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Prune Research Abstracts

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5 A DAY Just Eat More (fruit & veg)

Digestive Health

Kim S-E, Kim SM, Yu A, Marsh Z, Morales W, Kim G, Weitsman S, Triantafyllou K, Pimentel M, Chang C. (2014) The Effect of Dried Plum on Targeted Gut Flora and Phenotype in a Rat Model of Post Infectious IBS

Aims:

Dried plums are a source of antioxidants, polyphenolics, and dietary fibre, which we hypothesize could have a prebiotic effect, improve metabolism and bowel health, and mitigate effects of acute gastroenteritis.
We tested this using rats on dried plum and control diets, subsequently infected with the common pathogenic bacteria Campylobacter jejuni.

Methods:

Rats received normal chow or dried plum plus normal chow, with an inclusion requirement of prune consumption >7% bodyweight (n=10). Uninfected rats were euthanised after 6 weeks on diet. Remaining rats were gavaged with C. jejuni and euthanised 30 days post infection. DNA was extracted from luminal contents and total bacteria, Methanobrevibacter smithii, Bifidobacteria spp., Lactobacillus spp, Bacteroidetes spp, Firmicutes spp, Faecalibacterium prausnitzii, and segmented filamentous bacteria (SFB) were quantitated by qPCR. Gene expression was evaluated by RT-qPCR for β-defensin2, TNF-α, pregnane X receptor (PXR), (mucin) Muc-2, and (interleukin) IL-8.

Results:

We observed no change in animal weights or rate of colonization or clearance of the pathogen. Percent liquid content in stool was increased pre and post infection with plum diet. Total bacteria levels in rats on plum diet were equivalent to controls in large intestine pre infection but decreased post infection, and were decreased in the in the small intestine pre infection. Luminal composition was enriched in percent Bifidobacteria and M. smithii, and overall levels of lactobacillus and Bifidobacteria are significantly increased with plum diet. The percent content of Firmicuites was decreased post infection on plum diet. While there was no significant change in Bacteroidetes content, or Bacteroidetes to Firmicuites ratio, there were more rats with elevated Bacteroidetes post infection (increased mean) on plum diet. We did not find significant change in F. prausnitzii or SFB. Gene expression of β-defensin2 was elevated post infection and PXR levels were lower in rats on plum diet both pre and post infection. We did not see any significant changes in TNF-α, Muc-2, or IL-8.

Conclusions:

Rats on dried plum diet have increased Lactobacillus, Bifidobacteria and M. smithii suggesting a pre-biotic effect. While M. smithii is not considered a beneficial probiotic, it is associated with slowed gut transit could play a role in balancing diarrheal indications post infection. Plum fed rats also have decreased Firmicuites, which is associated with metabolic dysregulation and obesity, after C. jejuni exposure. With plum diet, PXR is suppressed, possibly decreasing sensitivity to toxin exposure and β-defensin2 was elevated post infection, potentially enhancing host immune defense to the pathogen.

As presented at American Gastroenterology Association, October 2014:
http://www.eventscribe.com/2014/acg/PostersTitles.asp?sort=num&dir=&h=Browse%20by%20NumberP1708

Lever E, Scott SM, Emery PW, Whelan K. (2014) The effect of prunes on stool output, whole gut transit time and gastrointestinal symptoms: a randomised controlled trial.

Prunes (dried plums) are perceived to help maintain healthy bowel function[1] and preliminary research suggests they improve stool frequency and consistency in mild constipation[2]. The high fibre and sorbitol content may aid in laxation[3], however the effects of prunes on gastrointestinal (GI) health are not well researched and mechanisms of action are unclear.

We conducted a three-arm, parallel group, randomised controlled trial to investigate the dose dependent effect of prunes on GI outcomes. 120 healthy people with 3-6 stools/wk (mean age 35 years, 60% female) were randomised to high-dose prunes (120 g/d + 300 ml water/d), low-dose prunes (80 g/d + 300 ml water/d) or control (300 ml water/d) for 4 weeks. The primary outcome was stool weight, assessed by 7-day total stool collection. Other outcomes included stool

frequency and consistency (stool diary), whole gut transit time (WGTT, radio-opaque markers) and GI symptoms (GI symptom rating scale). Outcome assessors were blinded to group assignment. Intervention effects were compared using analysis of covariance with baseline measurements as covariates, or Kruskal–Wallis test for non-parametric variables.

In the per-protocol analysis (n=104), compared with control, 120 g prunes increased stool weight and 80 g prunes increased the number of bowel movements (BMs). 80 g prunes also increased spontaneous BMs, but prunes had no effect on complete BMs, complete spontaneous BMs, WGTT, stool consistency, stool water and stool pH.

	Control (n=35)				80 g/d prunes (n=37)				120 g/d prunes (n=32)			
	Baseline		Intervention		Baseline		Intervention		Baseline		Intervention	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Stool weight (g/d)	110	43.0	109	61.4	90	45.1	114	70.5	99	51.6	135*	71.4
BMs (wk)	5.5	1.4	5.5	2.2	5.2	2.1	7.0**	3.9	5.0	1.7	5.7	1.6
SBMs (wk)	5.4	1.4	5.5	2.2	5.1	2.0	7.0***	3.9	5.0	1.7	5.5	1.5
WGTT (hrs)	43.4	27.4	36.3	28.9	41.0	29.1	32.8	27.3	46.5	30.5	39.5	29.4
BSC mean score	4.0	1.2	3.9	1.1	3.5	1.1	3.8	1.2	3.3	1.9	3.6	1.0
Stool water (%)	73.2	7.2	73.7	7.1	72.0	6.4	73.9	7.2	71.0	5.2	73.2	7.2
Stool pH	6.8	0.5	6.7	0.5	6.7	0.6	6.6	0.5	6.9	0.4	6.6	0.6

WGTT, whole gut transit time; BMs, bowel movements; BSC, Bristol Stool chart (1-7)
Means are significantly different from control (ANCOVA with baseline as covariate): * P 0.035 **P 0.027 *** P 0.032

Of 14 GI symptoms recorded, incidence of flatulence was higher in the 120 g group (4.9 (SD 2.2) d/wk) and 80 g group (4.8 (SD 2.6) d/wk), compared to control (0.5 (SD 0.6) d/wk, P 0.009) and severity of flatulence was higher in the 120 g group (1.1 (SD 0.7)) and 80 g group (1.0 (SD 0.7)) compared with control (0.5 (SD 0.6), P 0.001) although actual severity was relatively low (0=absent, 1=mild, 2=moderate, 3=severe). Incidence of acid reflux was higher in the 120 g group, compared to control (0.7 (SD 1.4) d/wk vs 0.1 (SD 0.2) d/wk, P 0.02) as was its severity (0.1 (SD 0.2) vs 0.0 (SD 0.0), P 0.02).

In healthy individuals, prunes seem well tolerated and significantly increase stool weight and bowel movements, but do not decrease WGTT. Stool weight is inversely related to colon cancer risk[4]. Therefore prunes have potential health benefits in the UK where average stool weight is low[4]. These findings support the existing health claim for prunes in the maintenance of normal bowel function.

Abstract available at:
http://www.nutritionsociety.org/summer-meeting-2014-programme

Attaluri A, Donahoe R, Valestin J, Brown K, Rao SS. (2011) Randomised clinical trial: dried plums (prunes) vs. psyllium for constipation. Alimentary Pharmacol Therapeutics. 33(7); 822-8

Background:

Treatment of chronic constipation remains challenging with 50% of patients dissatisfied with current therapy. There is an unmet need for natural and safe alternatives. Dried plums (prunes) have been used traditionally for constipation but their efficacy is not known. Aim To assess and compare the effects of dried plums and psyllium in patients with chronic constipation.

Methods:

Subjects were enrolled in an 8-week, single-blind, randomised cross-over study. Subjects received either dried plums (50 g b.d., fibre=6 gm/day) or psyllium (11 g b.d., fibre=6 gm/day) for 3 weeks each, in a crossover trial with a 1-week washout period. Subjects maintained a daily symptom and stool diary. Assessments included number of complete spontaneous bowel movements per week, global relief of constipation, stool consistency, straining, tolerability and taste.

Results:

Forty constipated subjects (m/f=3/37, mean age= 38 years) participated. The number of complete spontaneous bowel movements per week (primary outcome measure) and stool consistency scores improved significantly (P<0.05) with dried plums when compared to psyllium. Straining and global constipation symptoms did not differ significantly between treatments (P=N.S.). Dried plums and psyllium were rated as equally palatable and both were safe and well tolerated.

Conclusion:

Dried plums are safe, palatable and more effective than psyllium for the treatment of mild to moderate constipation, and should be considered as a first line therapy.

Abstract available at:
http://www.ncbi.nlm.nih.gov/pubmed/21323688

Howarth L, Petrisko Y, Furchner-Evanson A, Nemoseck T, Kern M. (2010) Snack Selection Influences Nutrient Intake, Triglycerides, and Bowel Habits of Adult Women: A Pilot Study. JADA. 110(9); 1322-7

Because appropriate snacking can promote a healthy body weight and serve as an important contributor to a healthy diet for women, identification of suitable foods for incorporation between meals is essential. We investigated the influence of short-term (2 weeks) incorporation of 100-kcal servings of snacks of dried plums vs low-fat cookies twice daily on total energy and nutrient intake, biochemical parameters, and bowel habits in a randomized crossover design of two 2-week trials separated by a 2-week wash-out period in 26 women aged 25 to 54 years with a body mass index between 24 and 35. Incorporation of dried plums or low-fat cookies into the diet did not alter energy intake or weight; however, compared to cookies, dried plums promoted greater (P< or =0.05) intake of fibre, potassium, riboflavin, niacin, and calcium. Total fat intake tended (P=0.094) to decrease with dried plum consumption, as did cholesterol intake (P=0.098). Plasma triglyceride concentration remained unchanged (P>0.05) by dried plum consumption and was 17.0+/-29.2 mg/dL (0.19+/-0.33 mmol/L) higher (P< or =0.05) after consumption of low-fat cookies vs dried plums at the end of 2 weeks. Dried plums promoted a softer (P< or =0.05) stool consistency vs usual intake and in comparison to intake of low-fat cookies. These results suggest that relative to a commercially processed low-fat cookie snack, dried plums promote more favourable plasma triglyceride responses, improved dietary quality, and slightly improved bowel function.

Abstract available at:
http://www.ncbi.nlm.nih.gov/pubmed/20800123

Satiety

Harrold JA, Hughes G, Boyland EJ, Williams NJ, McGill R, Blundell JE, Finlayson G, Higgs J, Harland JI, Halford, JCG. (2014) Dried fruit (prune) consumption does not undermine active weight management or produce adverse gastrointestinal effects.

Aim:

Consumption of dried fruit has been advised against during weight loss despite evidence it enhances satiety. This study examined whether (i) incorporating prunes into a weight loss intervention undermined weight control; (ii) low fibre consumers could tolerate the inclusion of prunes in their diet for a 12-week period, and (iii) prunes induced chronic beneficial changes in appetite.

Methods:

100 overweight and obese low-fibre consumers (74F, 26M; age 43(SEM1.3) y; BMI 29.8 (SEM0.3) kg/m^2) completed a randomised between-subjects study with two groups (intervention and active control) to assess the effects of prunes (140g/day F, 171g/day M) on weight and appetite in comparison to control (advice on healthy snacks) over a 12-week period of active weight loss.

Results:

The study showed that taking prunes as part of a healthy life-style intervention produced significant changes in body weight (1.99kg/2.4%; p<0.000) and waist circumference (2.5cm/2.3%; p<0.000) from baseline. These were slightly greater than in the active control but did not reach statistical significance. Weight loss between the groups diverged during the last 4 weeks with a trend for greater weight loss in the prune group (p=0.07). Moreover, despite the high daily doses, prunes were well tolerated. These are the first data to demonstrate both effects. Enduring effects on appetite were also observed with AUC analysis demonstrating increased fullness in the prune group after week 8 (p=0.05).

Conclusion:

This study clearly demonstrates no negative consequences of including prunes into weight control diets with some indication of benefit to long-term success. This may relate to chronic appetite effects.

Abstract available at:
http://eco2014.easo.org/wp-content/uploads/sites/7/2014/05/BOOK-OF-HT-ABSTRACT-POSTER.pdf
Abstract number HTPO.017

Fusco E, Clayton Z, Kass L, Carpenter J, Hooshmand S, Hong MY, Kern M. (2014) Carbohydrate-rich snacks influence plasma glucose, insulin and ghrelin responses in overweight adults. FASEB. 28(1); 1039.5

The effects of a whole food (dried plums; DP) or refined (low-fat muffins; LFM) snack on satiety and insulin responses following consumption were assessed before and after a snack intervention trial. Forty overweight men and women (age: 36.5 ± 11.4, BMI: 32.8 ± 7.1 kg/m^2) were randomly assigned to consume isocaloric, macronutrient-matched 100 kcal snacks twice per day of DP or LFM for 8-weeks. At baseline and 8 weeks, fasted subjects consumed 238 kcal of their randomly assigned food, and blood samples were collected at baseline, 15, 30, 45, 60, 90, and 120 min following intake. Insulin was lower (p≤0.05) and an earlier peak was observed in DP versus LFM at baseline and 8 weeks. Both groups exhibited lower plasma glucose during the acute response testing after 8 weeks, but glucose peaked earlier in DP than LFM. There were no significant differences in ghrelin concentration over time in either group. These results support the concept that consuming a whole food snack such as dried plums enhances insulin sensitivity as compared to an isocaloric refined snack food, as evidenced by lower insulin concentrations and an earlier peak in insulin and glucose in DP compared to LFM.

Abstract available at:
http://www.fasebj.org/content/28/1_Supplement/1039.5

Furchner-Evanson A, Petrisko Y, Howarth L, Nemoseck T, Kern M. (2010) Type of snack influences satiety responses in adult woman. Appetite. 54(3); 564-569

The effect of different snack foods on satiety and plasma glucose and hormone responses was assessed. Nineteen fasted adult women (mean age: 39.2 ± 0.7 years, mean BMI: 26.1 ± 0.8 kg/m^2) consumed test foods including dried plums, low-fat cookies, white bread and water only on separate days. The test foods (with the exception of water) provided 238 kcal and were similar in total carbohydrate, fat and protein content but differed in fibre and sugar content. Subjects rated their feelings of hunger using satiety index scales prior to snack consumption and again every 15 min for 2 h following initiation of intake. Blood samples were collected at baseline and 15, 30, 45, 60, 90, and 120 min following intake. At the end of the 120-min test period, subjects were presented with a meal to be consumed until satisfied. The satiety index AUC was greater for the dried plum trial versus the low-fat cookie trial ($p \leq 0.05$). There was no difference in post-snack consumption between the dried plums and cookie trials. The dried plums trial elicited lower plasma glucose and insulin AUC than the low-fat cookie trial ($p \leq 0.05$) and tended to promote a greater plasma ghrelin AOC ($p = 0.056$). These results demonstrate that consuming dried plums as a snack suppresses hunger relative to a low-fat cookie as evidenced by lower glucose and/or satiety-regulating hormone concentrations.

Available at:
http://www.sciencedirect.com/science/article/pii/S0195666310000711

Bone Health

Hooshmand A, Brisco JRY, Arjmandi BH. (2014) The effect of dried plum on serum levels of receptor activator of NF-kB ligand, osteoprotegerin and sclerostin in osteopenic postmenopausal women: a randomised controlled trial. BJN. 112; 55-60

Although several studies have confirmed the bone-protective properties of dried plum, its exact mechanisms of action remain unclear. Recent research has shown that osteocytes may control bone formation via the production of sclerostin and bone resorption via the receptor activator of NF-kB ligand (RANKL) and its inhibitor osteoprotegerin (OPG). To investigate the mechanism of action of dried plum in reversing bone loss, we measured serum levels of RANKL, OPG and sclerostin in osteopenic postmenopausal women (n 160). Participants were randomly assigned to the treatment group of either 100g dried plum/d or 75g dried apple/d (comparative control) for 1 year. All participants received 500mg Ca plus 400IU (10μg) vitamin D daily. Bone mineral densities (BMD) of the lumbar spine, forearm, hip and whole body were assessed at baseline and at the end of the study using dual-energy X-ray absorptiometry. Blood samples were collected at baseline and after 12 months to assess bone biomarkers. Dried plum significantly increased the BMD of the ulna and spine in comparison with the control group. In comparison with corresponding baseline values, dried plum increased the RANKL levels by only +1·99 v. +18·33% and increased the OPG levels by +4·87 v. -2·15% in the control group. Serum sclerostin levels were reduced by -1·12% in the dried plum group v. +3·78%. Although percentage changes did not reach statistical significance ($P \leq 0{\cdot}05$), these preliminary data may indicate that the positive effects of dried plum on bone are in part due to the suppression of RANKL production, the promotion of OPG and the inhibition of sclerostin.

Abstract available at:
http://www.ncbi.nlm.nih.gov/pubmed/24780728

Hooshmand S, Chai SC, Saadat RI, Payton ME, Brummel-Smith K, Arjmandi BH. (2011) Comparative effects of dried plum and dried apple on bone in 2 postmenopausal women. BJN 106(6); 923-30

Aside from existing drug therapies, certain lifestyle and nutritional factors are known to reduce the risk of osteoporosis. Among the nutritional factors, dried plum or prunes (Prunus domestica L.) is the most effective fruit in both preventing and reversing bone loss. The objective of the present study was to examine the extent

to which dried plum reverses bone loss in osteopenic postmenopausal women. We recruited 236 women, 1-10 years postmenopausal, not on hormone replacement therapy or any other prescribed medication known to influence bone metabolism. Qualified participants (n 160) were randomly assigned to one of the two treatment groups: dried plum (100 g/d) or dried apple (comparative control). Participants received 500 mg Ca plus 400 IU (10 µg) vitamin D daily. Bone mineral density (BMD) of lumbar spine, forearm, hip and whole body was assessed at baseline and at the end of the study using dual-energy X-ray absorptiometry. Blood samples were collected at baseline, 3, 6 and 12 months to assess bone biomarkers. Physical activity recall and 1-week FFQ were obtained at baseline, 3, 6 and 12 months to examine physical activity and dietary confounders as potential covariates. Dried plum significantly increased BMD of ulna and spine in comparison with dried apple. In comparison with corresponding baseline values, only dried plum significantly decreased serum levels of bone turnover markers including bone-specific alkaline phosphatase and tartrate-resistant acid phosphatase-5b. The findings of the present study confirmed the ability of dried plum in improving BMD in postmenopausal women in part due to suppressing the rate of bone turnover.

Abstract available at:
http://journals.cambridge.org/action/displayFulltexttype=6&fid=8376147&jid=BJN&volumeId=106&issueId=06& aid=8376146&bodyId=&membershipNumber=&societyETOCSession= &fulltextType=RA&fileId=S000711451100119X

Review

Stacewicz-Sapuntzakis M. (2013) Dried Plums and Their Products: Composition and Health Effects – An Updated Review. Critical Reviews in Food Science and Nutrition. 53(12); 1277-302

This paper describes composition of dried plums and their products (prune juice and dried plum powder) with special attention to possibly bioactive compounds. Dried plums contain significant amounts of sorbitol, quinic acid, chlorogenic acids, vitamin K1, boron, copper, and potassium. Synergistic action of these and other compounds, which are also present in dried plums in less conspicuous amounts, may have beneficial health effects when dried plums are regularly consumed. Snacking on dried plums may increase satiety and reduce the subsequent intake of food, helping to control obesity, diabetes, and related cardiovascular diseases. Despite their sweet taste, dried plums do not cause large postprandial rise in blood glucose and insulin. Direct effects in the gastrointestinal tract include prevention of constipation and possibly colon cancer. The characteristic phenolic compounds and their metabolites may also act as antibacterial agents in both gastrointestinal and urinary tracts. The indirect salutary effects on bone turnover are supported by numerous laboratory studies with animals and cell cultures. Further investigation of phenolic compounds in dried plums, particularly of high molecular weight polymers, their metabolism and biological actions, alone and in synergy with other dried plum constituents, is necessary to elucidate the observed health effects and to indicate other benefits.

Abstract available at:
http://www.ncbi.nlm.nih.gov/pubmed/24090144

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