

Food-Based Angiogenesis Inhibitors

Kinexum – Pennington

Translational Grand Rounds

Frank Greenway, MD, March 21, 2013

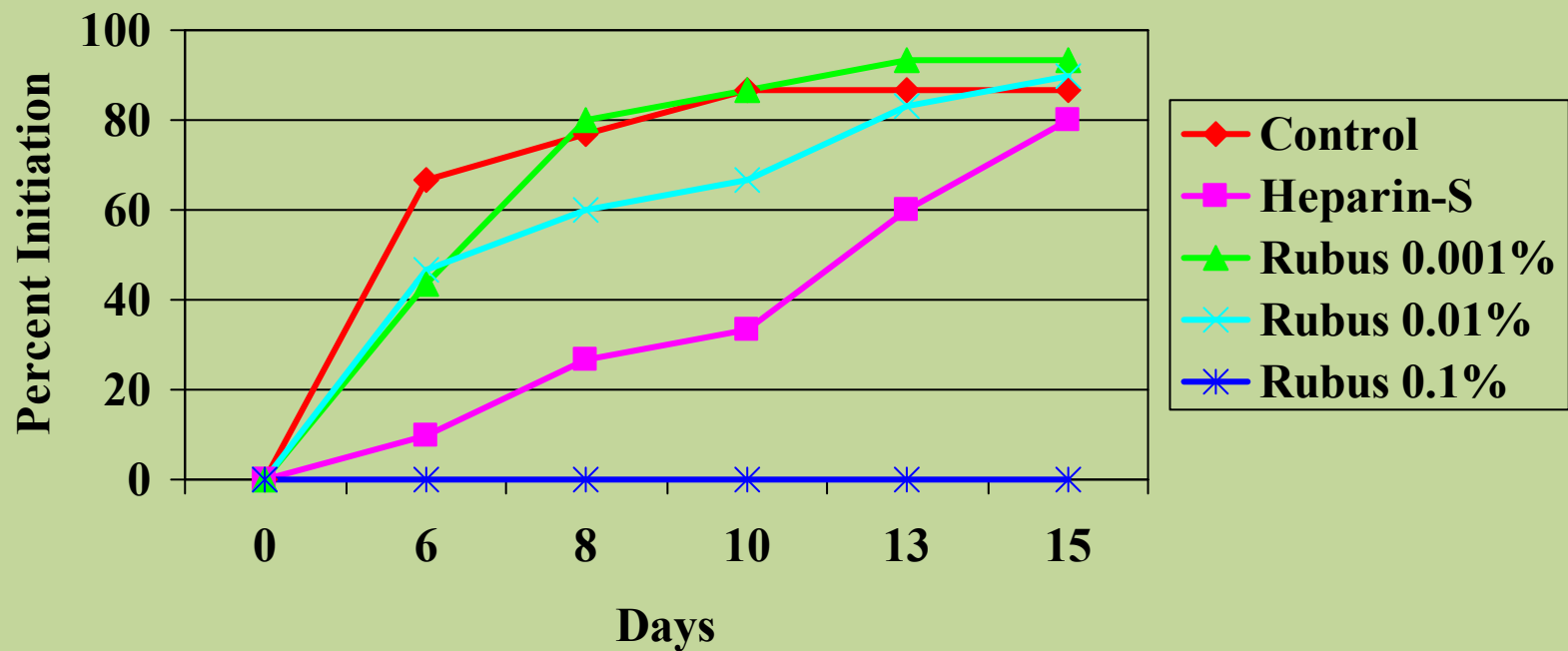
Black Raspberry



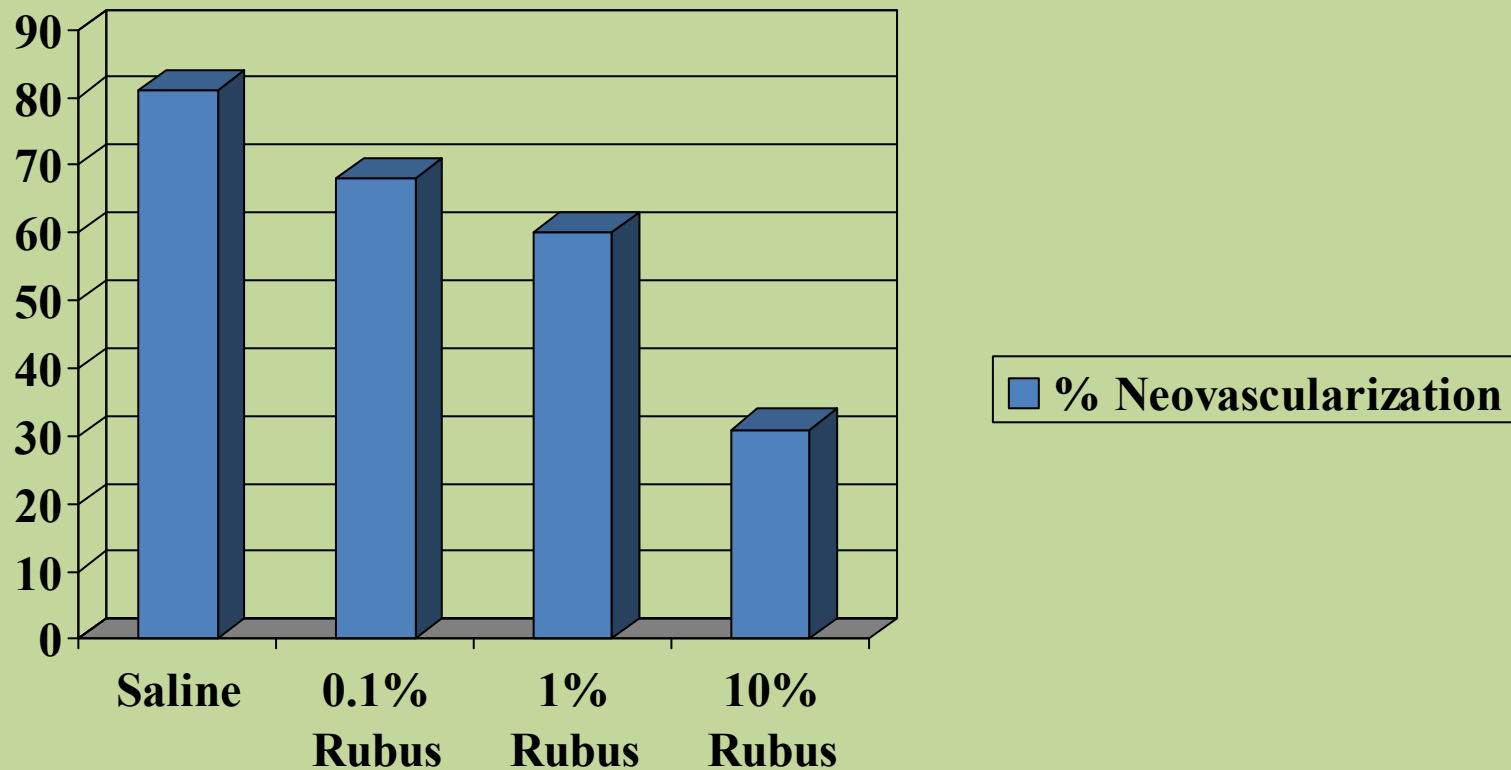
Rubus occidentalis
Black raspberry

Inhibition of Angiogenesis by Rubus extract in placental vein assay

N = 30 for Each Group

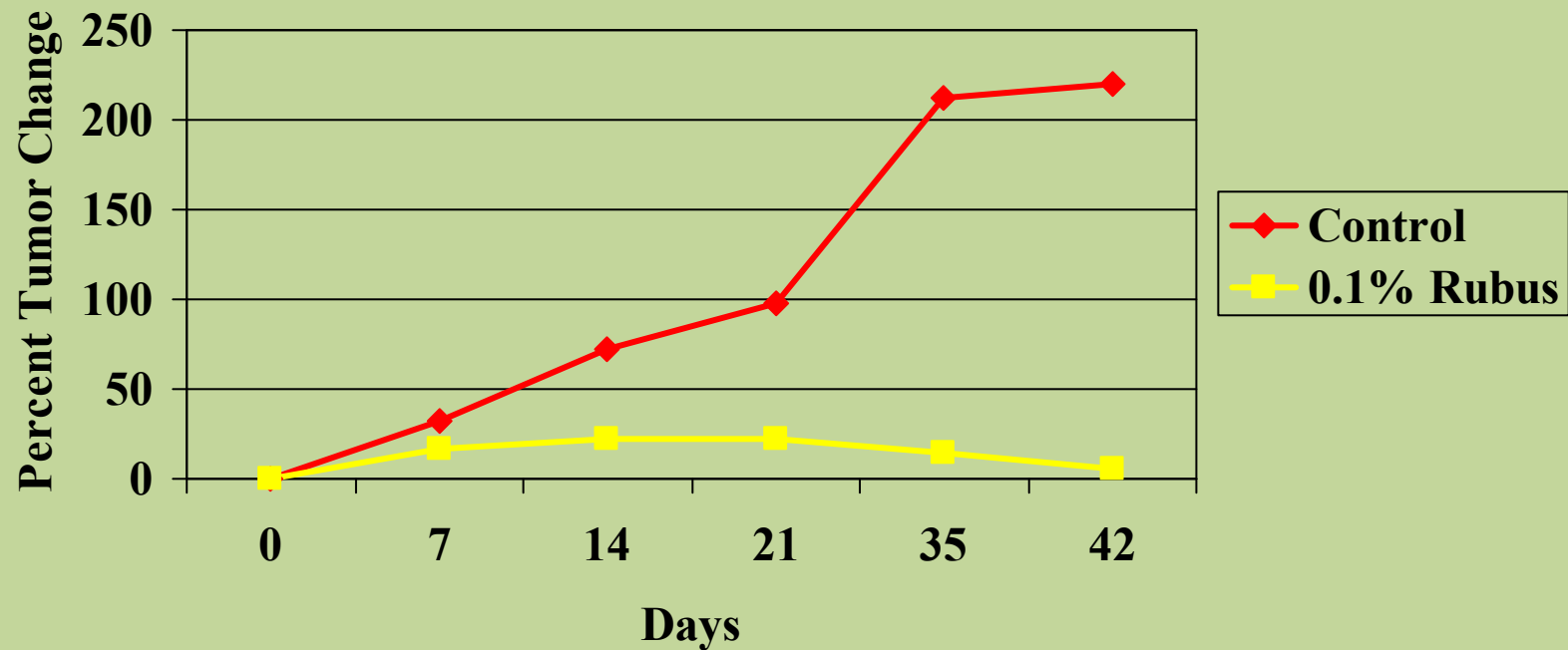


Neovascularization After Corneal Burns in Rats

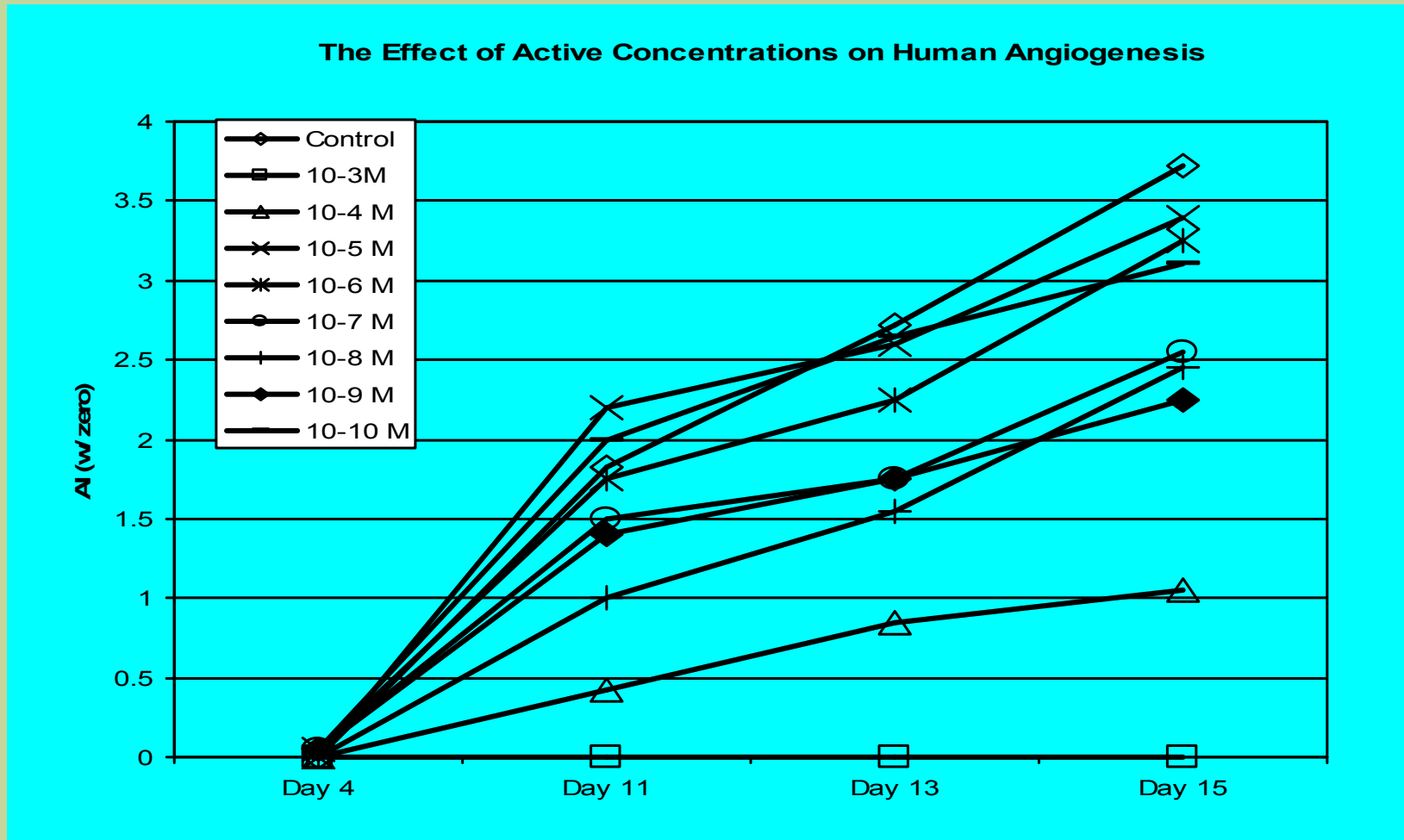


Pancreatic Tumor Bearing Rats

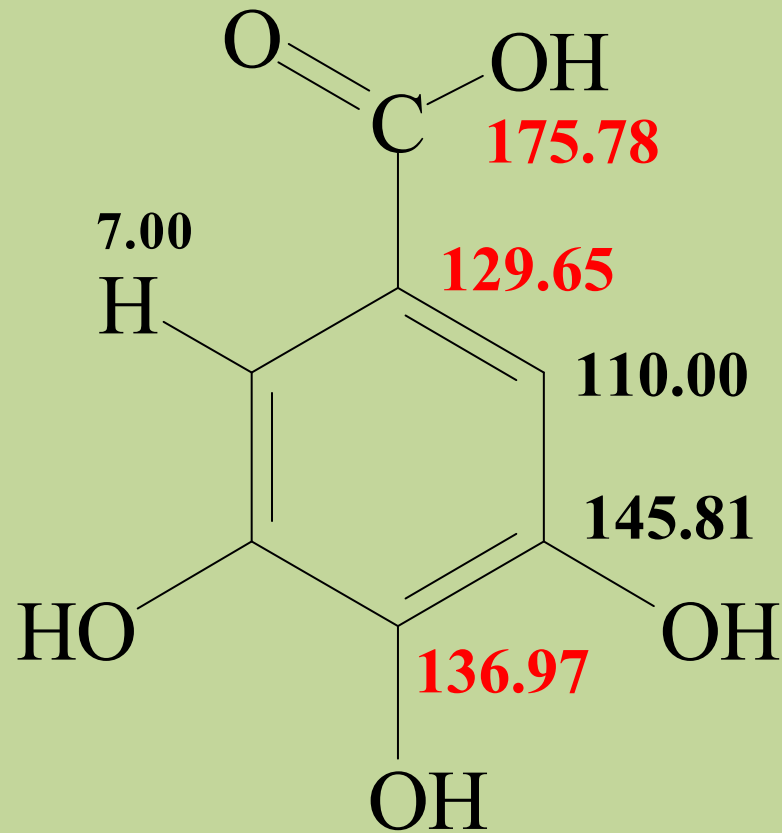
One control and One Injected Rat



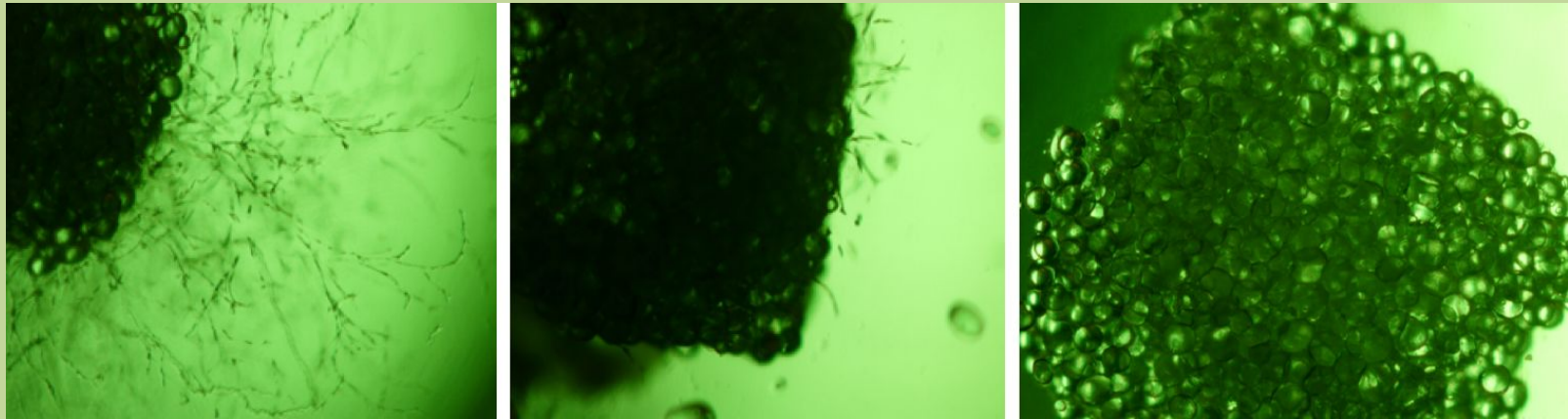
Gallic Acid Dose-Response: Placental Vein



Gallic Acid (USP)



Gallic Acid in Fat Tissue Assay



Control

0.0001 M

.001 M

Greenway FL et al. *Obes Res.* 2007;17:510-15

Gallic Acid Dose-Response: Fat Tissue

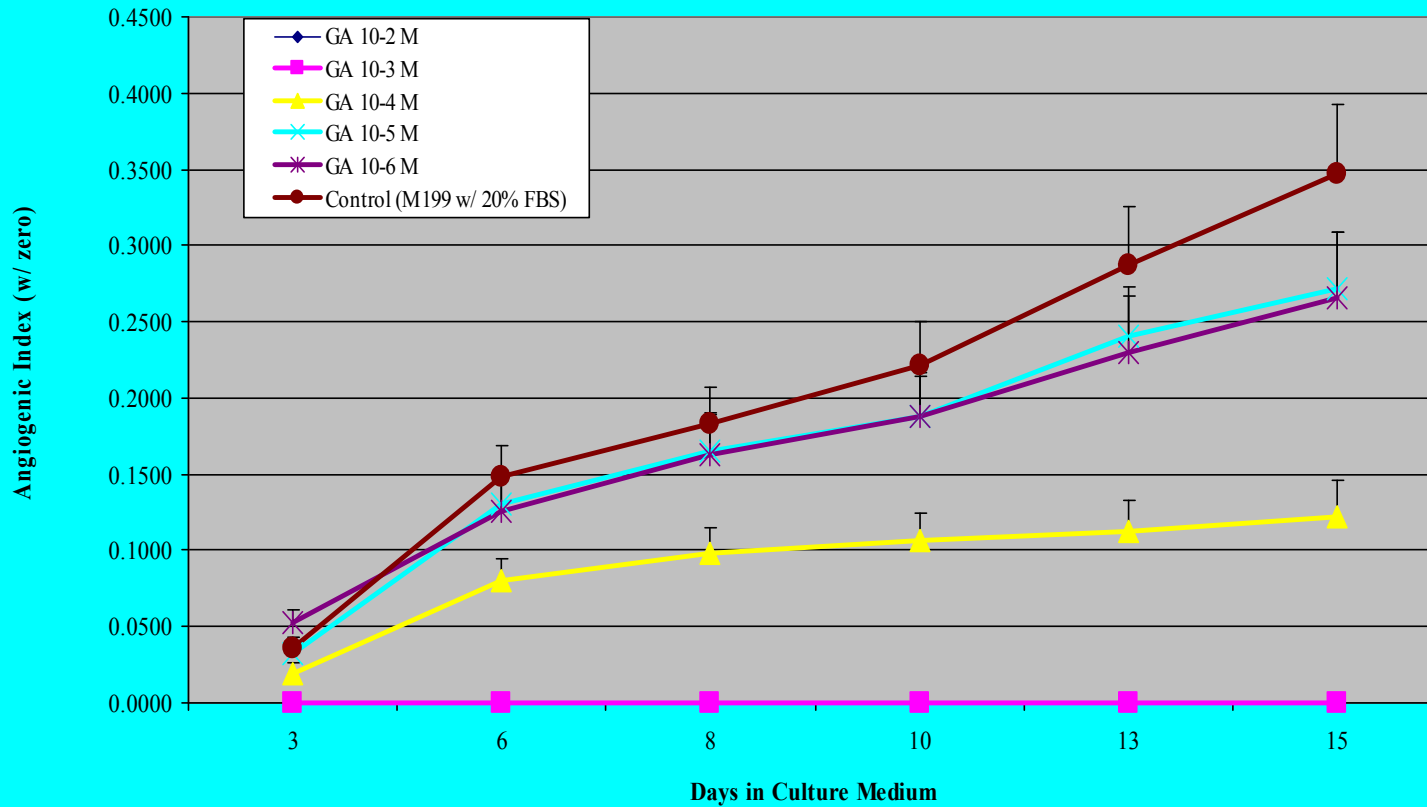
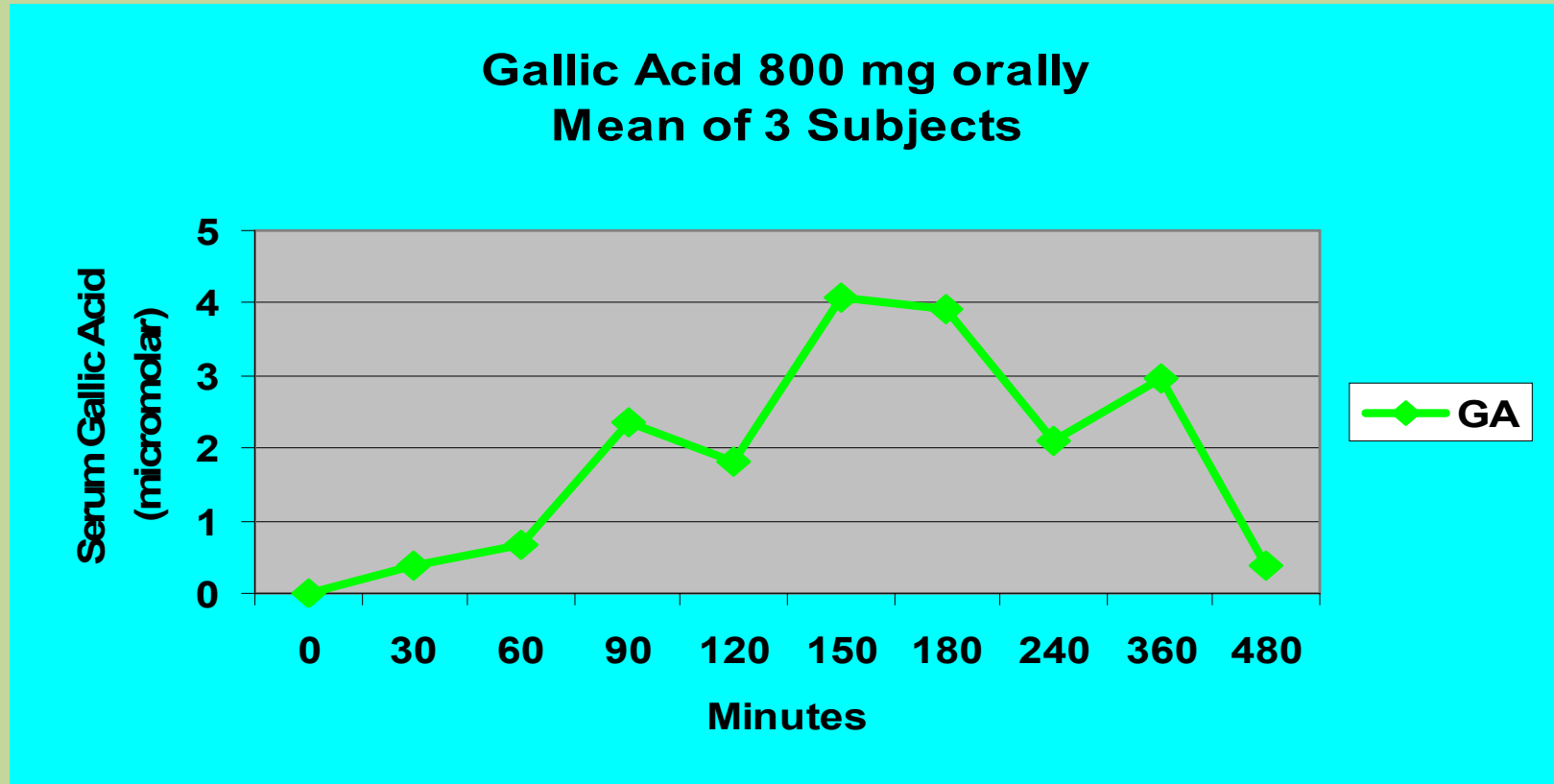


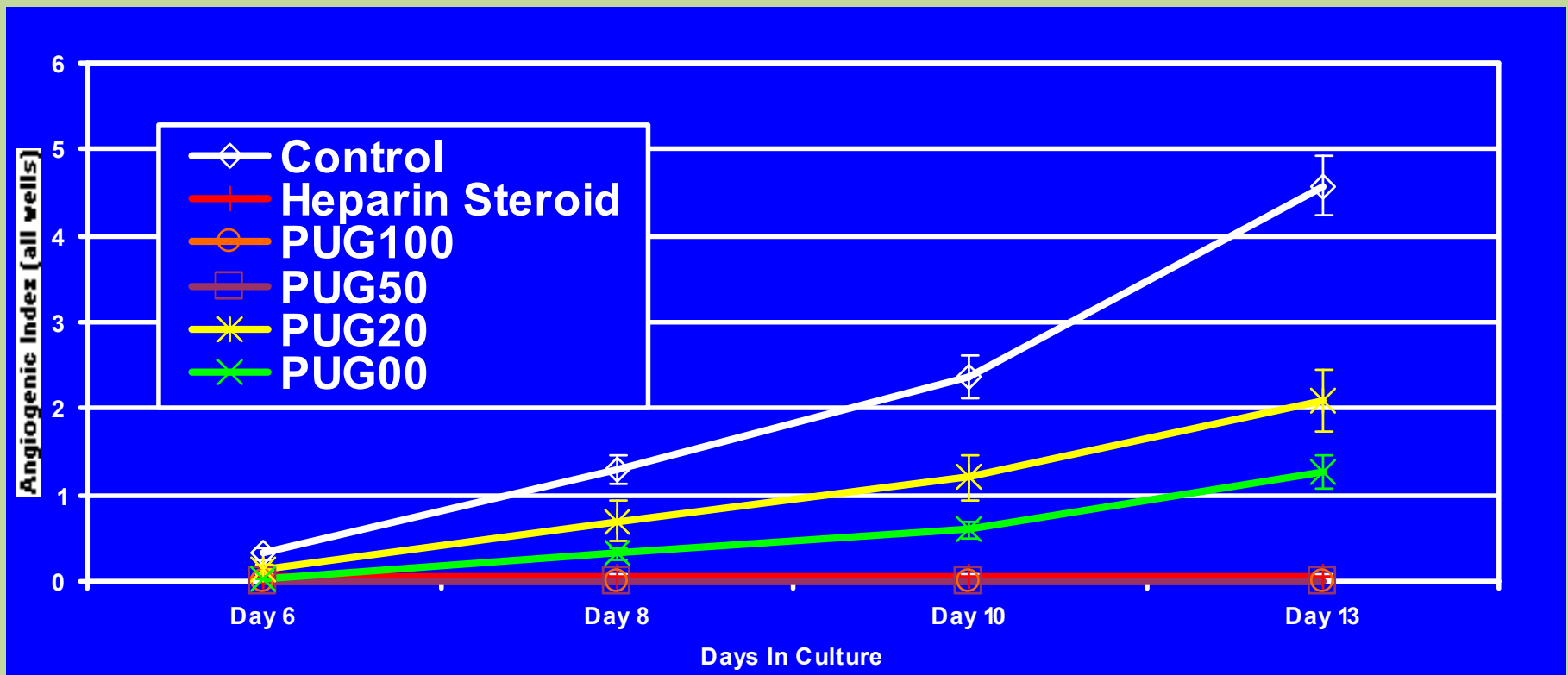
Figure 2. Fat Tissue Angiogenesis Exp-19. A Dose Response Test of GA.

Oral Gallic Acid Mean of 3 Subjects



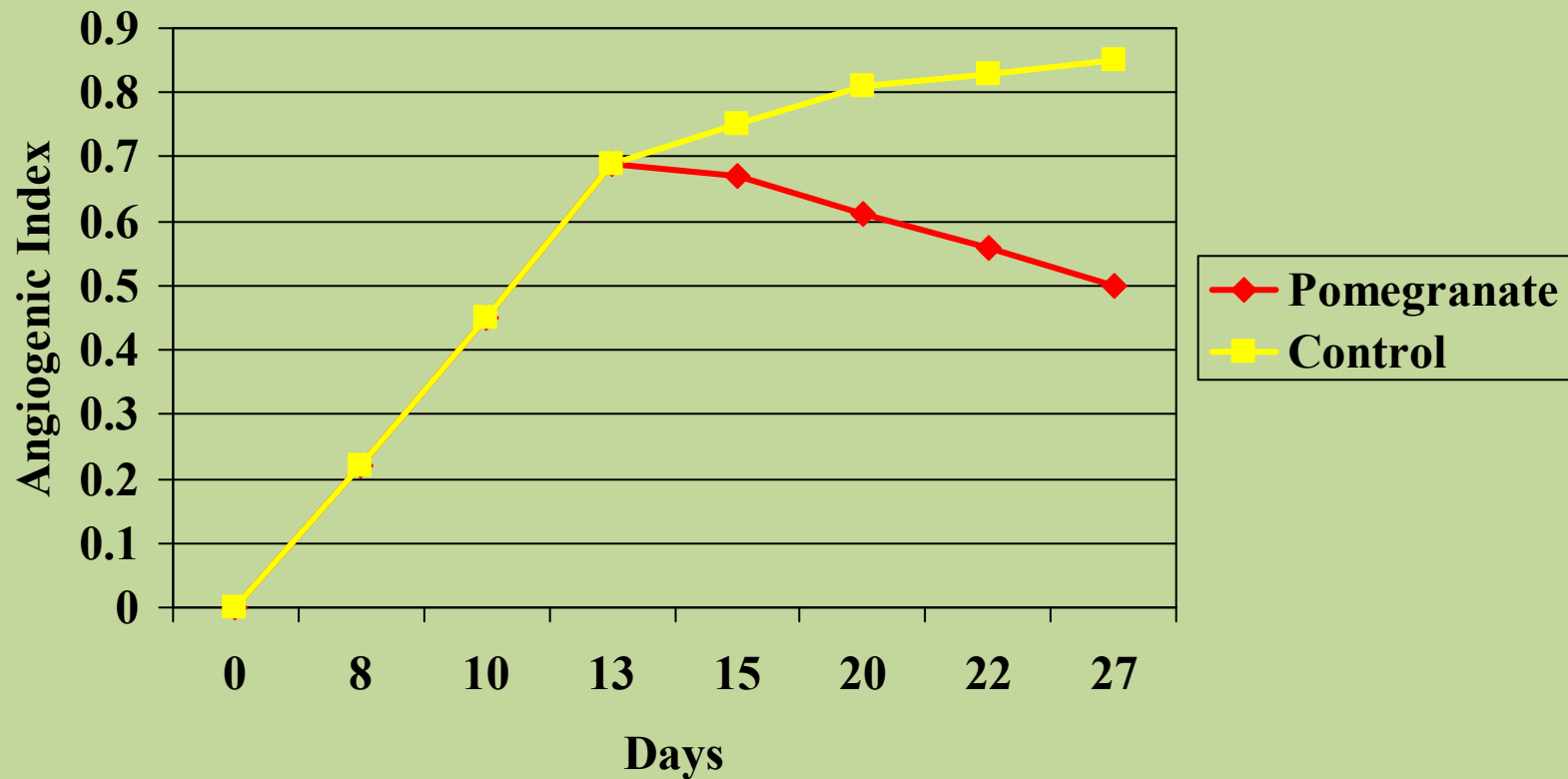
Roberts AT et al. J Med Food. 10(1):184-8, 2007

Pomegranate Extract Inhibition in Placental Vein Assay



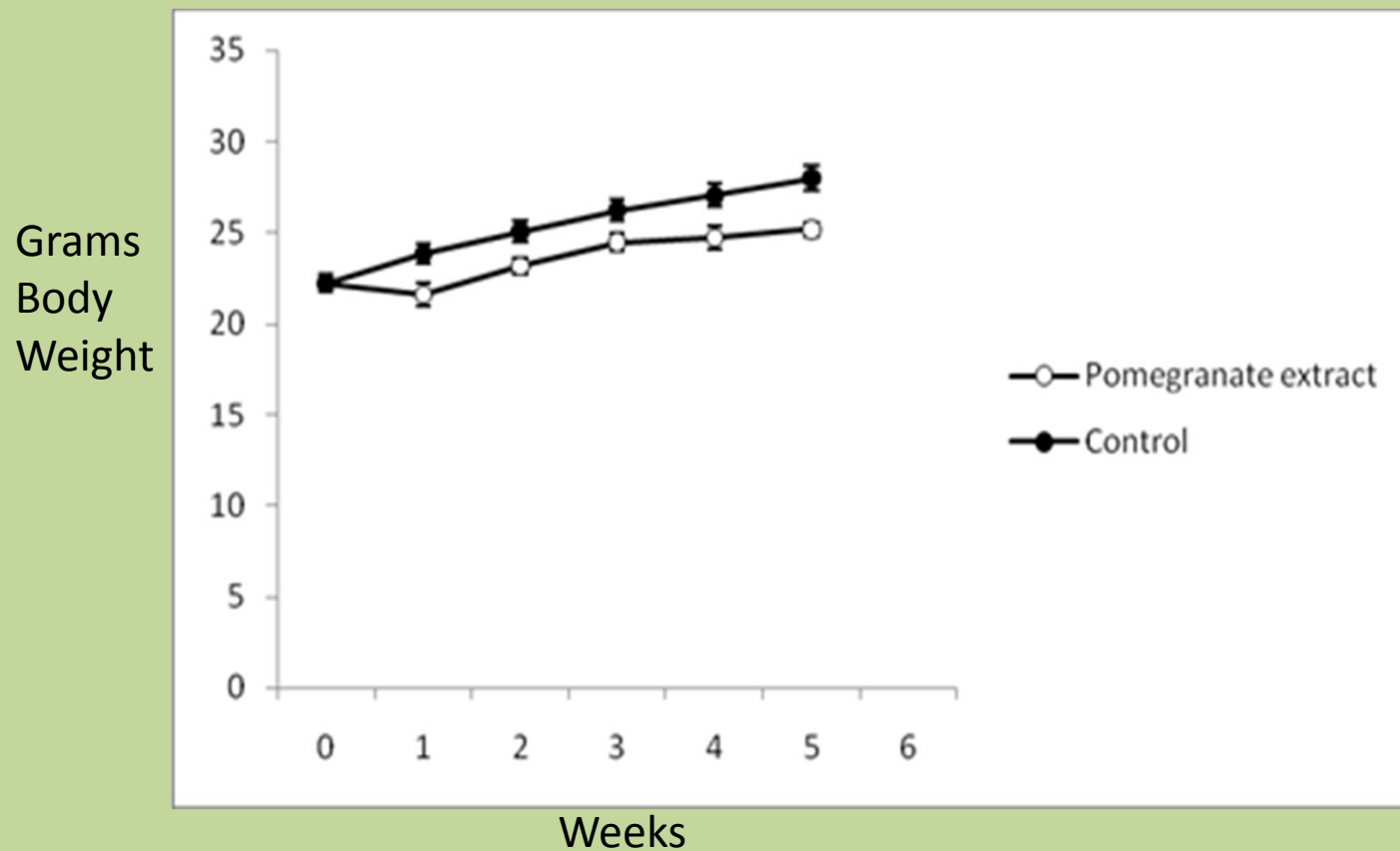
Pomegranate Extract

Delayed inhibition in Fat Assay

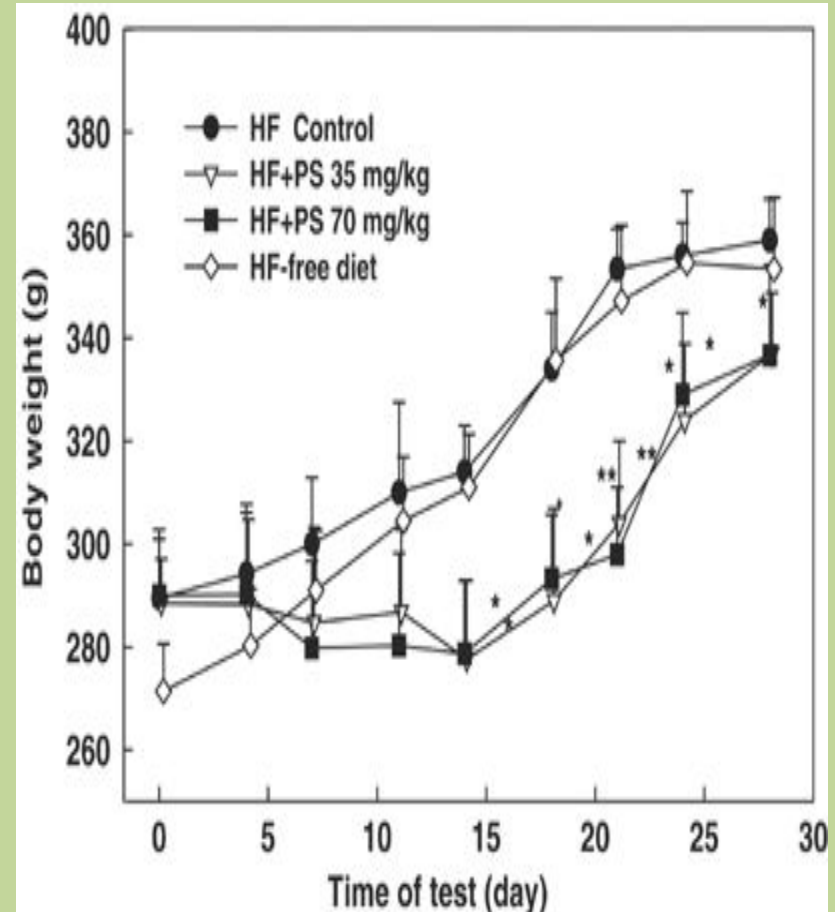
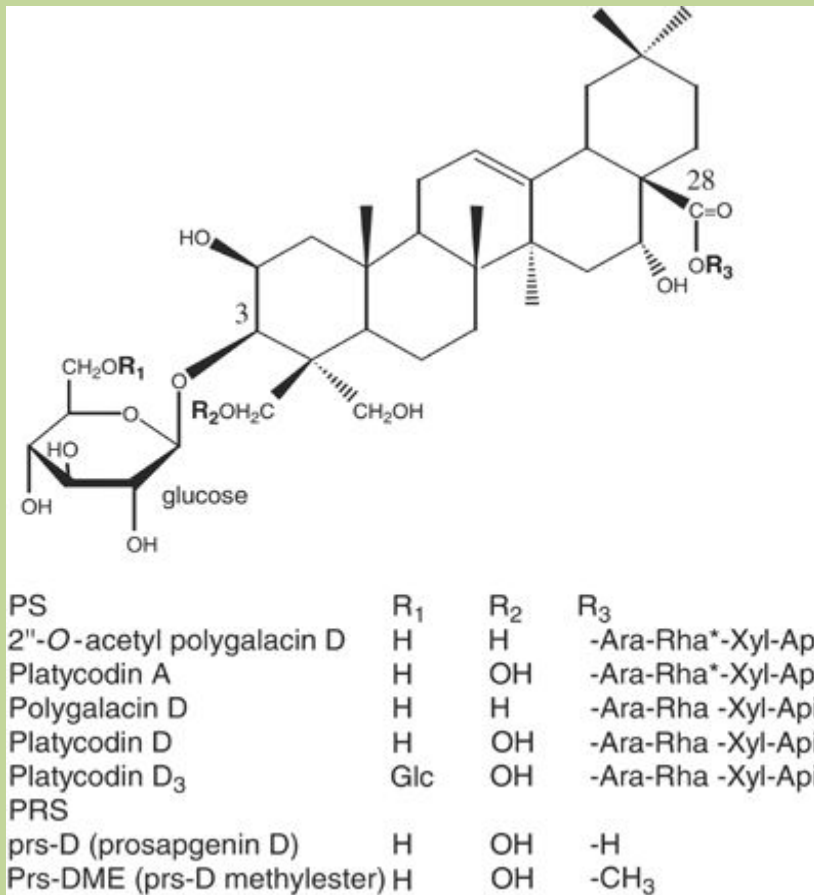


Oral Pomegranate Extract: Weight Loss Over 6 weeks in C57B6 Mice ($p < 0.05$)

60% Fat Diet, N = 10 per group

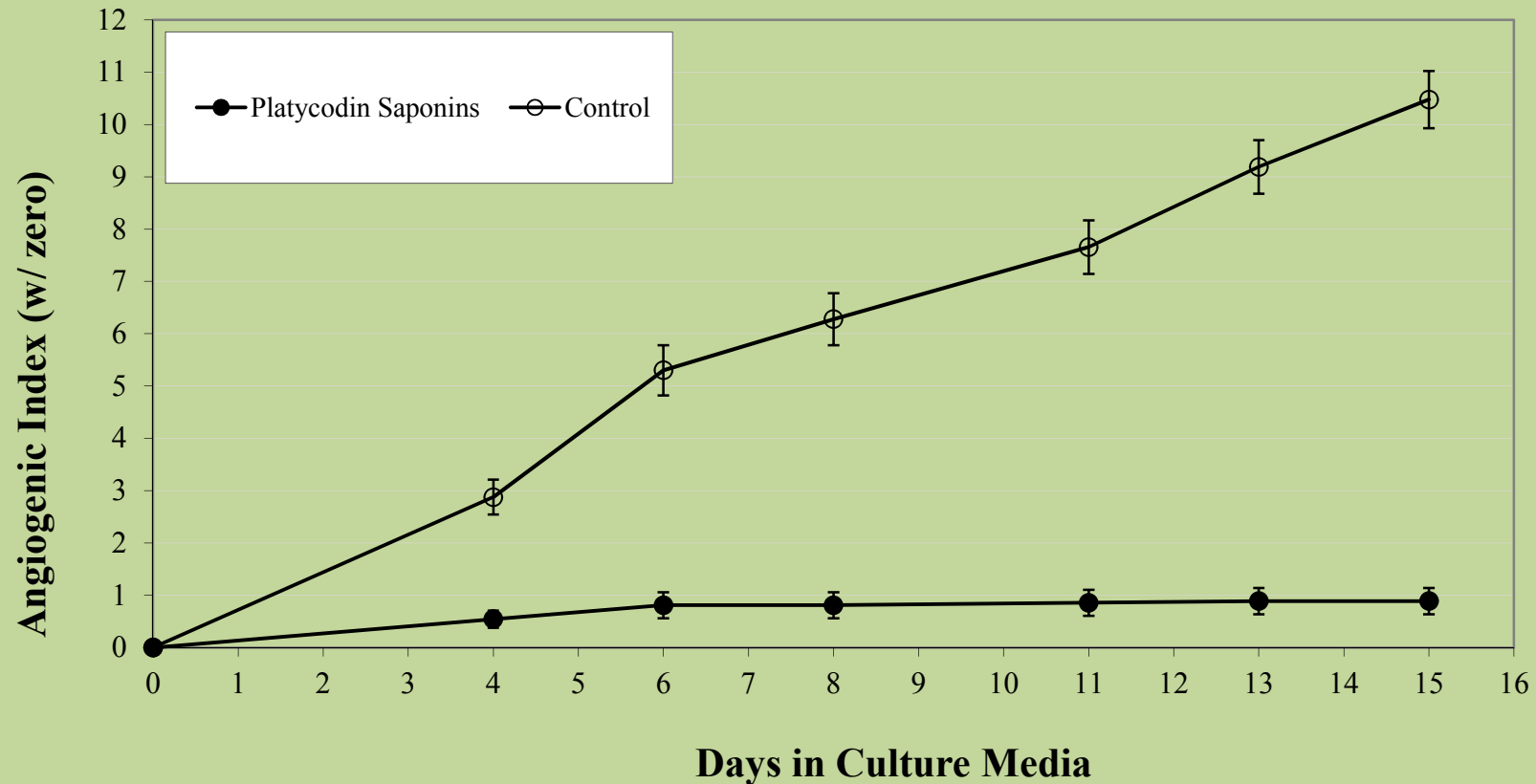


Platycodin Radix saponins Give Weight Loss in Rats

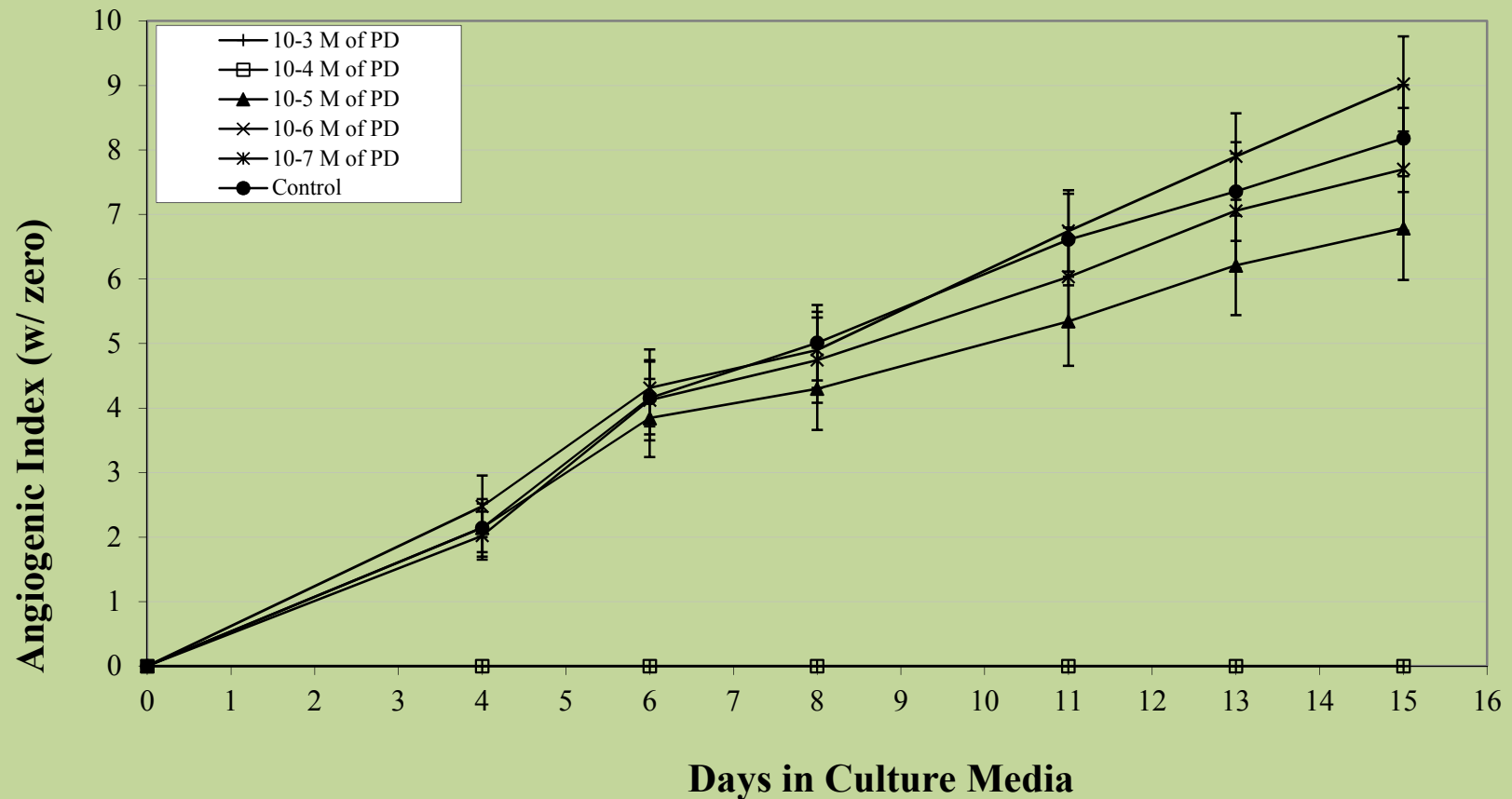


Zhao HL et al. Int J Obes. 2005;29:983-90

Platycodin radix saponins Inhibit Angiogenesis at 1% Concentration



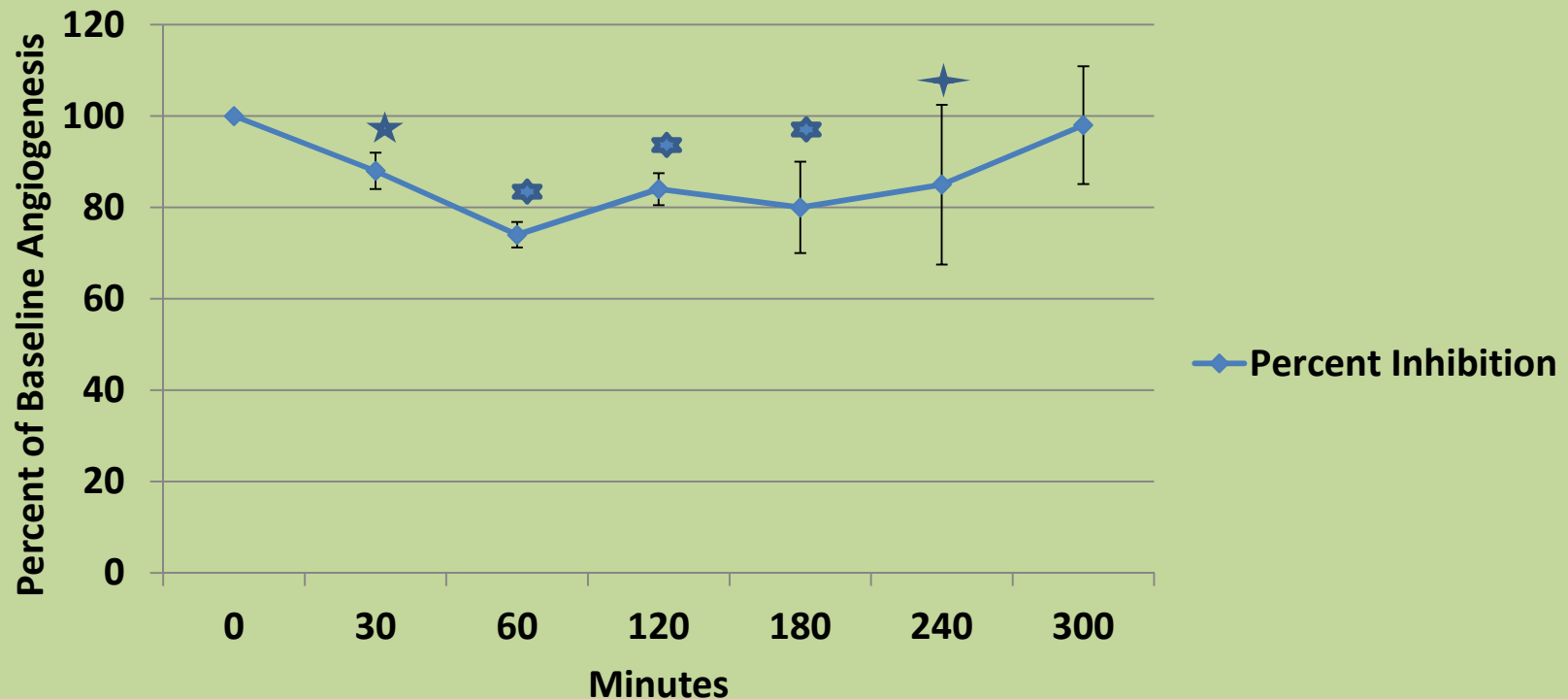
Platycodin D Completely Inhibited Angiogenesis at 10⁻⁴ M



The Angiogenesis inhibitory Capacity of 3 Subject's Serum after oral P. radix

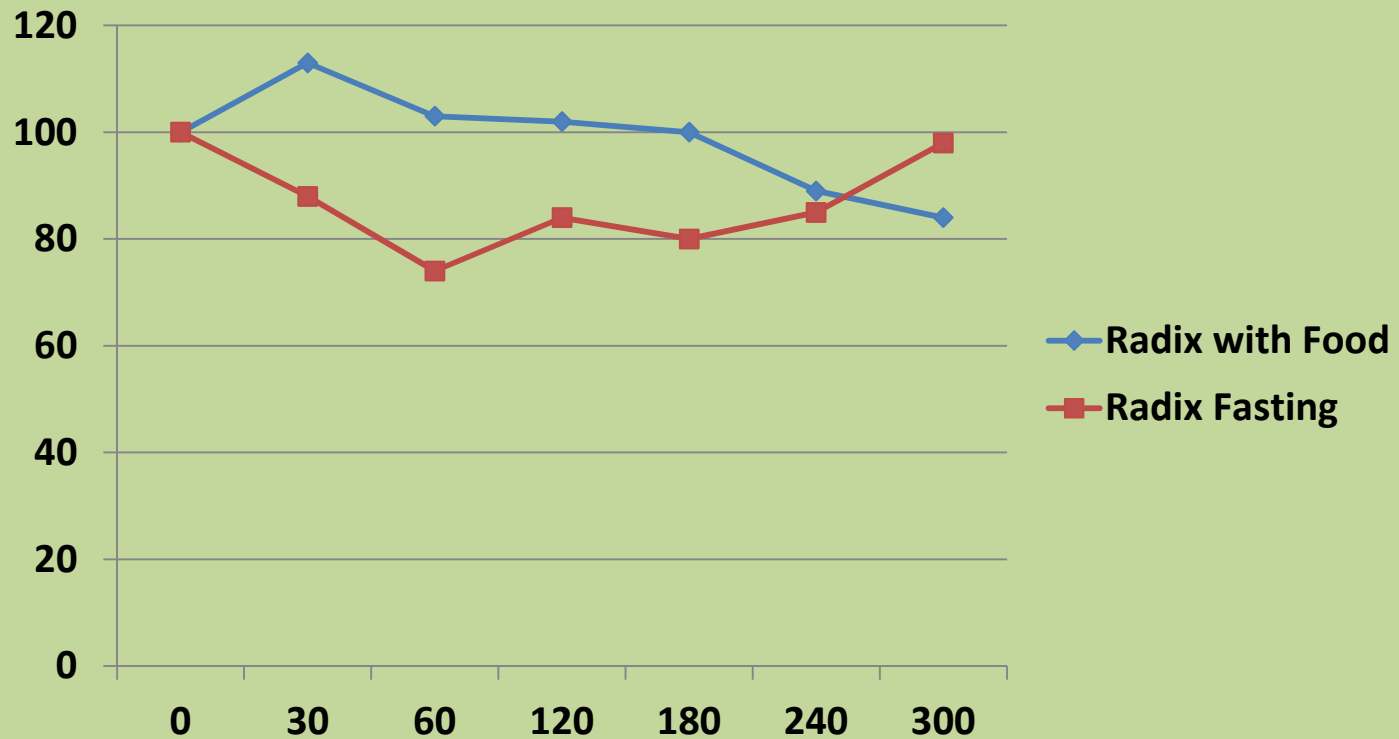
Inhibition by Serum of Angiogenesis after Oral Platycodin Radix
Fasting

N = 3, p < 0.05 ◆, p < 0.01 ★, p < 0.002 ☆



Food Delays Absorption of Platycodin Radix

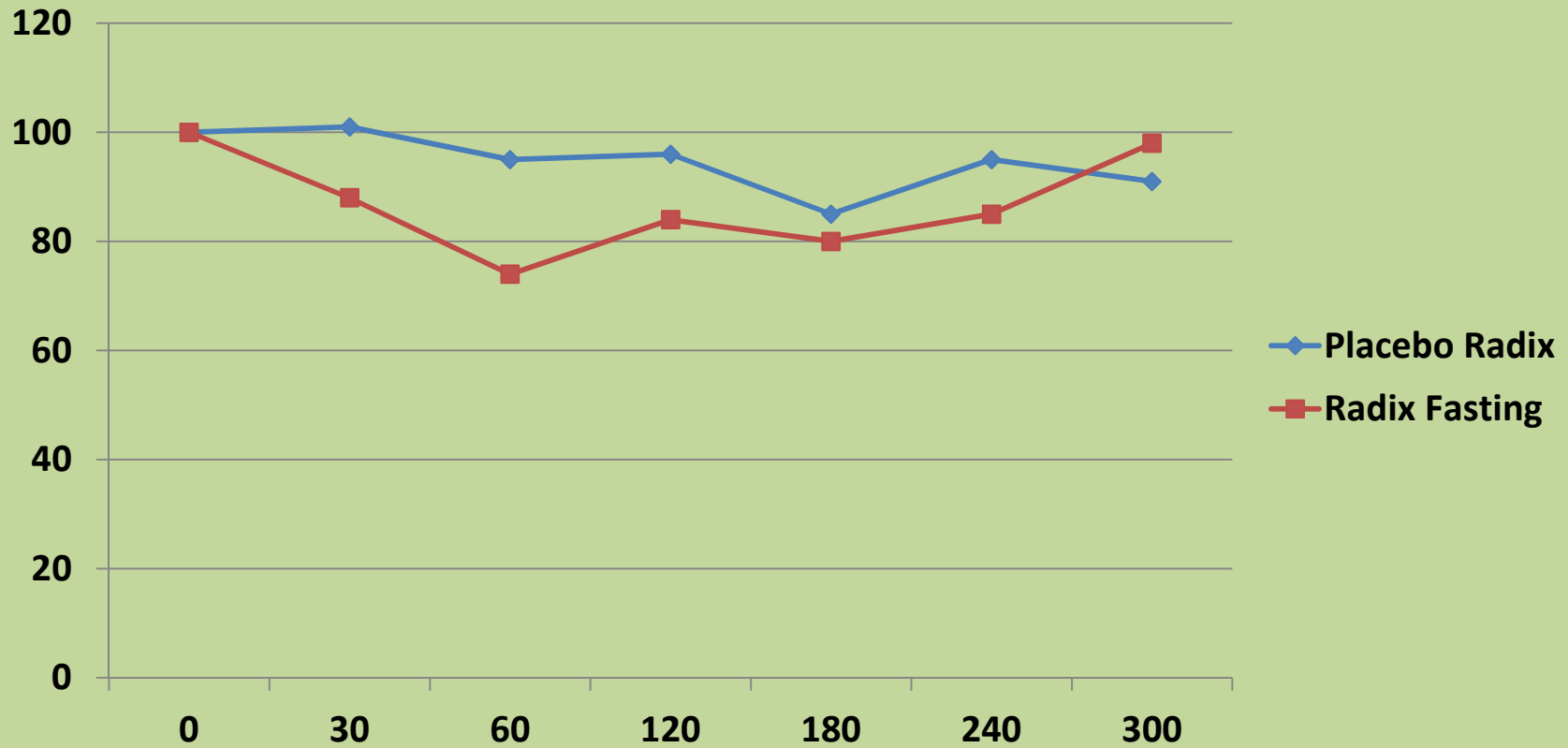
Inhibition by Serum of Angiogenesis by Oral Platycodin Radix
Fasting versus a Standardized Meal



Twiner EM et al. Adv Ther. 2011;28(10):857-65

Platycodi Radix inhibits Angiogenesis Compared to a Placebo

Inhibition by Serum of Angiogenesis by Oral Platycodin Radix Fasting versus a Placebo



Twiner EM et al. Adv Ther. 2011;28(10):857-65

Next Steps

- Gallic acid is effective for tumors in rodents parenterally - A potential human cancer therapy
- Pomegranate is orally active in rodents and is a food. A potential medical food in humans.
- Platycodin Radix is orally active in humans. A potential medical food for angiogenesis driven disease. Needs optimal dose defining and a clinical efficacy trial

Summary

- Patent Issued on anti-angiogenic agents from plants, gallic acid, gallic acid derivatives and black raspberry fruit. (includes cancer)
- Patent Issued on antiangiogenic extracts from pomegranate. (includes obesity)
- Patent application submitted for angiogenic disease treatment with platycodin radix extracts. (cancer and obesity not covered)