

implanted animals. After 3 months, body weight in the sham animals increased by 36%, whereas body weight in the implant animals decreased by 21%. There were no postsurgical complications, and all animals remained healthy throughout the study.

At the end of the study, animals receiving implants appeared lean. At necropsy, the internal and external appearance of the abdominal organs appeared normal in both sham and implanted animals. The OGVS was completely encapsulated in a thin sheath of white connective tissue. No tears were present, and no extension of the suture holes was noted. This device needs further study but may be a future option for the treatment of patients with obesity.

Benefits of Avocado Consumption in Overweight and Obese Subjects

Written by Brian Hoyle

Consumption of 1 avocado each day as part of a moderate-fat diet can lower low-density lipoprotein cholesterol (LDL-C) concentration and the number of low-density lipoprotein particles (LDL-P; determined by nuclear magnetic resonance) more so than a cholesterol-lowering low-fat diet or an avocado-free moderate-fat diet. The findings were presented by PhD candidate Li Wang, The Pennsylvania State University, University Park, Pennsylvania, USA.

Elevated LDL-C is a risk factor for cardiovascular disease and stroke. Avocados are a nutrient powerhouse that can lower LDL-C levels [Colquhoun DM et al. *Am J Clin Nutr* 1992; Lopez LR et al. *Arch Med Res* 1996; Pieterse Z et al. *Nutrition* 2005]. The number and size of LDL-P are also important in determining cardiovascular risk. Particles that are smaller and denser can more readily penetrate the arterial wall and promote plaque formation.

The study assessed 4 diets (Table 1). The 45 subjects were randomly assigned to initially receive a low-fat, moderate-fat, or avocado diet for 5 weeks, with subsequent 5-week diet periods with the remaining 2 diets. Each diet period was separated by a washout interval (Figure 1).

Clinical visit involving blood draw and monitoring of vital signs was performed at randomization and after each 5-week diet period. The subjects were 21 to 70 years of age, were healthy, and had a body mass index of 25 to 35 kg/m² and LDL-C in the 25th to 90th percentile. Exclusion criteria were history of cardiovascular disease or diabetes mellitus, blood pressure 140/90 mm Hg, and use of cholesterol-lowering medications or supplements. Baseline characteristics are summarized in Table 2.

All 3 diets lowered total cholesterol and LDL-C compared to baseline. The reduction of LDL-C on the avocado diet was greater than the moderate- and low-fat diets. Triglycerides, very-low-density lipoprotein cholesterol, and intermediate-density lipoprotein

Table 1. Diets Used in the Study

Nutrient ^a	Average US Diet	Lower-Fat Diet	Avocado Diet	Moderate-Fat Diet
Percentage of total calories				
Total fat	34	24	34	34
SFA	12	7	7	7
MUFA	15	12	18	18
PUFA	7	5	9	9
Carbohydrate	51	~59	~48	~48
Protein	16	16–17	16–17	16–17
Fiber, g/day	15	25	35	25
Cholesterol, mg/day	336	<200	<200	<200

MUFA=monounsaturated fatty acid; PUFA=polyunsaturated fatty acid; SFA=saturated fatty acid. ^aBased on a 2000-calorie diet.



CLINICAL TRIAL HIGHLIGHTS

Figure 1. Study Design

		5 weeks	2 week break	5 weeks	2 week break	5 weeks
2 week run-in using average American diet	Randomization (n = 45)	Lower fat diet		Moderate fat diet		Avocado diet
		Avocado diet		Lower fat diet		Moderate fat diet
		Moderate fat diet		Avocado diet		Lower fat diet

Table 2. Baseline Characteristics of Subjects

Baseline Characteristics	Male (n=27)	Female (n=18)	Combined (n=45)
Age, years	40 ± 14.1	51 ± 9.1	45 ± 13.3
Body mass index, kg/m ²	28.2 ± 2.3	28.2 ± 2.5	18.2 ± 2.4
Total cholesterol, mg/dL	192.6 ± 28.4	211.0 ± 35.6	199.9 ± 32.4
LDL	124.8 ± 23.0	133.0 ± 30.3	128.1 ± 26.1
HDL	44.2 ± 10.1	55.3 ± 12.0	48.7 ± 12.1
Triglyceride, mg/dL	113.6 ± 38.8	114.8 ± 41.9	114.0 ± 39.6
Glucose, mg/dL	94.0 ± 8.9	89.2 ± 5.6	92.2 ± 8.0
Insulin, µIU/mL	3.0 (1.9, 6.0)	4.0 (2.0, 6.0)	3.5 (1.6, 6.0)
hsCRP, mg/L	0.8 (0.4, 1.3)	1.1 (0.8, 2.7)	0.9 (0.5, 2.4)
Blood pressure, mm Hg			
Diastolic	80.4 ± 7.4	77.2 ± 7.0	79.2 ± 7.4
Systolic	118.4 ± 9.8	115.2 ± 11.3	117.2 ± 10.4
Race			
White	23	18	41
African	1		1
Asian	3		3

Values are mean ± SD, except for hsCRP, which is reported as median with 25% and 75% percentile values. HDL, high-density lipoprotein; hsCRP, high-sensitivity C-reactive protein; LDL, low-density lipoprotein.

cholesterol were elevated in subjects on the low-fat diet. Both large and small subclasses of LDL-C decreased from baseline for all diets; however, only the avocado diet significantly decreased small, dense LDL-C (LDL₃₊₄). In addition, only the avocado diet significantly decreased LDL-P. The discordance between the change in LDL-C versus LDL-P by the low- and moderate-fat diets is due to their effects on small LDL-P. The moderate- and low-fat diets significantly increased small LDL-P, but the avocado diet did not.

The study supports the importance of a diet that includes an avocado per day for decreasing the risk of cardiovascular disease, and the benefit extends beyond the cholesterol-lowering fatty acid profile of avocados.

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