



# Effects of dried plum on bone biomarkers in men

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## Abstract

Osteoporosis in men is an overlooked yet increasingly important clinical problem that, historically, has not received the same degree of awareness as with women. Although several studies of male animals have demonstrated bone protective effects of dried plum, no human study has evaluated the effect of dried plum on bone metabolism in men. For this purpose, we conducted a randomized controlled clinical study to test if daily inclusion of 100 g dried plum will positively influence serum markers of bone metabolism in men. Sixty-six men (50-79 years old) were randomly assigned to one of two treatment groups: 1) control (0 g dried plum + calcium/Vitamin D supplement) or; 2) 100 g dried plum (+calcium/Vitamin D supplement) with fifty-eight subjects completing the study. Blood samples were collected at baseline, and after three and six months to assess biomarkers of bone turnover. Serum bone specific alkaline phosphatase (BAP) levels decreased significantly at 6 months in both control and dried plum groups. 100 g/day dried plum consumption resulted in a time dependent reduction in serum tartrate resistant acid phosphatase-5b (TRAP5b) levels, a marker of bone resorption, at three- and six-month time intervals compared to baseline while there were no significant changes in serum TRAP5b levels of the control group. Dried plum consumption significantly decreased C-terminal collagen cross-links (CTX), another marker of bone resorption, at three- and six-months compared to baseline. No changes were observed in the control group for CTX levels. The results of the current study suggest that daily consumption of 100 g dried plum for 6 months has modest bone protective effects in men that are somewhat similar to those observed in postmenopausal osteopenic and older osteopenic women.

## Introduction

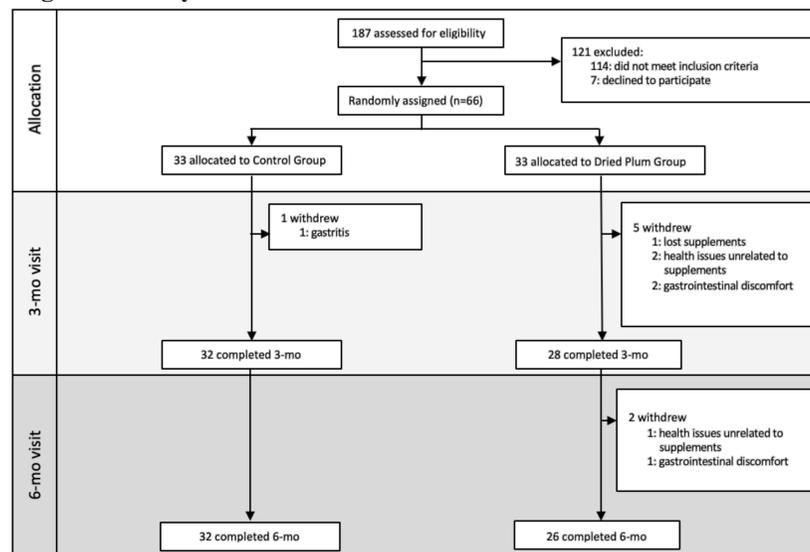
- Osteopenia and osteoporosis affect over 54 million people in the United States and their incidences are increasing due to the aging of the population (NOF, 2019).
- Dried plums are natural foods that may be effective in preventing bone loss (Arjmandi et al., 2017).
- The effect of dried plums has been observed in male rats. However no comparable studies have been done on men (Smith et al., 2014).
- The aim of this study is to determine the effects of 100 g of dried plum per day on the bone biomarkers of men 50-79 years of age when consumed over a six-month period.



## Methodology

- Sixty-six men (50 to 79 years of age) received either 100 g dried plum/day plus calcium /Vitamin D supplement or a control regimen (calcium/Vitamin D supplement) for 6 months.

Figure 1: Study Flowchart



- Blood samples were obtained at baseline, 3 months, and 6 months and analyzed for serum markers of bone formation (BAP and PINP) and bone resorption (TRAP 5b and CTX).
- Data were analyzed using analysis of variance methods with PROC MIXED in PC SAS analyzing the main and interaction effects of two factors, treatment (0, 100 g/day dried plum), and time (baseline, 3 months, and 6 months) and differences were considered statistically significant at P<.05.

Table 1: Baseline characteristics of study population

Group	Dried Plum (n=33) M ± SD	Control Group (n=33) M ± SD
Age (years)	62.1 ± 13.1	62.0 ± 12.9
Height (cm)	175.5 ± 6.5	178.7 ± 7.7
Weight (baseline, kg)	84.9 ± 12.3	88.7 ± 15.0
Weight (3 months, kg)	83.6 ± 10.4	89.1 ± 15.1
Weight (6 months, kg)	86.1 ± 11.3	89.2 ± 14.7
BMI (baseline, kg/m <sup>2</sup> )	27.6 ± 3.4	27.7 ± 3.6
T-Score Spine (baseline)	0.2 ± 1.6	0.5 ± 1.7
T-Score Femur (baseline)	-0.4 ± 1.0	-0.5 ± 1.2

BMI, body mass index

## Results

- Serum BAP levels decreased significantly at 6 months in both control and dried plum groups (Table 2).
- 100 g/day dried plum consumption reduced serum TRAP5b levels, a marker of bone resorption, at 3 and 6-month time intervals compared to baseline while there were no significant changes in serum TRAP5b levels of the control group (0 g/day dried plum).
- CTX, another marker of bone resorption, decreased significantly at 3 and 6-months compared to baseline in dried plum group. No changes were observed in control group for CTX levels.

Table 2: Mean serum concentrations of biomarkers of bone metabolism

Measures	Dried Plum	Time			P Value	P Value Group x Time
		Baseline	3 Months	6 Months		
BAP (U/L)	0 g	22.83 <sup>a</sup> ± 1.03	22.06 <sup>a</sup> ± 0.96	19.67 <sup>b</sup> ± 1.04	0.01	0.01
	100 g	23.85 <sup>a</sup> ± 1.54	23.28 <sup>a</sup> ± 1.41	20.86 <sup>b</sup> ± 1.79	0.03	
TRAP5b (U/L)	0 g	2.73 ± 0.18	2.61 ± 0.22	2.79 ± 0.19	NS	0.04
	100 g	3.04 <sup>a</sup> ± 0.21	2.70 <sup>b</sup> ± 0.15	2.76 <sup>b</sup> ± 0.19	0.028	
CTX (ng/mL)	0 g	0.3 ± 0.18	0.28 ± 0.18	0.27 ± 0.17	NS	0.02
	100 g	0.30 <sup>a</sup> ± 0.16	0.27 <sup>b</sup> ± 0.16	0.25 <sup>b</sup> ± 0.2	0.04	
PINP (ng/mL)	0 g	48.58 ± 18.27	47.16 ± 15.26	45 ± 15.04	NS	0.1
	100 g	45.5 ± 13.85	46.6 ± 13.85	46.6 ± 16.1	NS	

## Discussion

- TRAP5b and CTX confirmed our hypothesis that dried plum improves bone turnover.
- The results of the current study suggest that daily consumption of 100 g dried plum for 6 months has modest bone protective effects in men.

## Acknowledgements

- This project was funded by the California Dried Plum Board.
- Calcium/vitamin D supplements were graciously donated by Shaklee (Pleasanton, CA).

Nutrition Facts	
Serving size	100 grams
Amount Per Serving	
Calories	240
% Daily Value*	
Total Fat 0g	0%
Saturated Fat 0.0875g	0%
Trans Fat 0g	
Polyunsaturated Fat 0.0625g	
Monounsaturated Fat 0.0525g	
Cholesterol 0mg	0%
Sodium 0mg	0%
Total Carbohydrate 64g	23%
Dietary Fiber 7g	25%
Total Sugars 38g	
Includes 0g Added Sugars	0%
Protein 0g	0%

Vitamin D 0mcg	0%
Calcium 55.3mg	4%
Iron 0.8325mg	4%
Potassium 732mg	15%
Vitamin A	4%
Vitamin K	45%
Thiamin	4%
Riboflavin	15%
Niacin	10%
Vitamin B6	10%
Folate	2%
Phosphorus	10%
Magnesium	10%
Zinc	4%
Copper	15%
Manganese	15%

\*The % Daily Value (DV) tells you how much a nutrient in a serving of food contributes to a daily diet. 2,000 calories a day is used for general nutrition advice.