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Further insight into the health benefits of prunes

The latest published study exploring the health benefits of California Prunes (a descendant of the Petite d'Agen plum *Prunus domestica* L.) details findings from a USDA funded study by Dr Robert Hackman and his nutrition research team at the University of California, Davis. Published in the *Journal of Medicinal Food*¹, this randomised cross over trial explored markers of **bone resorption and vascular function** in healthy postmenopausal women following **short-term modest prune consumption**. This study represents realistic and easily achievable prune consumption patterns for most consumers, building on earlier clinical studies in postmenopausal women (bone and cardiovascular health) and men (cardiovascular health) which were of longer duration (6-12 months) and higher doses of up to 100g/15 prunes daily.



For this study, 27 healthy postmenopausal women, with an average BMI of 24.5 and normal blood pressure, fasting blood glucose and blood lipids, were randomised to consume 2 or 6 California Prunes, equivalent to approximately 14g and 42g respectively, as a daily snack for 2 weeks in addition to their habitual diet. Following a 2 week washout period subjects consumed the other study arm. 3 day food diaries were taken during each phase. **C-telopeptide, beta crosslinked (CTX) a marker of bone resorption and a predictor of fracture risk;** and markers of vascular health, including peripheral artery tonometry, plasma lipids, blood pressure, and other metabolic panels, were monitored at baseline and after the test period during both arms of the study.

CTX is now recommended by the International Osteoporosis Foundation (IOF) and the International Federation of Clinical Chemistry and Laboratory

Medicine (IFCC) Bone Marker Standards Working Group as the reference marker of bone resorption in clinical studies². A decline in CTX values represents a decline in bone resorption (break down) and is considered favourable. Intakes of monounsaturated and polyunsaturated fats significantly decreased when subjects consumed the higher prune dose and although saturated fat intake also decreased, this was not significant. The authors stated that this decrease in unsaturated fat was 'suggestive of a potential substitute of prunes for other macronutrients'. No other significant changes were seen to macro- or micronutrients intakes. Short term consumption of prunes did not alter CTX marker of bone health or cardio vascular health compared to baseline.

Results showed a favourable and significant (p=0.006) decline in CTX when subjects consumed 6 prunes during the second phase of the study compared to those consuming 2 prunes in the second phase.

When considering the age post menopause, further exploratory analysis showed that those women who were less than or equal to 7 years after the menopause had significantly (p=0.045) lower levels of Alx (augmentation index - a measure of peripheral arterial stiffness) compared to baseline. The authors' rationale for exploring the age post menopause was explained in their

discussion in relation to the increasing interest in the timing of hormonal treatment in order to achieve the greatest benefit in women, which is currently favouring early menopause.

The lack of control group could be considered a limitation of the study. However, control groups can be a challenge in whole foods research, as explained by the authors, where the potential substance of interest and its effect on the body is unknown, eg to the microbiome, metabolism and physiology, thus making it difficult to design a suitable control. Additionally, blinding would be difficult without significantly changing the form of the prune (eg by cooking or chopping), which could in turn alter the effect on the body, and furthermore not represent habitual diets in a free-living population. The low, 2 prune/day dose included in this study was deemed to be sufficiently low as to not show an effect.

The authors concluded that 'the combination of a decreasing trend of CTX in the second phase of the study among women consuming six prunes per day and the differential effect in Alx between women in early versus late menopause suggest that further investigation is warranted.' Further investigations using parallel-arm studies of longer durations, and possibly additional biomarkers of bone and cardiovascular health, are also warranted.



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Very latest Prune Research Headlines - as presented at the American Society for Nutrition annual conference

As part of the growing research around the role of prunes in health, latest findings from no fewer than 5 different research studies were showcased through posters and a presentation at the American Society for Nutrition 'Nutrition 2019', attended by 3600 health professionals in Baltimore, USA, from 8th-11th June. Abstracts outlining preliminary results from these ongoing prune studies have now been published as a supplement to the *Current Developments in Nutrition* journal and give some insights into the exciting up and coming research. Brief summaries are provided here with links to the full abstracts.

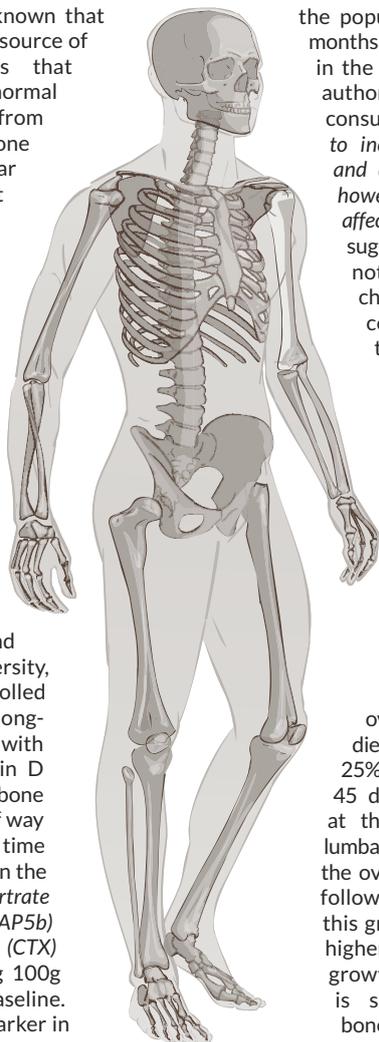
BONE HEALTH

After peaking in our early twenties, bone mass starts to remodel and weaken, leading to osteoporosis, which affects 200 million women globally. Osteoporosis is responsible for more than 8.9 million fractures each year, equivalent to one every 3 seconds; and in the over 50s, 1 in 3 women and 1 in 5 men globally will experience osteoporotic fractures³. Whilst aging and genetics, both risk factors for osteoporosis, cannot be altered, dietary and lifestyle habits (weight bearing exercise, not smoking or drinking alcohol in excess) can help maximise bone strength and minimise bone loss as we age.

Research into the role of prunes in bone health continues to grow. It is already known that prunes are high in vitamin K and a source of manganese, two key nutrients that contribute to the maintenance of normal bones, and two research reviews from 2017^{4,5}, suggest that the bone protective benefits of prunes go far and beyond these nutrients. Whilst the exact mechanism for their protective effects remain to be confirmed, Arjmandi (2017) concludes: 'it is likely that there are additive and/or synergistic effects among these [bioactive] compounds [in prunes]', and Wallace (2017) concludes that these 'may in part be due to the unique variety of phenolics and nutrients present'. The following latest findings add to this knowledge base.

PRUNES FOR BONE HEALTH IN MEN

Researchers Shirin Hooshmand and Mark Kern, San Diego State University, are conducting a randomised controlled trial⁶ to investigate the effect of long-term intake of prunes (0g or 100g, with 500mg calcium and 300IU vitamin D supplementation) on biomarkers of bone turnover in men. Data from the half way point of the 12-month study shows time - dependent significant reductions in the bone resorption markers *serum tartrate resistant acid phosphatase-5b (TRAP5b)* and *C-terminal collagen cross-links (CTX)* at both 3 and 6 months following 100g daily prune intake compared to baseline. No changes were seen to either marker in



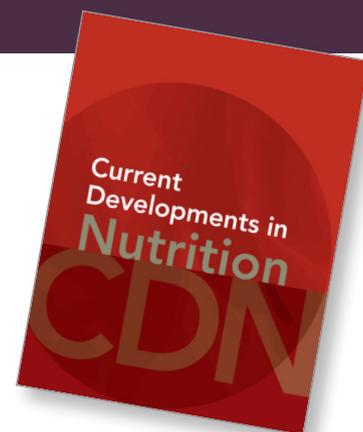
the control group. Based on these results to date, the authors have concluded that *'The results of the current study suggest that daily consumption of 100g dried plum [prunes] for 6 months has modest bone protective effects in men that are somewhat similar to those observed in postmenopausal osteopenic and older osteopenic women.'*

A separate randomised controlled study funded by the USDA and conducted by Professor Arjmandi and his team⁷ at Florida State University is also underway exploring the effects of daily prune intake (0g, 50g and 100g, with vitamin D and calcium supplementation) for 12 months, on inflammation and indices of bone health in osteopenic men (55-80 year olds).

Data from a small subset of the population group following 3 months' consumption was included in the poster presentation, with authors suggesting that prune consumption *'may contribute to increases in bone formation and decreases in inflammation, however not to an extent that affects bone quality'*. The authors suggest that three months may not be long enough to see changes in bone as a result of consuming prunes and therefore further analysis of data will be conducted for the full study population, following six months and one year of prune consumption.

BONE HEALTH - RESEARCH

Professor Arjmandi also presented results from an animal study⁸ where 4 groups of female rats (sham, ovariectomised, ovariectomised plus 5% prune diet; and ovariectomised plus 25% prune diet) were fed for 45 days. Loss of bone density at the right femoral and 4th lumbar vertebrae caused by the ovariectomy was prevented following the 25% prune diet; this group also had significantly higher levels of insulin-like growth factor-1 (IGF-1), which is strongly correlated with bone formation.



PRUNE POLYPHENOLS AND CARBOHYDRATE EFFECTS ON WEIGHT AND THE GUT ENVIRONMENT

Researchers from Oklahoma conducted two animal studies⁹ to explore the effects of prunes and their components (polyphenol and carbohydrate) on weight gain, body composition and on the gut environment (through measuring cecal bacterial taxa), in animal models of ovarian hormone deficiency (8 week old sham and ovariectomised mice). In the first study, mice were fed a control diet; 25% prunes; or crude polyphenol extract (CPE) (to a level equivalent to that in prunes). Those fed prunes or CPE significantly lessened the weight gain, percentage fat and abdominal white adipose tissue that was seen in the ovariectomised control mice at 5 and 10 weeks. A reduced decrease in bone mass density; enrichment of the Short Chain Fatty Acid (SCFA)-producing family was noted, specifically Lachnospiraceae, Coriobacteriaceae and Verrucomicrobiaceae, which are associated with weight regulation; and increases in cecal acetic, propionic, n-butyric and n-valeric acids, were also seen.

In the second study, mice were fed CPE fractions, polyphenols (PP) or carbohydrate (CHO) via a 2x2 factorial design. Carbohydrate, with or without polyphenols, significantly reduced the weight gain, percentage body fat and white adipose tissue induced by ovariectomy; and also reversed the loss of bone mass density. Verrucomicrobiaceae was more abundant with the PP group than CPE and the CHO group showed no changes to the cecal bacterial environment. SCFA were increased with CHO, regardless of PP content. Among the assessed outcomes, there were no additive effects of CHO and PP. The authors concluded that *'Although their prebiotic effects differ, both the carbohydrate and polyphenol components contribute to prunes effects on weight gain and body composition.'*

(Continued from Page 2)

DRIED FRUIT AND VASCULAR HEALTH

Prunes were included as part of investigating the effect of dried fruits on vascular health¹⁰. Professor Penny Kris-Etherton's research group at Pennsylvania State University studied 55 overweight or obese adults, who also exhibited at least 1 risk factor for cardiometabolic disease, randomised to a 2-period crossover trial.

Subjects consumed ¾ cup of dried fruit with no added sugars (28g each of prunes, raisins, figs and dates) versus a calorie and carbohydrate matched processed snack, daily for 4 weeks with a 2-4 weeks washout. Both groups were also advised to consume a daily portion of fresh fruit. No changes were seen to systolic blood pressure or measures of arterial stiffness. A significant decrease was seen in mean central pulse pressure following daily consumption of dried fruit compared to the control, which the authors note warrants further investigation.

PRUNES RESEARCH BROCHURE

For a full list of all research on prunes, please see our newly updated research brochure available at https://californiaprunes.co.uk/wp-content/uploads/2019/09/V2.0-CPB_2019_Research-Book-FINAL.pdf which lists prune research and references by topic.



Try this delicious autumn recipe...

Warm Goat's Cheese, Beetroot, Walnut & California Prune Salad

4 portions

10 mins prep time

15 mins cook time

INGREDIENTS (FOR THE SALAD)

60g whole walnuts, roughly chopped
200g round of goat's cheese, cut into four thick slices
8 handfuls of mixed leaves (suggest watercress, baby-spinach and lamb lettuce)
8 California Prunes, finely sliced
1 pack of 4 vacuum-packed cooked beets, drained and thickly sliced

INGREDIENTS (FOR THE DRESSING)

2 tbsp extra virgin olive oil
4 tbsp California Prune juice
1 tbsp lemon juice
2 tbsp orange juice
Salt and pepper, to taste

INSTRUCTIONS

1. Preheat the oven to 190C, (375F), gas mark 5.
2. Place all the dressing ingredients into a jar, close tightly and shake well. Set to one side.
3. Place the chopped walnuts on a baking tray and roast for 5 minutes, shaking once. When browned all over, remove and set to one side. Be careful not to burn the walnuts.
4. Place the cheese rounds on a baking tray lined with parchment or foil. Place in the hot oven and leave until they have started to melt, but are still holding their shape - about 5 minutes. Don't try to turn them.
5. Place the mixed leaves in a wide, shallow salad dish, arrange the sliced beets on top, and scatter over the sliced prunes and walnuts.
6. Remove the hot cheese slices from the oven, and using a lifter, carefully place them on top of the salad.
7. Drizzle with the dressing and serve immediately.
8. This salad is delicious with a side of barley couscous or quinoa.

CPB Nutrition Advisory Panel (NAP)

Correction: Our June newsletter outlined the NAP aims and listed members. In addition to the 2 new members announced, we also welcome Connie Weaver as a new member to join the NAP from 2019.

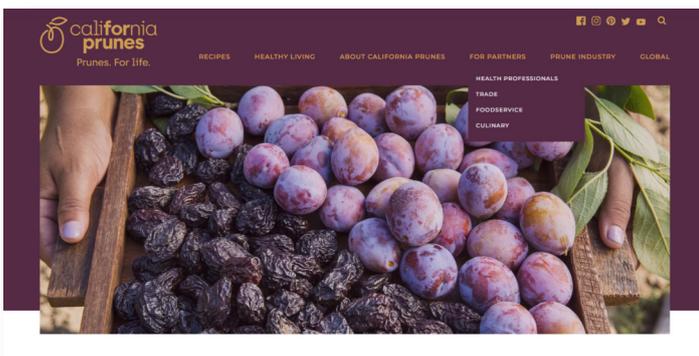


California Prune Board launch new branding and website

In May 2019, the California Prune Board rebranded in order to celebrate the benefits of California Prunes and to reflect how the industry has grown and evolved in light of research evidence. The new branding and website highlight the premium quality of California Prunes, and their role in gut and bone health.



With the new branding comes a tool kit of communication materials, including a contemporary fresh-looking website which is easy to navigate, and mobile friendly. With a dedicated section for our health professional partners, all nutrition research, information, newsletter archive and industry-specific resources are readily accessible. In addition, we have updated and rebranded our Nutrition Handbook and Research Brochure, publications aimed at



supporting HCPs with the latest research and nutrition information as it relates to prunes and their benefits. As well as printed copies, digital copies of these publications can also be located on the new website.

To access the health professionals' pages, we encourage you to sign up to our quarterly English-language newsletters via the website: <https://californiaprunes.co.uk/for-partners/health-professionals/>

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