



## A SUMMARY OF KEY NUTRITION & HEALTH STUDIES

California Prunes pack a powerful punch of important vitamins, minerals, antioxidants and fiber. Together these nutrients form a web of vital functions that support overall health and the immune system.

More than 70 published studies have examined the nutrient composition and health benefits of prunes. Here are some key studies investigating their relation to digestion and gut health, bone health, cardiovascular health, weight management and satiety.

➤ **For more information about published studies on prunes, please visit [www.californiaprunes.org](http://www.californiaprunes.org).**

### SUMMARY OF HEALTH EFFECTS

**A systematic review on the health effects of plums (*prunus domestica* and *prunus salicina*).**

Igwe EO, Charlton KE. [A systematic review on the health effects of plums \(\*prunus domestica\* and \*prunus salicina\*\)](#). *Phytother Res.* 2016 May;30(5):701-31. doi: 10.1002/ptr.5581. Epub 2016 Mar 16. PMID: 26992121.

Most of the human trials used the dried version of plums rather than fresh fruit. This body of research shows promising results on plums' anti-inflammatory, antioxidant and memory-improving characteristics.

The increased interest in plum research has been attributed to their high phenolic content, mostly the anthocyanins, which are known to be natural antioxidants. Plums have been shown to possess antioxidant and antiallergic properties, and consumption is associated with improved cognitive function, bone health parameters and cardiovascular risk factors.

### DIGESTION AND GUT HEALTH

**Randomized clinical trial: Dried plums (prunes) vs. psyllium for constipation.**

Attaluri A, Donahoe R, Valesin J, Brown K, Rao SS. [Randomized clinical trial: Dried plums \(prunes\) vs. psyllium for constipation](#). *Aliment Pharmacol Ther.* 2011 Apr;33(7):822-8. doi: 10.1111/j.1365-2036.2011.04594.x. Epub 2011 Feb 15. PMID: 21323688.

The authors concluded that prunes are safe, palatable and more effective than psyllium for the treatment of mild to moderate constipation. Prunes should be considered as a first-line therapy.

**Systematic review: The effect of prunes on gastrointestinal function.**

Lever E, Cole J, Scott SM, Emery PW, Whelan K. [Systematic review: The effect of prunes on gastrointestinal function](#). *Aliment Pharmacol Ther.* 2014 Oct;40(7):750-8. doi: 10.1111/apt.12913. Epub 2014 Aug 11. PMID: 25109788.

Prunes appear superior to psyllium for improving stool frequency and consistency among constipated subjects. In non-constipated subjects, the evidence for other outcomes and the effects are weak.

Prunes may be a promising intervention for the management of constipation and increasing stool weight, but more research is needed.



## DIGESTION AND GUT HEALTH (CONTINUED)

### The effect of prunes on stool output, gut transit time and gastrointestinal microbiota: A randomized controlled trial.

Lever E, Scott SM, Louis P, Emery PW, Whelan K. [The effect of prunes on stool output, gut transit time and gastrointestinal microbiota: A randomized controlled trial.](#) Clin Nutr. 2019 Feb;38(1):165-173. doi: 10.1016/j.clnu.2018.01.003. Epub 2018 Feb 15. PMID: 29398337.

In healthy individuals with infrequent stool habits and low fiber intake, prunes significantly increased stool weight and frequency and were well tolerated. Prunes may have health benefits in populations with low stool weight.

### Prune juice containing sorbitol, pectin, and polyphenol ameliorates subjective complaints and hard feces while normalizing stool in chronic constipation: A randomized placebo-controlled trial.

Koyama T, Nagata N, Nishiura K, Miura N, Kawai T, Yamamoto H. [Prune juice containing sorbitol, pectin, and polyphenol ameliorates subjective complaints and hard feces while normalizing stool in chronic constipation: A randomized placebo-controlled trial.](#) Am J Gastroenterol. 2022 Oct 1;117(10):1714-1717. doi: 10.14309/ajg.0000000000001931. Epub 2022 Aug 12. PMID: 35971232; PMCID: PMC9531972.

Prune intake significantly decreased hard and lumpy stools while increasing normal stool and not increasing loose and watery stools. Prune intake also resulted in fewer subjective complaints of constipation and hard stools, without alteration of flatulence, diarrhea, loose stools or urgent need for defecation. There were no adverse events or laboratory abnormalities of liver or renal function after prune intake.

### Prune supplementation for 12 months alters the gut microbiome in postmenopausal women.

Simpson, AMR; De Souza, MJ; Damani, J; Rogers, C; Williams, NI; Weaver, C; Ferruzzi, MG; Chadwick-Corbin, S; Nakatsu, CH. [Prune supplementation for 12 months alters the gut microbiome in postmenopausal women.](#) Food Funct. 2022, 13, 12316–12329. doi: 10.3390/foods9050584

Results from the study showed notable enrichment in bacteria from the family Lachnospiraceae. This group of bacteria has been associated with an ability to decrease inflammatory markers in the body and help maintain the integrity of the gut barrier.

## BONE HEALTH

### Prune consumption attenuates proinflammatory cytokine secretion and alters monocyte activation in postmenopausal women: Secondary outcome analysis of a 12-month randomized controlled trial: The Prune Study.

Damani JJ, Oh ES, De Souza MJ, Strock NC, Williams NI, Nakatsu CH, Lee H, Weaver C, Rogers CJ. [Prune Consumption Attenuates Proinflammatory Cytokine Secretion and Alters Monocyte Activation in Postmenopausal Women: Secondary Outcome Analysis of a 12-Mo Randomized Controlled Trial: The Prune Study.](#) J Nutr. 2023 Nov 19;S0022-3166(23)72732-6. doi: 10.1016/j.tjnut.2023.11.014. Epub ahead of print. PMID: 37984741.

Study results showed that daily consumption of prunes may reduce inflammation markers connected to bone signaling pathways and reduce the effects of bone loss among postmenopausal women.

Finding showed significant reductions in inflammatory cytokines, which are proteins that help control inflammation, and activated monocytes, which are a major type of immune cell that has been shown to drive the chronic inflammatory response, when 50 to 100 grams of prunes (about 5-12 prunes) were included in the diet, daily.

### Prunes preserve cortical density and estimated strength of the tibia in a 12-month randomized controlled trial in postmenopausal women.

Koltun KJ, Strock NCA, Weaver C., Hang L, Williams NI, Rogers CJ, Damani J, Ferruzzi MG, Nakatsu CH & De Souza MJ. [Prunes preserve cortical density and estimated strength of the tibia in a 12-month randomized controlled trial in postmenopausal women: The Prune Study.](#) Osteoporos Int (2024). doi: 10.1007/s00198-024-07031-6

Study showed that postmenopausal women who ate at least 50 grams of prunes daily for a year preserved certain measures of bone structure and estimated bone strength as compared to women who didn't eat prunes, as measured by a peripheral quantitative computed tomography (pQCT) scan every 6 months.



**Bone-protective effects of dried plums (prunes) in postmenopausal women: Efficacy and possible mechanisms.**

Arjmandi BH, Johnson SA, Pourafshar S, Navaei N, George KS, Hooshmand S, Chai SC, Akhavan NS. Bone-protective effects of dried plums (prunes) in postmenopausal women: Efficacy and possible mechanisms. *Nutrients*. 2017 May 14;9(5):496. doi: 10.3390/nu9050496. PMID: 28505102; PMCID: PMC5452226.

This study showed that postmenopausal women who previously consumed 100 g of dried plums (prunes) per day during a one-year clinical trial conducted five years earlier retained bone mineral density to a greater extent than those receiving a comparative control.

Overall, the findings of this review strongly suggests that prunes are a promising and efficacious functional food therapy for preventing bone loss in postmenopausal women, with the potential for long-lasting bone-protective effects.

**Comparative effects of dried plum and dried apple on bone in postmenopausal women.**

Hooshmand, S, Chai, S, Saadat, R, Payton, M, Brummel-Smith, K, & Arjmandi, B (2011). Comparative effects of dried plum and dried apple on bone in postmenopausal women. *British Journal of Nutrition*, 106(6), 923-930. doi:10.1017/S000711451100119X

Overall findings suggest that prune consumption improves bone mass in part by slowing down the rate of bone turnover.

**The effect of two doses of dried plum on bone density and bone biomarkers in osteopenic postmenopausal women: A randomized, controlled trial.**

Hooshmand S, Kern M, Metti D, Shamloufard P, Chai SC, Johnson SA, Payton ME, Arjmandi BH. The effect of two doses of dried plum on bone density and bone biomarkers in osteopenic postmenopausal women: A randomized, controlled trial. *Osteoporos Int*. 2016 Jul;27(7):2271-2279. doi: 10.1007/s00198-016-3524-8. Epub 2016 Feb 22. PMID: 26902092.

These results confirm the ability of prunes to prevent the loss of total body bone mineral density in older osteopenic, postmenopausal women and suggest that a lower dose of prunes (i.e., 50 g) may be as effective as 100 g of prunes in preventing bone loss in older, osteopenic, postmenopausal women. This may be due, in part, to the ability of prunes to inhibit bone resorption.

**Prunes preserve hip bone mineral density in a 12-month randomized controlled trial in postmenopausal women: The Prune Study.**

De Souza MJ, Strock NCA, Williams NI, Lee H, Koltun KJ, Rogers C, Ferruzzi MG, Nakatsu CH, Weaver C. Prunes preserve hip bone mineral density in a 12-month randomized controlled trial in postmenopausal women: The Prune Study. *Am J Clin Nutr*. 2022 Oct 6;116(4):897-910. doi: 10.1093/ajcn/nqac189. PMID: 35798020.

A 50 g daily dose of prunes prevented loss of total hip bone mineral density (BMD) in postmenopausal women after 6 months, which persisted for 12 months. Given that there was high compliance and retention at the 50 g dosage over 12 months, the 50 g dose represents a valuable nonpharmacologic treatment strategy that can be used to preserve hip BMD in postmenopausal women and possibly mitigate hip fracture risk.

**The role of prunes in modulating inflammatory pathways to improve bone health in postmenopausal women.**

Damani JJ, De Souza MJ, VanEvery HL, Strock NCA, Rogers CJ. The role of prunes in modulating inflammatory pathways to improve bone health in postmenopausal women. *Adv Nutr*. 2022 Oct 2;13(5):1476-1492. doi: 10.1093/advances/nmab162. PMID: 34978320; PMCID: PMC9526830.

Findings from preclinical and clinical studies that have assessed the effect of prunes on oxidative stress, inflammatory mediators, and bone outcomes are summarized, and evidence supporting a potential role of prunes in modulating inflammatory and immune pathways is highlighted. Overall, evidence from in vitro, preclinical studies, and limited clinical studies suggest a potential role of prunes with improving bone loss outcomes. These findings may be attributed to components of prunes including minerals, vitamin K, phenolic compounds and dietary fiber working additively or synergistically to inhibit inflammation and oxidative stress, and mediate beneficial effects.

**Effects of 12 months consumption of 100g dried plum (prunes) on bone biomarkers, density, and strength in men.**

Hooshmand S, Gaffen D, Eisner A, Fajardo J, Payton M, Kern M. Effects of 12 months consumption of 100g dried plum (prunes) on bone biomarkers, density, and strength in men. *J Med Food*. 2022 Jan;25(1):40-47. doi: 10.1089/jmf.2021.0080. Epub 2021 Oct 29. PMID: 34714130.

The results suggest that daily consumption of 100 g prunes for 12 months has modest bone-protective effects in men.



## BONE HEALTH (CONTINUED)

### The short-term effect of prunes in improving bone in men.

George KS, Munoz J, Ormsbee LT, Akhavan NS, Foley EM, Siebert SC, Kim J-S, Hickner RC, Arjmandi BH. [The short-term effect of prunes in improving bone in men](#). *Nutrients*. 2022; 14(2):276. <https://doi.org/10.3390/nu14020276>

Regular consumption of either 100 g or 50 g prunes for three months may positively affect bone turnover. In this study among 35 men between the ages of 55 and 80, consumption of 100 g prunes led to a significant decrease in serum osteocalcin ( $p < 0.001$ ) higher levels of which are linked to chronic disease. Consumption of 50 g prunes led to significant decreases in serum osteoprotegerin (OPG) ( $p = 0.003$ ) and serum osteocalcin ( $p = 0.040$ ), and an increase in the OPG:RANKL ratio ( $p = 0.041$ ), an important determinant of bone mass.

## CARDIOVASCULAR DISEASE RISK FACTORS

### Use of prunes as a control of hypertension.

Ahmed T, Sadia H, Batool S, Janjua A, Shuja F. [Use of prunes as a control of hypertension](#). *J Ayub Med Coll Abbottabad*. 2010 Jan-Mar;22(1):28-31. PMID: 21409897.

The data in this study predicts cardiovascular protective effects of prunes. There was significant reduction of blood pressure, total and LDL cholesterol.

### Regulatory/modulatory effect of prune essence concentrate on intestinal function and blood lipids.

Chiu HF, Huang YC, Lu YY, Han YC, Shen YC, Golovinskaia O, Venkatakrishnan K, Wang CK. [Regulatory/modulatory effect of prune essence concentrate on intestinal function and blood lipids](#). *Pharm Biol*. 2017 Dec;55(1):974-979. doi: 10.1080/13880209.2017.1285323. PMID: 28164731; PMCID: PMC6130511.

Overall, study results suggest that the use of prune essence concentrate may positively regulate the intestinal microflora and thereby effectively lower total and LDL cholesterol levels and can be a promising treatment for people with hypocholesterolemia.

### Dried plum consumption improves total cholesterol and antioxidant capacity and reduces inflammation in healthy postmenopausal women.

Hong MY, Kern M, Nakamichi-Lee M, Abbaspour N, Ahouraei Far A, Hooshmand S. [Dried plum consumption improves total cholesterol and antioxidant capacity and reduces inflammation in healthy postmenopausal women](#). *J Med Food*. 2021 Nov;24(11):1161-1168. doi: 10.1089/jmf.2020.0142. Epub 2021 May 11. PMID: 33978491.

Study findings suggest that daily consumption of 50-100 g of prunes improves cardiovascular health risk factors in postmenopausal women as exhibited by lower total cholesterol, oxidative stress, and inflammatory markers.

## SATIETY AND WEIGHT MANAGEMENT

### Type of snack influences satiety responses in adult women.

Furchner-Evanson A, Petrisko Y, Howarth L, Nemoseck T, Kern M. [Type of snack influences satiety responses in adult women](#). *Appetite*. 2010 Jun;54(3):564-9. doi: 10.1016/j.appet.2010.02.015. Epub 2010 Mar 3. PMID: 20206217.

Study results demonstrate that consuming prunes as a snack suppresses hunger relative to a low-fat cookie as evidenced by lower plasma glucose, insulin resistance and/or satiety-regulating hormone concentrations.

### Short-term effects of a snack including dried prunes on energy intake and satiety in normal-weight individuals.

Farajian P, Katsagani M, Zampelas A. [Short-term effects of a snack including dried prunes on energy intake and satiety in normal-weight individuals](#). *Eat Behav*. 2010 Aug;11(3):201-3. doi: 10.1016/j.eatbeh.2010.02.004. Epub 2010 Feb 26. PMID: 20434071.

Statistical analysis of the results showed that after subjects consumed a prune snack compared to an isoenergetic and equal weighed bread product they consumed less dessert and had lower total energy intake at mealtime. Additionally, subjects' feelings of hunger, and desire and motivation to eat were lower between snacks and meals. The addition of prunes to a snack seems to promote satiety besides providing valuable nutrients.



## SATIETY AND WEIGHT MANAGEMENT (CONTINUED)

### Experimental studies and randomized controlled trial investigating the impact of traditional dried fruits consumed as snacks on food intake, experience of appetite and body weight.

Harrold, JA, Sadler, M, Hughes, GM, Boyland, EJ, Williams, NJ, McGill, R, et al (2021). [Experimental studies and randomized controlled trial investigating the impact of traditional dried fruits consumed as snacks on food intake, experience of appetite and body weight.](#) *Nutrition Bulletin*, 46, 451-467. doi: 10.1111/nbu.12528

Phase 1 of this study demonstrated that prune snacks resulted in appetite reduction compared to gummy snacks. Researchers found that those who ate prunes consumed the fewest calories overall at subsequent meals. The prune snackers also reported reduced hunger levels, improved satiety, and a greater perceived ability to eat less food at subsequent meals. Phase 2 demonstrated that prunes did not undermine weight loss, and this warrants further study. Those who consumed prunes also reported higher levels of satisfaction and greater ease of following a weight-loss program.

## HEALTHY AGING AND COGNITION

### Dietary polyphenols as modulators of brain functions: biological actions and molecular mechanisms underpinning their beneficial effects.

Vauzour D. [Dietary polyphenols as modulators of brain functions: biological actions and molecular mechanisms underpinning their beneficial effects.](#) *Oxid Med Cell Longev*. 2012;2012:914273. doi: 10.1155/2012/914273. Epub 2012 Jun 3. PMID: 22701758; PMCID: PMC3372091.

In light of their multiple biological activities, the consumption of polyphenol-rich foods (including prunes) throughout life holds a potential to limit neurodegeneration and to prevent or reverse age-dependent deteriorations in cognitive performance. Though more human trials are needed, investigations into the absorption and metabolism of various polyphenols in humans indicate that there are common pathways for the metabolism of most polyphenols, notably via their bacterial metabolism in the large intestine.

## HEALTHY AGING

### Impact of polyphenolic food on longevity: An elixir of life. An overview.

Meccariello R, D'Angelo S. [Impact of polyphenolic food on longevity: An elixir of life. An overview.](#) *Antioxidants (Basel)*. 2021 Mar 24;10(4):507. doi: 10.3390/antiox10040507. PMID: 33805092; PMCID: PMC8064059.

Several studies collectively suggest that the intake of polyphenols and their food sources (including prunes) has been associated with a reduced aging in humans and may exert beneficial effects on improving insulin resistance and related diabetes risk factors, such as inflammation and oxidative stress. Polyphenolic intake has been shown to be effective at ameliorating several age-related phenotypes, including oxidative stress, inflammation, impaired proteostasis, and cellular senescence, both in vitro and in vivo.