

Potential Applications for Alternative Medicine to Treat Obesity in an Aging Population

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Abstract

Obesity is a growing problem causing significant morbidity and mortality. The efficacy of conventional therapies is limited. Numerous alternative therapies are advocated for weight loss, including dietary modifications, hypnotherapy, and acupuncture. Many herbal medications and dietary supplements such as conjugated linoleic acids, chitosan, *Garcinia cambogia*, and *Citrus aurantium*, are also being used. Most have been tested in very limited trials. None have been evaluated to the extent they can be definitively recommended, nor have they been studied to ascertain the extent of potential hazards. Given the scope of the problem, and the potential risk to a vulnerable population, further research should be conducted to define the efficacy of these treatments, particularly for the elderly. (*Altern Med Rev* 2008;13(1):34-42)

Introduction: The Problem of Obesity

Obesity is a growing problem, resulting in significant morbidity and mortality from weight-related disease and reduced quality of life.¹ Although obesity does confer the advantage of increased bone mineral density with age, which may result in fewer fractures, obese individuals are more likely to develop arthritis, lung disease, diabetes, metabolic syndrome, hypertension, coronary artery disease, congestive heart failure, urinary incontinence, cataracts, and cancer, and are more likely to suffer an earlier death.^{1,2} According to a survey of 184,450 adults, 46 percent of women and 33 percent of men were trying to lose weight.³

The pathophysiology of obesity over the lifespan is quite complex. Body weight increases until age 65, after which it declines,² probably due to loss of bone mass, body water, and lean mass with age.⁴ Although total energy intake does not increase with age, total energy expenditure decreases.¹ Resting metabolic rate, fat-free mass, physical activity, and the thermic effect of food are all reduced.¹ Body fat also redistributes in aging; visceral fat increases, while subcutaneous fat decreases. Changes in hormone and cytokine levels result in increased adipose tissue formation over a lifespan. These include reductions in testosterone and growth hormone levels and decreased responsiveness to leptin and thyroid hormone. Decreased testosterone and growth hormone levels increase fat mass while causing reductions in fat-free mass. There is less oxidative metabolism with fewer surges of thyroid hormone. Loss of response to leptin may create inadequate satiation after feeding. New research has identified that abdominal adiposity, as measured by waist circumference or waist-to-hip ratio, and sarcopenia (loss of muscle mass) are more important correlates of morbidity and mortality than older measures, such as total weight and body mass index (BMI).²

Despite conventional treatments a significant proportion of the elderly remain obese. Low-calorie diets do induce weight loss – approximately 6-10 percent of body weight after six months.¹ In the Diabetes Prevention Program, older patients utilized a series of lifestyle interventions to lose weight, including diet, exercise, and education. Only 67 percent achieved their

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target weights over three years.⁵ Although bariatric surgery can be used safely in appropriately selected individuals,^{6,7} the procedure contributes to higher morbidity and mortality in the elderly, and not all elderly individuals qualify for or desire surgical treatment.⁷

Many individuals use complementary and alternative medicine (CAM) to aid with weight loss. Herbal supplements and diet-based therapies for weight loss are among the 10 most common CAM modalities.⁸

The purpose of this article is to outline from the published medical literature how alternative therapies address obesity in the elderly and identify what therapies might be used in the future.

Dietary Interventions for Weight Loss

Although a large number of weight-loss diets are employed by adults, most studies have been conducted on middle-aged subjects, particularly women. The evidence for efficacy, especially in the elderly, is often lacking. One advantage of dietary interventions is they do not involve the addition of medications – an important consideration in older individuals who are often already taking several medications. Unfortunately, it may be more difficult for the elderly to comply with the steps involved in a diet than to take an extra pill.

Much attention in recent years has focused on low-carbohydrate diets – such as the Atkins, South Beach, and SugarBusters diets. A review of investigations of low-carbohydrate diets noted weight loss of 1-10 percent of body weight.⁹ Short-term weight loss from low-carbohydrate diets has been compared to other diets in younger subjects.⁹⁻¹¹

In one study, 120 obese individuals (ages 18-65) participated in an investigation in which they were offered either a low-carbohydrate or low-fat diet for six months.¹⁰ The subjects were given dietary instruction in group meetings held twice monthly for the first three months and once monthly thereafter. Significantly more of those assigned to the low-carbohydrate diet (76%) adhered to the diet than those who received the low-fat diet (59%) ($p=0.02$). Subjects in the low-carbohydrate group lost a mean 12.9 percent of body weight, while subjects on the low-fat diet lost 6.7 percent of body weight ($p<0.001$).

In one trial, 34 individuals with a BMI >30 (mean age mid-40s) were admitted to the hospital for six weeks, randomized to receive a high- or low-carbohydrate diet, and participated in a multidisciplinary program including physical activity, education, and behavioral modification.¹² Although the low-carbohydrate diet group lost a mean 8.9 kg while the high-carbohydrate group lost an average of 7.5 kg, there was not a significance difference in the amount of weight lost between diets.

Sixty-three subjects (mean age 44; average BMI=34) were randomized to receive either a low-carbohydrate or conventional diet.¹³ After six months the subjects receiving the low-carbohydrate diet lost seven percent more weight than those on the conventional diet; however, after one year there was no significant difference between the two groups.

In another one-year study, two low-carbohydrate, higher-fat diets (Atkins and Zone) were compared with two low-fat diets (Ornish and LEARN), in 311 premenopausal obese women (BMI 26-40). Participants on the Atkins diet lost the most weight (4.7 kg); those on the other diets experienced less weight reduction (Zone=1.6 kg, Ornish=2.2 kg, LEARN=2.6 kg).¹⁴

One of the most well-studied is the Ornish diet, which, in addition to being low-fat, is a low animal-protein, high complex-carbohydrate diet. The diet has been shown to modify risk factors for coronary artery disease and lower atherosclerotic risk.¹⁵ In two of the recent diet comparison trials mentioned above, subjects lost 2.2-3.3 kg.^{10,14} A small number of elderly subjects lost 2.2 kg in an uncontrolled, unblinded investigation of the Pritikin diet – another low-fat, high complex-carbohydrate diet.¹⁶

A recent study of diets of different protein contents noted that high-protein content increases satiety, suggesting easy satiety might explain the weight loss in a low-carbohydrate, high-protein diet.¹⁷ A low-fat, high-protein diet tested in one small trial yielded a comparable weight loss (6%) to a low-fat, high-carbohydrate diet.¹⁸

Concerns expressed over potential long-term side effects of low-carbohydrate diets include lack of vitamins, minerals, and fiber, and possible increased risk



of cardiovascular disease.¹⁹ In the short term, the diet does not appear to increase cardiovascular disease risk markers.²⁰

Dietary Supplements in the Treatment of Obesity

Conjugated Linoleic Acid (CLA)

CLAs are trans fats that are beef and dairy constituents.²¹ Two different forms of CLA were tested in a double-blinded, randomized, placebo-controlled trial of 180 men and women ages 18-65, BMI 25-30. After one year there was a small but statistically significant 1.8-kg weight reduction (0.6 kg/m² reduction in BMI) when CLA was given as a triglyceride (4.5 g/day, 76% CLA-triacylglycerol).²¹ Subjects were given a written questionnaire asking about dietary and exercise habits at baseline, six months, and one year. In a one-year, open-label extension of the trial no further decrease in weight was observed.²² Adverse events were noted in less than four percent of subjects, were not serious, and were similar for CLA and placebo groups.²² When CLA was given as free fatty acids rather than a triglyceride, weight loss was not observed.²³

Chitosan

Chitosan is a polysaccharide extracted from the shells of invertebrates.²⁴ Chitosan has been found to enhance weight loss via blockage of fat absorption in animal studies,²⁵ although human studies have yielded mixed results.^{24,26-30} In one study of obese subjects (mean age 50; 82% women; BMI 25-50), subjects given 3 g chitosan daily for six months lost 0.56 kg (p=0.03) more than those receiving a placebo;²⁸ change in BMI was not significant.

In a more recent study, 150 subjects (mean age 45; 83% women) were randomized into a control group (subjects chose whatever diet plan they wished and received no active or placebo supplement), a chitosan group, and a placebo-supplemented group.²⁶ Participants in the chitosan and placebo group were double-blinded, took 3 g chitosan or placebo daily for 60 days, and received a guidebook on dietary behavioral modification. Individuals who received chitosan lost 2.2 kg more than those in the placebo group (p=0.03) and 3.6 kg more than those in the control group (p<0.001).

A meta-analysis acknowledged the weight loss reported in trials, but concluded the studies were not methodologically sound enough to establish definitive benefit.^{29,30} In an animal study, mice fed a high-fat diet gained less weight taking chitosan.³¹

Botanicals in the Treatment of Obesity

Tea (Green, Black, and Oolong)

A number of studies have used tea to promote thermogenesis to increase energy expenditure in humans and rodents, indirectly implying tea promotes weight loss. While most of the studies have examined green tea, several have used oolong tea and one examined black tea.

Green tea is created when tea leaves are processed soon after collection, oolong tea leaves are left to ferment before processing, and black tea leaves are crushed before fermentation.³² Tea is believed to induce thermogenesis through actions of polyphenol constituents called catechins, which inhibit the breakdown of norepinephrine. This results in a rise in mitochondrial oxidation and lowered coupling with ATP synthesis, producing heat.^{32,33} Alternatively, catechins may impair angiogenesis and retard the development of adipose tissue.³⁴

Several studies in rodents and humans suggest green tea augments thermogenesis and energy expenditure.³²⁻⁴⁰ The experiments utilized encapsulated green tea extracts rather consumption as a beverage. While some of the increase in energy expenditure is believed to be related to the caffeine content,^{32,36} substances other than caffeine are thought to be responsible for much of its effect.^{33,37,38} A number of investigations have used extracts with different concentrations of green tea, caffeine, and other components, making it difficult to draw conclusions about which components might be responsible for the observed effects, or how much tea is necessary to induce human weight loss.

In one study, on three occasions 10 healthy men (average age 25; average BMI=25) were given either a green tea extract containing 90 mg of the green tea catechin epigallocatechin gallate (EGCG) and 50 mg caffeine, a capsule of 50 mg caffeine alone, or a placebo. Mean daily energy expenditure in the 24 hours after consumption was higher (6,754 kJ) in individuals given



the green tea extract than in subjects given either caffeine alone (6,547 kJ) or placebo (6,463 kJ) ($p < 0.01$).³⁹

Weight loss induced by green tea extracts has been reported in rats and humans. After seven days of treatment, rats given green tea extract lost 15-21 percent more weight compared to baseline and 30-41 percent more weight than rats given a placebo.³⁵ A human would have to consume 6-12 cups of tea daily to obtain the equivalent dose the rats received.³⁷

In a clinical study, 46 women (ages 19-57; BMI=25-31) were placed on a reduced-calorie diet (60 percent of expected energy expenditure) and either 1,206.9 mg catechins from green tea or a placebo for 90 days. There were no differences in weight loss, BMI, waist:hip ratio, or fat-free mass between groups.^{41,42}

In a controlled trial, 240 Japanese men and women were assigned to consume green tea extract with 583 mg catechins daily (catechin group; $n=123$) or 96 mg catechins daily (control group; $n=117$). Greater decreases in weight, BMI, visceral fat area, and waist and hip circumference, as well as improved signs of cardiovascular health – systolic blood pressure and LDL cholesterol – were observed in the high-catechin group compared to the control group.⁴³

In an uncontrolled investigation, 70 subjects ages 20-69 (BMI 24-32) consumed two capsules of a green tea extract (270 mg EGCG; 475 mg total catechins) while dieting for three months and lost an average of 4.6-percent of body weight.⁴⁴

Green tea extracts have also been used to achieve weight maintenance after loss. In one study, 104 subjects ages 18-60 (BMI 25-35) were given a low-calorie diet (2.1 mJ daily) for four weeks, then three months of a weight maintenance program in which they received a green tea extract (95.46 mg catechins, 17.25 mg caffeine) or a placebo.⁴⁵ Although green tea did not affect weight gain overall, a subset of individuals with lower habitual caffeine intake (mean 149 mg/day versus 511 mg/day) experienced 13-percent less weight regain with green tea compared to placebo.⁴⁵ The low-caffeine group who used green tea also demonstrated greater resting energy expenditure through thermogenesis.⁴⁶

Several studies have examined oolong tea to induce increased energy expenditure,^{47,48} but fat mass and weight loss in humans has only been demonstrated when investigators added green tea extract to oolong tea.^{49,50} In one of these studies, 38 non-obese men

ages 27-46 consumed a diet for two weeks containing 90 percent of their average energy intake. They were then given a drink containing 340 mL oolong tea daily, supplemented with green tea extract containing 209 mg catechins/100 mL for three months. The supplemented tea drinkers lost only 1.1 kg more than those in the control group ($p < 0.05$).⁴⁹ In mice, a supplement of oolong tea prevented weight gain in mice fed a high-fat diet.⁵¹

Although no published study has found black tea induces weight loss, one study demonstrated increased metabolic rate after consumption of black tea combined with other substances. Sixteen men and women (ages 21-55; BMI 20-30) took an extract consisting of 600 mg black tea (20% caffeine) in addition to guarana (*Paullinia cupana*; a source of caffeine), ginger, dill weed, vitamin C, and rutin (a plant polyphenol) or a placebo.⁵² One hour after ingestion, resting metabolic rate increased by 77.19 (kcal/24 hr²) ($p < 0.02$) in the group receiving the supplement but not in the placebo group.⁵²

Garcinia cambogia

The fruit from *Garcinia cambogia*, a plant that grows in Southeast Asia, has been used in several investigations to induce weight loss.⁵³ The active ingredient is believed to be (-)-hydroxycitric acid (HCA), which comprises up to 30 percent of the fruit by weight. In a double-blind trial, 89 women (mean age 40; mean BMI=28) were given 2.4 g *Garcinia* standardized extract (1.2 g HCA) or placebo daily for three months, in addition to a 1,200 kcal, 30-percent fat diet.⁵³ The individuals who consumed HCA lost only slightly more than the placebo group – 1.3 kg ($p=0.026$).

In another placebo-controlled trial, 135 subjects (mean age late-30s; average BMI=31) were treated with 1.5 g HCA or placebo for three months, with no differences between the two groups after treatment.⁵⁴

Citrus aurantium

Synephrine alkaloids reputed to cause weight loss can be derived from *Citrus aurantium*, the sour orange.⁵⁵ It is unclear which of several alkaloids from the plant actually contribute to weight loss.⁵⁶ Although three small trials revealed such alkaloids can increase systolic blood pressure and heart rate,^{57,58} others showed no effect.⁵⁹⁻⁶³ Investigations of weight loss properties, not



Table 1. Nutrients and Botanicals for Weight Loss

Treatment	Dosage/length of study	Evidence	Results
CLA-triglyceride (76% CLA)	4.5 g/day or placebo for one year	RCT	Small but s.s. 1.8-kg weight reduction with CLA
Chitosan	3 g/day or placebo for six months	RCT	Chitosan=0.56 kg > loss than placebo (p=0.03); no difference in BMI
Chitosan	3 g/day, placebo, or nothing (control) for 60 days	RCT	Chitosan=2.2 kg > loss than placebo and 3.6 kg > loss than control
<i>Garcinia cambogia</i> (active ingredient HCA)	2.4 g/day (1.2 g HCA) or placebo for three months	RCT	Gambogia=1.3 kg > loss than placebo (p=0.026)
HCA	1.5 g/day or placebo for three months	RCT	No differences between groups
<i>Citrus aurantium</i> , <i>Hypericum perforatum</i> , and caffeine	975 mg <i>Citrus aurantium</i> , 900 mg <i>Hypericum perforatum</i> , 528 mg caffeine daily, placebo, or nothing for six weeks	RCT	Average weight loss in treatment group 1.4 kg; significant when compared to placebo or control (p<0.05)
Ephedrine, synephrine, caffeine, and salicin	Ephedrine 20 mg, synephrine 5 mg (from Citrus), caffeine 200 mg, salicin 15 mg twice daily or placebo for eight weeks	RCT	Average weight loss in treatment group 3.14 kg versus 2.05 kg in placebo group; 16% decrease in body fat in treatment group/1% in placebo group
Green tea extract	Containing 1,125 mg catechins/225 mg caffeine daily for three months	RCT	No differences in weight loss, BMI, waist:hip ratio, or fat-free mass between groups
Green tea extract	Containing 583 mg catechins versus 96 mg catechins (control)	RCT	Greater decrease in weight, BMI, visceral fat area, and waist & hip circumference in high catechin group
Green tea extract	Containing 270 mg EGCG/475 mg total catechins	Uncontrolled trial	Subjects lost an average 4.5-percent body weight
Oolong and green tea	340 mL oolong/green tea extract; 209 mg catechins/100 mL daily for three months	RCT	Treatment group lost only 1.1 kg more than control group

all controlled, have been conducted in small numbers of younger subjects.⁶⁴⁻⁶⁸ In four of these investigations weight loss ranged from 2.05 to 3.1 kg,⁶⁴⁻⁶⁷ while in a fifth study there was no effect.⁶⁸ In all trials *Citrus*

aurantium products were combined with other agents, making it unclear which caused the benefit.⁵⁵

Table 1 summarizes research on nutrients and botanicals for weight loss.



Acupuncture for Weight Loss/Obesity

More studies have been performed on acupuncture as a treatment for obesity than any other CAM therapy. Design flaws, however, prevent determination of acupuncture's efficacy for weight loss. In one small investigation, five mildly obese (average BMI=26.5) and 55 non-obese (average BMI=24.3) individuals were given auricular acupuncture or sham acupuncture to lose weight.⁶⁹ Both normal and obese subjects received auricular acupuncture with needles inserted into the ear once weekly and kept there during the week. Non-obese subjects lost an average of 0.7 kg ($p<0.01$) with 53.5 percent experiencing a small decline in weight after eight weeks of treatment. Obese subjects were given 18 weeks of treatment. During the eight weeks for which weight loss was recorded, individuals lost an average of 0.6 kg ($p<0.01$). The sham treatment was given to normal subjects, who had needles quickly inserted in the ear at the same acupuncture site as the other subjects. However, in these subjects the needle was quickly removed and covered with tape. The sham-treated subjects were questioned and believed they received true acupuncture but did not lose weight.

In a non-blinded investigation of 74 postmenopausal women (ages 50-62; BMI >30), those given twice-weekly laser acupuncture in addition to a low-calorie diet lost 12.82 kg and BMI was reduced by 5.03 points over six months ($p<0.01$).⁷⁰ Subjects assigned to calorie restriction alone lost 8.41 kg and BMI was reduced by 3.28 points.

In another study 55 women were divided into three groups: (1) electroacupuncture (mean age=39; mean BMI=34.8) once daily for 20 days; (2) dietary restriction (mean age=42.7; mean BMI=34.9); and (3) neither (mean age=43.3; mean BMI=32.2).⁷¹ Electroacupuncture induced a 4.8-percent weight loss, the dietary-restriction group lost 2.5 percent of body weight, and the control group lost no weight in this unblinded study.

Hypnotherapy

In the past 30 years, several investigations have piloted the addition of hypnotherapy to cognitive-behavioral therapy for weight loss. A meta-analysis revealed an average weight loss of six pounds with the addition of hypnotherapy and an increased effect over time.⁷² A subsequent study on the use of hypnotherapy in obese patients with sleep apnea in which dietary advice was combined with two half-hour sessions of hypnotherapy-focused stress reduction yielded a similar average weight loss of six pounds after 18 months.⁷³

Future Considerations

Several therapies have been tested in animal models but need clinical trials. One is platycodin, a compound derived from the root of a Japanese flower, *Platycodon grandiflorum*. Rats fed platycodin for four weeks had a 13-percent greater loss of body weight than rats fed placebo.⁷⁴ Guabiroba, a plant derivative used in traditional Brazilian medicine has been used to prevent weight gain in rats fed a high-fat diet.⁷⁵

Conclusion

The epidemic of obesity in the United States is crying out for CAM therapies that work. Many substances and diets have been aggressively marketed and used for weight reduction, but relatively few have been evaluated in methodologically rigorous trials. The results of studies conducted thus far need to be confirmed by larger and appropriately designed and conducted trials. While there is likely no magic bullet to melt the pounds away, a combination of exercise, dietary modification, and select supplements, with the possible addition of hypnotherapy or acupuncture, can aid in weight loss and help stem the increasing obesity epidemic.

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