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Ashley Anderson  
*Winona State University*

Melanie Anderson  
*Winona State University*

Janel Jacobson  
*Winona State University*

Mackenzie Popko  
*Winona State University*

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# Metabolic Effects of Bedtime Pistachio Consumption for 6 weeks in Overweight Persons

Ashley D. Anderson, Melanie M. Anderson, Janel L. Jacobson, Mackenzie R. Popko, Jessica R. Young, Ted Wilson



Department of Biology, Winona State University, Winona, MN

## Introduction:

Weight loss can lower LDL and total cholesterol. Diets rich in mono- and polyunsaturated fatty acids can lower LDL and total cholesterol as well as increase HDL cholesterol. All of these effects can reduce heart disease mortality [Anderson, 2012; Rossi, 2012; Leichtle, 2011]. Pistachios are high in mono- and polyunsaturated fats as well as fiber, which lead to improved cholesterol profiles. Because pistachios are rich in fat many consumers avoid these nuts for fear that consumption could lead to weight gain and greater dyslipidemia. However, pistachios are rich in protein potentially resulting in increased satiety or fullness which can beneficially alter caloric intake and weight maintenance/loss [USDA.gov; Dreher, 2012].

Both healthy men and women should have an LDL below 100 mg/dL [Shepherd, 2001]. Healthy men should have an HDL above 40 mg/dL, whereas healthy women should have an HDL above 50 mg/dL [Yetukuri et. al., 2010]. If LDL cholesterol levels are too high, there are different steps that individuals can take to lower their cholesterol to a healthy level and prevent heart disease. Weight loss and conversion from using diets rich in saturated fatty acids to mono- and polyunsaturated fatty acids are central to improvements in dyslipidemia [Matheus et. al., 2013].

Prior pistachio studies on metabolic effects are legion with caloric intakes of 15% [Sheridan et. al., 2007], 16% and 27% [Wang et. al., 2012], 20% [Edwards et. al., 1999], and 20% [Li et. al., 2010]. Our study sought to determine the effect of consumption of 1.25 ounces of pistachios (13.67% daily caloric intake) at bedtime on metabolic profiles and weight loss. We chose to study overweight people because of their risk for dyslipidemia, risk for impaired insulin sensitivity, concern (fear) about caloric intake effects on weight loss success, and high risk for cardiovascular disease.

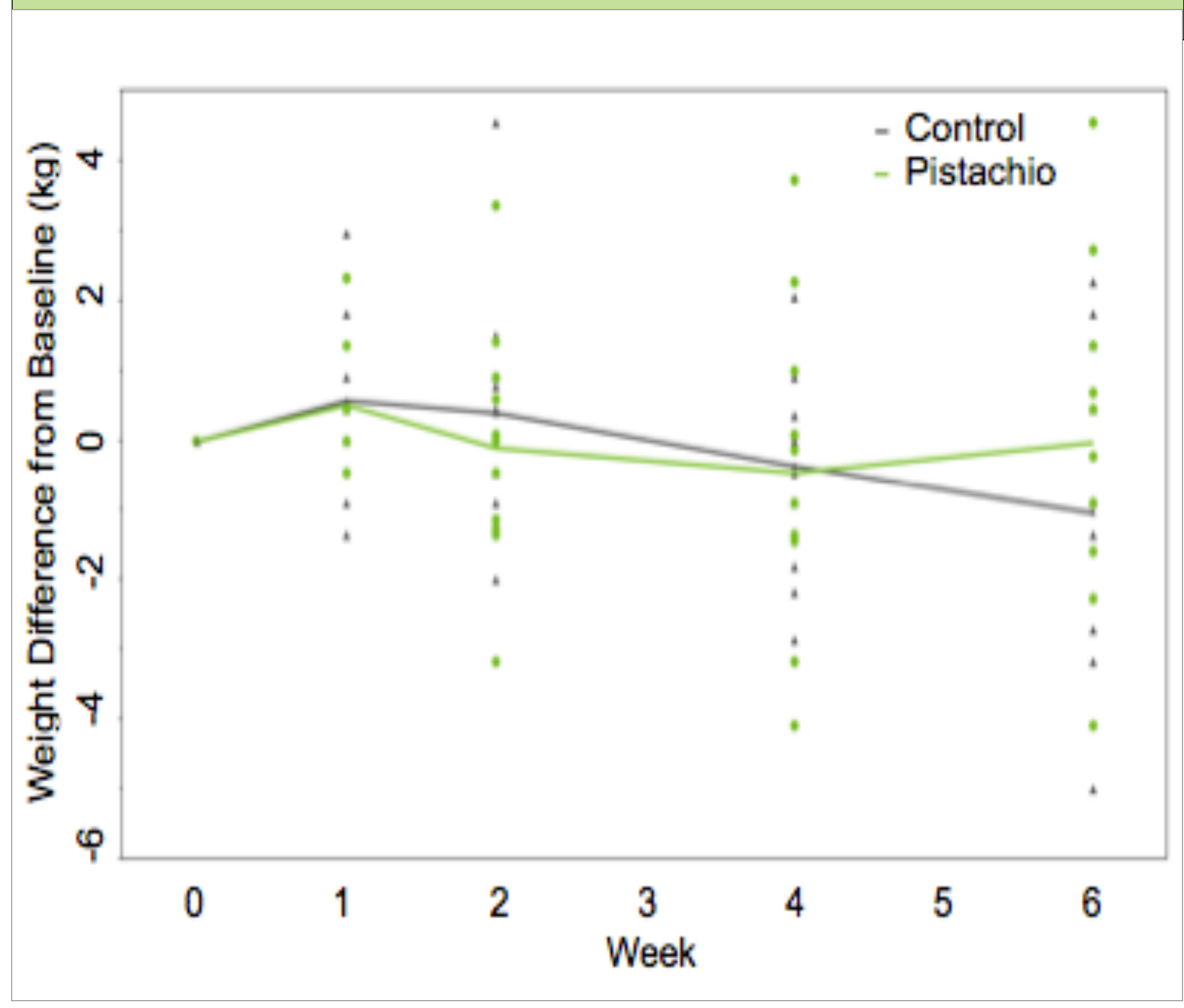
## Methods:

This study was approved by the Winona State University Institutional Review Board. Subjects [female (n=16) and male (n=6)] were recruited through email, posters, and newspapers. Control participants had an initial mean BMI of 32.1 ± 4.4. Pistachio participants had an initial mean BMI of 30.2 ± 3.6.

Participants were randomized to either pistachio or control treatment groups. Pistachio individuals consumed 13.67% of their daily caloric intake in pre-shelled, roasted, unsalted pistachios at bedtime for 42 days. Pistachios were donated from American Pistachio Growers in California. This serving contained 200 total calories and 16.3 g total fat (1.9 g saturated, 8.7 g monounsaturated, and 5.0 g polyunsaturated fat). No other nuts were permitted in either group. Participants were required to complete daily dietary journals and exercise records (in minutes) to ensure compliance with dietary restrictions and to determine their activity level throughout the study. Weight was measured on days 0, 7, 14, 28, and 42. Blood work was completed at days 0 and 42. All data is expressed as mean ± standard deviation.

## Results:

**Figure 1:** Pistachio consumption in overweight person once daily at bedtime resulted in no significant effect on body weight differences within or between treatment groups.



**Table 1:** Pistachio consumption had no significant effect on BMI differences between each treatment group.

Variable	Week	Control	Pistachio
BMI	0	32.1 ± 4.5	30.2 ± 3.4
	6	31.8 ± 4.5	30.2 ± 3.3

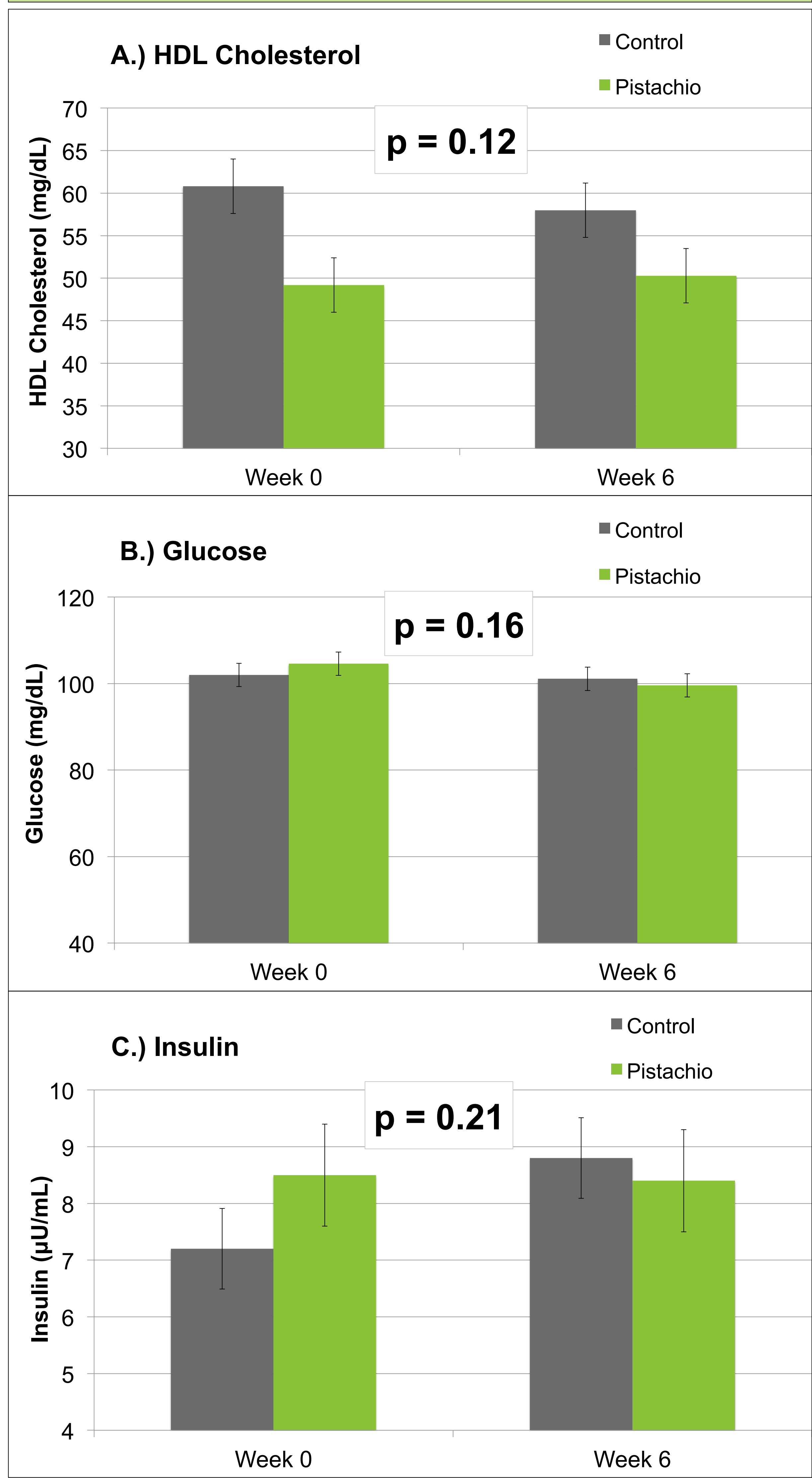
**Table 2:** Pistachio consumption effects on plasma glucose and insulin.

Variable	Week	Control	Pistachio
Glucose (mg/dL)	0	102.0 ± 2.8	104.6 ± 2.8
	6	101.1 ± 2.6	99.6 ± 2.6
Insulin (µU/mL)	0	7.2 ± 0.7	8.5 ± 1.0
	6	8.8 ± 0.7	8.4 ± 0.9

**Table 3:** Pistachio consumption effects on HDL cholesterol, LDL cholesterol, total cholesterol, and triglycerides.

Variable	Week	Control	Pistachio
HDL Cholesterol (mg/dL)	0	60.8 ± 3.8	49.2 ± 3.5
	6	58.0 ± 2.7	50.3 ± 3.0
LDL Cholesterol (mg/dL)	0	150.7 ± 28.8	161.9 ± 30.2
	6	144.6 ± 30.4	152.4 ± 27.9
Total Cholesterol (mg/dL)	0	211.6 ± 29.9	211.1 ± 30.7
	6	202.6 ± 31.3	202.6 ± 24.7
Triglycerides (mg/dL)	0	120.6 ± 51.7	123.7 ± 41.8
	6	111.3 ± 49.0	118.2 ± 33.7

**Figure 2:** Pistachio consumption (6 weeks) promoted a trend towards beneficial effects for HDL cholesterol, glucose, and insulin. [p-values compare the difference between week 6 and 0 for the control and pistachio groups.]



**Table 4:** Exercise differences between pistachio and control groups were not statistically significant and likely did not affect metabolic profiles.

Exercise	Control	Pistachio
Walking	34.3 ± 24.9	32.1 ± 11.9
House/Yard Work	25.8 ± 20.3	25.1 ± 15.6
Total	47.4 ± 15.1	44.7 ± 20.2

## Main Points:

- 1.) Subject study completion was 100% for the 6-week study.
- 2.) Evaluation of daily dietary records (not shown) suggest 95% compliance regarding required dietary restrictions.
- 3.) Body weight and BMI were unchanged during the 42-day study within or between pistachio and control groups.
- 4.) A similar lack of statistically significant changes in body weight and BMI were observed when results were split into tertiles.
- 5.) Difference in HDL cholesterol between treatment groups (p = 0.12) from week 6 to 0 trended toward significant beneficial effects.
- 6.) Difference in glucose between treatment groups (p = 0.16) from week 6 to 0 trended toward significant beneficial effects.
- 7.) Difference in insulin between treatment groups (p = 0.21) from week 6 to 0 trended toward significant beneficial effects.

## Conclusion:

This is the first study of once daily pistachio consumption in overweight persons with a specific daily time of nut consumption. Consumption of 1.25 ounces of pistachios at bedtime by overweight persons for 42 days is not associated with statistically significant changes in body weight, LDL cholesterol, total cholesterol, and triglycerides. A beneficial trend toward significance was observed for HDL cholesterol, glucose, and insulin. This suggests that 1.25 ounces per day at bedtime is near the minimum daily amount needed for beneficial effects, without deleteriously affecting body weight.



## Acknowledgments:

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