOR SATIETY AND WEIGHT MANAGEMENT

Only a few small studies have examined prunes effect on weight management and satiety and only in women. A short, two-week crossover study, with 25 women aged 25-54yrs with a BMI 24-35, compared a twice daily snack of about 80g of prunes (100kcal) and an equal caloric quantity of low fat cookies.\(^{49}\) Researchers found diet quality improved (P<0.05) and participants had softer stools with no abnormally greater frequency of bowel motions with no change in body weight.\(^{49}\) Some of the bone health studies noted above found participants did not gain weight despite additional energy from prunes.\(^{30, 32, 33}\) A US study investigating dried fruit found those consuming at least a ¼ cup of dried fruit a day had overall improved nutrient intakes, higher diet quality scores and lower body weight and adiposity measures.\(^{57, 58}\)

Including prunes prior to meals appears to enhance satiety. A randomised crossover study of 45 normal weight women, who ate 5 prunes (40g) prior to a lunch meal, found they had lower energy intakes at the meal and ate less dessert compared to those eating a bread snack. Following prune consumption their feelings of hunger and desire, and motivation to eat were reduced (P<0.05) and satiety was increased (P<0.05).\(^{59}\)

Another study of 19 women (average age 39 years and BMI 26) consumed snack foods such as 100g prunes as well as low fat cookies. Over a 2 hour time period they recorded their satiety levels while blood hormone samples were taken at regular intervals. Satiety was higher with the prune snack (P<0.05) than low fat cookies. Prunes caused lower blood levels of glucose and insulin (P<0.05) with a trend for higher ghrelin levels (P=0.056)\(^{60}\) all influences of appetite.

Prune and Zucchini Fritters
PRUNES FOR HEART HEALTH

Few studies have investigated prunes health effects on cardiovascular measures but to date it appears prunes help lower cholesterol and blood pressure:

For blood lipids — no change in blood triglycerides was found after consuming 11-100g of prunes a day despite prunes higher carbohydrates and sugars.\(^{(9,49,61)}\) Significant reductions in total and LDL cholesterol (\(P<0.05\)) were found in consumers of 3 or 6 prunes a day as part of a blood pressure trial noted below.\(^{(62)}\)

Another crossover study of 41 men with mild hypercholesterolaemia consuming 12 prunes (100g, 1004kJ) as part of their usual diet for 4 weeks, found a significant drop in LDL cholesterol when compared to a grape juice control (\(P=0.02\)). There were no changes in HDL cholesterol although a trend for reductions in total cholesterol (\(P=0.07\)). Nor were there any consistent changes in faecal output, bowel habits or complaints from eating 100g prunes a day.\(^{(9)}\)

This study found no increase in total faecal bile acid but individual types did increase. Soluble fibre preventing reabsorption of bile acids alone does not explain improvements in cholesterol.

An animal study by the same research group found prune fibre and pectin reduced blood and liver cholesterol in hyperlipidemic rats compared to a control group consuming cellulose.\(^{(60)}\)

A study in 100 postmenopausal women randomised to either consuming 75g dried apple or 100g prunes (control) daily for 12 months found no significant difference in body weight, total, LDL HDL cholesterol at 12 months between the groups.\(^{(61)}\) Results may have been different if the control was no dried fruit at all.

For blood pressure (BP) — only one clinical trial has assessed prunes impact on BP — 248 pre-hypertensive volunteers consumed prune juice and 3 or 6 whole prunes a day (12 or 23g) for 8 weeks. BP was recorded fortnightly and after 8 weeks there was a significant reduction in BP in those eating 3 prunes a day (\(P<0.05\)) compared to those avoiding prunes.\(^{(62)}\)
Animals studies support these outcomes with prune treatment causing lower blood and liver cholesterol levels,\(^{(63)}\) lower blood pressure,\(^{(64)}\) and a possible slower progression of atherosclerosis.\(^{(65)}\)

**PRUNES FOR DIABETES**

Prunes have a high natural sugar content (16g/50g serve) so it’s possible people with diabetes may think they need to avoid prunes. While there are no clinical trials investigating prune consumption by people with diabetes two studies have assessed prunes effect on blood glucose and insulin. The first — 100 women (1-10 years post menopause) ate either 100g of prunes or 75g of dried apple (control) for a year. There was no change in blood glucose or insulin after 12months on either group.\(^{(66)}\) The second — a small study noted above with 19 women eating 100g of prunes in a single setting resulted in reduced blood glucose and insulin levels compared with those eating low fat cookies.\(^{(60)}\) These outcomes are supported by a rat study that found a dried plum concentrate improved blood glucose, insulin sensitivity and adiponectin levels.\(^{(67)}\)

Prunes do have a Low Glycemic Index of 29\(^{(12)}\) which may be explained by sorbitol’s low GI of 9\(^{(68)}\) and they contain soluble fibre pectin. Pectin appears to delay gastric emptying and reduce glucose and insulin levels.\(^{(69-71)}\)

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**Prune, buckwheat and quinoa lunchbox bar**

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**Mothers and Babies**

Pregnancy is a special time when extra nutrition is needed. Encourage prunes as a regular snack food to provide bone building nutrients: vitamin K, potassium and boron. Pregnant women can often have bouts of constipation too due to iron supplements. Around 100grams of prunes a day will help keep bowels moving regularly due to dietary fibre and sorbitol. For constipated infants and toddlers try diluted prune juice or prune water (soak prunes for a couple of hours or simmer prunes in enough water to cover them for a few minutes, remove the prunes and give the “water” cooled, to babies and toddlers). When introducing solids try prune puree mixed in natural yoghurt.
Prune puree with natural yoghurt

Prunes – a fresh look at nutrition and health benefits

A health professionals report
What about...

**DENTAL CARIES**

It’s assumed dried fruit could cause dental caries because they’re “sticky” and oral bacteria metabolise their sugars reducing mouth pH causing erosion. However few studies have tested the impact of dried fruit on teeth. Raisin research found they don’t cause a drop in mouth pH and the polyphenols in dried fruit appears to inhibit oral bacteria that causes dental caries.\(^{(72, 73)}\) A recent literature review found there is a lack of good quality scientific data to substantiate advice to restrict dried fruit consumption for dental health reasons.\(^{(74)}\)

**HIGH SUGARS CONTENT**

Prunes, like most fruits, are high in sugars predominately fructose and glucose but they also contain fibre and sorbitol which explains prunes’ low glycemic index (GI 29).\(^{(2, 68)}\)

Prune varieties are chosen specifically for their high sugar content. These varieties can be dried to lower moisture levels without causing them to ferment and their waxy, thick skin can reabsorb moisture needed prior to packing.\(^{(75)}\)

**FODMAPS**

Prunes contain fermentable carbohydrates such as fructose as well as polyols such as sorbitol. Those with Irritable Bowel Syndrome may need to reduce the quantity or frequency of eating prunes if they are unable to digest these sugars fully.

**PRESERVATIVES**

Packaged prunes contain potassium sorbate (E 202) which further preserves prunes by preventing spoilage caused by moulds and yeasts. Organic prunes and particular brands of whole prunes (non-pitted) are preservative free.

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**Did you know?**

- “Prune” is the French word for “plum” and dried plums are “pruneaux” (pron “pruno”).
- Prunes are dried sugar plums predominately of the French d’Agen variety. Agen, in the south west of France, have been growing prunes since the 12th century.
- Australians ate their way through 6553 tonnes of prunes in 2016/17 with 57% from Australia (3750 tonnes) and 43% imported (2803 tonnes).\(^{(76)}\)
- Australians only ate around 220g prunes per person in 2016/17 – much less than recommended.\(^{(76)}\)
- Prune orchards are found around Griffith and Young in NSW.
- There are 54 growers with some 262,000 prunes trees in Australia.
- It takes around 7 years for prune trees to reach maximum commercial yields.
- Prunes are dried on trays on trolleys in a gas fired tunnel where hot air is blown over them at 72–78°C for up to 20hrs.
- Store prunes in their original zip lock bag, or in an air tight container once the bag is open, in the fridge to keep them moist and juicy.
- Prune flavours and aromas are fruit acids and volatile compounds produced from the caramelisation of sugars during drying and released during chewing.\(^{(4, 77)}\)
- Prunes’ purple/black colours are from colourful carotenoids (beta carotene, lutein and zeaxanthin) as well as degradation of the red/purple pigment anthocyanin during drying.\(^{(19, 29)}\)
Prunes are a versatile ingredient in many dishes with properties that can replace sugars and fats. ‘Prune’ down your recipes by simply reducing the sugar and/or fat ingredients by ⅓ to ½, depending on the recipe. Instead incorporate some chopped prunes or prune puree to help retain moisture, delicious flavour and fat-like characteristics. Prunes can be used to sweeten biscuits, cakes, pastries and natural yoghurt. Prunes also go well with minced meat dishes (pasta sauces, burgers), and in gravies and poultry stuffings.

For all the recipes shown throughout this report and more visit: www.ausprunes.org.au/recipes.php
References

1) National Health and Medical Research Council (2013) Australian Dietary Guidelines. Canberra: National Health and Medical Research Council


