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File: ■ Goji (*Lycium barbarum*)
■ Weight Loss
■ Energy Expenditure

HC 021267-449

Date: May 31, 2012

RE: Dietary Supplement Containing Goji Berry Assessed for Weight Loss

Amagase H. A combination of various functional food ingredients as a weight management program: randomized, placebo-controlled, and double-blind human clinical studies. *Functional Foods in Health and Disease*. December 30, 2011;1(12):555-573.

As obesity is one of the most pressing problems facing world health, weight loss strategies are of utmost importance. Functional foods containing medicinal properties are a good target in the search for tools for weight management. Goji berry (*Lycium barbarum*) has been used traditionally for a variety of ailments, and recent studies have shown that it increased postprandial energy expenditure (PPEE) in a clinical trial, as well as promoted weight loss in rats.¹ Goji was incorporated into a liquid dietary supplement as part of a line of 3 weight loss products. This randomized, placebo-controlled, double-blind study assessed the effectiveness of the products in healthy adults.

The liquid dietary supplement, called TAI*slim*® (FreeLife International; Phoenix, Arizona), contained goji berry (GoChi®; FreeLife International), as well as indigestible maltodextrin dietary fiber, amino acids with appetite suppressant qualities, and an extract of oolong, green, black, and white teas (*Camellia sinensis*) which contained 200 mg of polyphenols, including 90 mg of epigallocatechin-3-gallate (EGCG), and 100 mg of caffeine (amount in 1 serving). A serving of 60 ml contained 20 kcal. These ingredients were chosen based on their potential to increase thermogenesis and fat oxidation, decrease absorption of dietary fats and starches by inhibiting lipase and amylase enzymes, improve insulin sensitivity, suppress appetite, reduce fasting lipids, improve serum glucose control, and improve the balance of intestinal flora. Placebo material for TAI*slim* was identical except that it did not include the GoChi, amino acids, tea extract, or fiber. Previous studies showed that TAI*slim* decreased weight, body mass index (BMI), total body fat, blood pressure, and fasting glucose concentrations.

The 2 other products in the line consisted of the TAI*slim* SHAKE (a meal replacement) and the TAI*slim* SKINNY (a snack). The TAI*slim* SKINNY chew snack contained glucomannan fiber combined with goji berry polysaccharide extract; the placebo was identical except that it did not contain the fiber and extract. The TAI*slim* SHAKE product contained fatty acids and triglycerides along with glucomannan fiber and goji berry

extract, while the placebo was identical except that it did not have these ingredients. All products were produced by FreeLife International; Phoenix, Arizona.

This trial consisted of 2 separate studies: a 12-week, double-blind, randomized, placebo-controlled clinical trial investigating TAI*slim*, TAI*slim* SHAKE, and TAI*slim* SKINNY on weight, appetite, and other metabolic parameters, along with caloric restriction and exercise. The other study tested acute effects of TAI*slim* on resting metabolic rate and PPEE.

Patients included both men and women over 18 years of age and excluded were those with heart, liver, lung, or kidney disease, or any who had allergies to TAI*slim* contents. Patients that were pregnant, breastfeeding, taking anticoagulant medication, utilizing any other weight loss therapy, or with other serious conditions were excluded. There were n=67 patients enrolled for the 12-week study (study 1) and n=12 in the PPEE study (study 2). All enrolled participants completed a 2-week washout period prior to the studies. In study 1, the treatment group consumed all TAI*slim* products, while the placebo group consumed the specially designed placebo products, all under free-living conditions. Dosages consisted of 60 ml of TAI*slim* along with the TAI*slim* SHAKE (40.5 g with 240 ml of water) at breakfast and 60 ml of TAI*slim* before lunch with 240 ml of water. The TAI*slim* SKINNY was taken 2 times per day with 240 ml of water with the option of another serving if needed. Placebo products were consumed in the same manner. Subjects were counseled to decrease their caloric intake to 1200 calories total per day and not to eat after dinner within 3 hours of bedtime.

Participants were counseled weekly as to a weight loss diet and daily exercise; weight, waist and hip circumference, blood pressure, and glucose concentrations were collected after a 12-hour fast at baseline, 4, 8, and 12 weeks. Empty product containers were submitted at the weekly counseling sessions to ensure compliance. In addition, gastrointestinal states were measured using a questionnaire that rated flatulence, stomach and intestinal rumbling, distension and pain, and stool conditions. Satiety was also measured using a 100 mm scale ranging from 0 (not at all) to 100 (very much so). Any adverse side effects were also recorded.

Patients in study 2 were tested 6 times with 1 week in between each test day. After a 12-hour fast, patients consumed either all TAI*slim* products together (60 ml of TAI*slim*, 1 chew of TAI*slim* SKINNY and 158 kcal of TAI*slim* SHAKE), or all of the product placebos along with a commercial shake (Boost Plus[®]; Nestlé HealthCare Nutrition, Inc.; Minneapolis, Minnesota). [Note: To maintain stable levels of resting metabolic measurement throughout the entire 4-hour testing period, a total of 360 kcal was given to all study participants. As the meal replacement shake product contains 158 kcal by itself, a commercial shake product was used to adjust the caloric intake for the placebo group.] Resting metabolic rate (RMR) and PPEE were assessed through breath oxygen volume at baseline, 1, 2, and 4 hours.

For study 1, the weight of treatment group patients was significantly reduced by $6.2 \pm 0.7\%$ compared to baseline ($P < 0.01$), as well as compared to the placebo group (1.6% decrease, $P < 0.05$), after 12 weeks. There were no significant differences in the weight of the placebo group patients across the study. Waist circumference of the treatment group was also significantly lowered in the treatment group as compared to baseline (108.7 ± 2.8 cm vs. 101.0 ± 2.4 cm, $P < 0.05$). Both systolic and diastolic blood pressure were significantly reduced in the treatment group as compared with baseline measurements

(systolic: 112.6 ± 1.9 mmHg vs. 105.5 ± 1.3 mmHg, $P < 0.05$; diastolic: 72.4 ± 1.3 mmHg vs. 65.4 ± 1.6 mmHg, $P < 0.05$). Also, appetite was significantly suppressed in the TAI*slim* group by $38.6 \pm 6.5\%$ as compared to baseline ($P < 0.05$).

In study 2, the PPEE increased significantly from baseline 1 hour after treatment consumption by 269.1 ± 9.1 ml/min ($P < 0.05$). Also, at 2 and 4 hours after treatment, PPEE significantly increased by 252.4 ± 7.7 ml/min and 254.3 ± 8.9 ml/min, respectively ($P < 0.05$). These levels were also significantly higher than placebo throughout the time course ($P < 0.05$). Area under the curve (AUC) of the treatment group during the 4-hour study showed a significant increase ($7.2 \pm 1.2\%$) as compared to the placebo group ($0.8 \pm 0.9\%$) ($P < 0.05$). There were no differences in RMR in either of the groups. Additionally, the only adverse side effects noted were "abdominal rumbling" and stool inconsistencies but these did not cause any patients to drop out.

This combination of studies with TAI*slim* shows that this series of products may be useful in promoting weight loss, appetite suppression, and exercise via increased PPEE. It is mentioned that previous studies reported that tea and fiber have beneficial effects on fat metabolism in humans and that goji berry reduced weight circumference in humans. This previously reported bioactivity may help explain the results seen here. Also, due to the caloric content of TAI*slim* and previous experiments with goji berry, it is surmised that individual dosages of these agents alone are not sufficient to explain the effect on PPEE. Thus, the authors conclude that there may be synergistic effects of the functional foods in the product, including fiber.

This study does not mention anything about how the tea extracts in TAI*slim* products are prepared; this would seem important as tea may have a large role in the bioactivity observed. However, as the tea extract was expected to lower fat, it would be discussed in future studies which test these aspects. The tea extract was hydroethanolic (80% ethanol), which is the standard process for high-polyphenolic extracts. In any case, it is suggested that future investigations of TAI*slim* would ideally include measurements of cholesterol, insulin, and various hormones, among other parameters.

—Amy C. Keller, PhD

Reference

¹Keller AC, Schulman R. A thorough review of the botany, phytochemistry, actions, efficacy, and safety of goji berry. *HerbClip*. February 15, 2012 (No. 091163-442). Austin, TX: American Botanical Council. Review of A review of botanical characteristics, phytochemistry, clinical relevance in efficacy and safety of *Lycium barbarum* fruit (goji) by Amagase H, Farnsworth NR. *Food Res Int*. August 2011;44(7):1702-1717.

Referenced article can be found at <http://www.functionalfoodscenter.net/files/48097612.pdf>.

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