

## Complementary and alternative therapies for obesity

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### SUMMARY

Obesity is a serious medical disorder because it can cause a myriad of health problems, such as heart disease, hypertension, and adult-onset diabetes. While conventional medical treatment for obesity has limitations, there is enormous public enthusiasm for complementary and alternative treatments of obesity. This article reviews currently commonly used complementary and alternative therapies for obesity, such as medicinal herbs, nutritional supplements and acupuncture. Beneficial effects and possible adverse effects associated with these treatment are discussed.

**Key words:** Obesity; Complementary and alternative therapies

Obesity is defined as body weight 30% over the ideal body weight. Body mass index (BMI) has emerged as an indicator of obesity (Hollander, 2000; Negro, 2000). BMI is defined as weight in kg divided by height in meter squared (i.e.,  $BMI = \text{kg}/\text{m}^2$ , or  $BMI = \text{pound}/\text{inch}^2 \times 705$ ). The American Heart Association (AHA) has adopted BMI as an indicator to measure adiposity. A person who has a BMI of greater than 25 is considered overweight and greater than 27 is considered obese.

Obesity is a chronic condition that affects approximately one-third of the United States population (KucZmarski *et al.*, 1997; Flegal *et al.*, 1998). Obesity is the second leading cause of preventable deaths in this country (Flegal *et al.*, 1998; McGinnis and Forge, 1993), and it causes or exacerbates many health problems, both independently and in association with other diseases. For example, it is associated with the development of coronary heart disease, type 2 diabetes, an increased incidence of several forms of cancer, respiratory complications (obstructive sleep apnoea) and

osteoarthritis of large and small joints (Kopelman, 2000).

The economic burden of the condition is substantial. The weight-loss industry accrues about \$33 billion each year. The estimated medical costs of treating obesity are about \$238 billion per year, of which approximately \$100 billion covers the cost of treating comorbid conditions (Negro, 2000).

### FACTORS INFLUENCING OBESITY

Obesity is not a single disorder but a heterogeneous group of conditions with multiple causes. Body weight is determined by an interaction between genetic, environmental and psychological factors acting through the physiological mediators of energy intake and expenditure (Kopelman, 2000).

According to the first law of thermodynamics, obesity results from an imbalance between energy intake and energy expenditure. Energy expenditure can be divided into 3 major components. They are thermic effect of food, resting energy expenditure, and physical activity. Sympathetic nervous system controls part of energy expenditure process (de Jonge and Bray, 1997).

Elements of the system that control obesity are also presented as a feedback model (Bray, 1998, 2000): a controlled system that ingests, metabolizes,

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and stores food; afferent signals (e.g., cholecystokinin and leptin) that tell the brain about the internal and external environment; the central controller in the brain (e.g., serotonin, adrenergic and noradrenergic receptors in the hypothalamus) that transduces messages from the periphery into action; and the efferent or action system (e.g., endocrine and autonomic nervous system).

## CONVENTIONAL THERAPIES

Current therapies for obesity include life style modification, pharmacological therapy, and less frequently, bariatric surgery, all which are summarized below.

### Life Style Modification

Once weight begins to exceed the ideal body weight, lifestyle modification should be started. In patients with comorbidities, lifestyle modification should begin when the BMI is  $\leq 25$ . Life style modification includes changes in the diet and addition of exercise. Dietary therapies include moderate calorie restriction, very low calorie diets (VLCDs), and alteration of diet composition (Hollander, 2000).

The caloric intake should be below the minimum amount necessary to maintain weight. A diet and exercise plan resulting in a reduction of 300 to 500 calories per day can result in approximately a 10 lb weight loss over 10 to 20 weeks. VLCDs are indicated when caloric restrictions have failed or when rapid weight reduction is required in a short period time. VLCDs limit daily caloric intake to 800 or fewer calories. Mineral nutrients and vitamin supplements are often needed since they are frequently inadequate in the VLCD (Hollander, 2000).

### Pharmacological Therapy

When lifestyle modification does not produce adequate weight loss, pharmacological therapy may be initiated. Patients with BMI  $> 30$  are candidates for pharmacological therapy. Patients with a BMI  $> 27$  who have concomitant obesity-related risk factors (e.g., cardiac disease, hypertension, and diabetes) should also receive pharmacological therapy.

There are three theoretical sites at which

pharmacological therapy can intervene: energy intake, energy storage, and energy expenditure (Hollander, 2000). Antiobesity medication has been successful at modifying energy intake only. Energy intake can be modified by limiting food intake, such as blocking appetite, delaying gastric emptying, or modifying intestinal absorption of some or all nutrients. Two types of pharmacological therapies are currently available: the systematically acting anorectics that limit intake by suppressing appetite, and nonsystemic lipase inhibitor that interferes with fat absorption.

### *Systemically Acting Anorectics*

Anorectics act on the central nervous system and include three classes of drugs: noradrenergic, serotonergics, and combination noradrenergic and serotogenic agents (Hollander, 2000).

**Noradrenergic anorectics.** Noradrenergic anorectics include phenylpropanolamine and phentermine, which stimulate norepinephrine release. There are few studies as to either short term or long term safety and efficacy of these drugs. In general, when given as monotherapy they appear to be minimally effective.

**Serotonergic anorectics.** Serotonergic anorectics include dexfenfluramine and fenfluramine. They act by increasing the release of serotonin and decreasing the uptake of serotonin. These two drugs were withdrawn from the market two years ago, when their combination was demonstrated to produce adverse cardiac effects, including valve abnormalities.

**Combination noradrenergic serotonergic anorectics.** Sibutramine is b-phenethylamine that selectively inhibits the reuptake of noradrenaline, serotonin and, to a lesser extent, dopamine. Data from a controlled clinical trial showed a dose related reduction in body weight up to 9.4% of their weight after sibutramine administration (Bray, 1999). Side effects of sibutramine include dry mouth, insomnia, headache, constipation, and gastrointestinal upset. Sibutramine may also increase blood pressure and heart rate (Hollander, 2000).

### *Nonsystemic Lipase Inhibitor*

Orlistat is produced under the registered trademark Xenical. Also known as tetrahydrolipstatin, it is a

chemically synthesized derivative of lipstatin, which is naturally produced by *Streptomyces toxytricini* (Hadvary et al., 1988; Borgstrom, 1988). It blocks pancreatic lipase, thereby preventing the degradation of ingested triglycerides into fatty acids and monoglycerides. Thus, nondigested triglycerides are not absorbed and are excreted in the stool (Hollander, 2000). The most frequent side effects of orlistat are GI symptoms, such as oily spotting, flatus with discharge, fecal urgency, fatty/oily stool, oily evacuation, increased defecation or fecal incontinence. Orlistat also reduces absorption of fat-soluble vitamins.

#### **Others**

**Leptin.** Leptin, an investigational compound, is a peptide hormone that appears to play a role in affecting fat metabolism. It has produced substantial weight loss in animals (Zhang *et al.*, 1994; Yuan *et al.*, 2000). A recent study of subcutaneous recombinant methionyl human leptin in lean and obese individuals showed that it produced a mean weight loss at 6 months of 5.4 kg (Heymsfield *et al.*, 1999). Although there were no clinically significant adverse effects, there was significant discomfort at the injection site. Leptin has also been shown to be clinically effective in those rare individuals who lack leptin (Farooqi *et al.*, 1999).

#### **Bariatric Surgery**

The purpose of bariatric surgery is to impede food intake. There are a number of surgical approaches involving either gastric stapling or gastric bypass. Surgical procedures are currently unsatisfactory in weight reduction because of their serious side effects (Blake *et al.*, 1991; Pi-Sunyer, 1992).

The ideal anti-obesity medication would induce loss of body fat without significant loss of lean body mass, would maintain the weight loss with long-term use, would be non-toxic with few or no side effects, would have no abuse potential or dependency issues, and be cost effective. None of the available therapies meets all of these criteria. Current available treatments, including medications, are palliative and are effective only while the treatment is being actively used. The limited long

term effectiveness of conventional weight management is the impetus of major efforts aimed at searching alternative therapies. Among these therapies, medicinal herbs, nutritional supplementation, and acupuncture are commonly used.

## **ALTERNATIVE THERAPIES**

### **Medicinal Herbs**

#### ***Ma huang (Ephedra)***

Ma huang (Chinese name), also known as desert herb contains ephedra, a compound that is similar to ephedrine. Dietary supplements that contain ephedra alkaloids (Ma huang) are widely promoted and used in the United States as a mean of losing weight and increasing energy. Ephedra has been shown to increase heart rate, affect blood pressure variably and increase 24 hour energy expenditure in humans (White *et al.*, 1997). These effects are probably associated with the thermogenic effect of direct  $\beta_1$  and  $\beta_2$  agonism (Shannon *et al.*, 1999).

Cardiovascular symptoms, such as hypertension, followed by palpitation, tachycardia, or both, and central nervous system side effects, such as stroke and seizures, were reported. Death and permanent disability were also noticed. The Food and Drug Administration (FDA) has proposed to establish the limits on the dose and duration of the use of ephedra, due to the recently reported adverse effects. The FDA also requested an independent review of reports of adverse events related to the use of supplements that contained ephedra alkaloids to assess causation and to estimate the level of risk the use of these supplements poses to the consumers (Haller and Benowitz, 2000). Haller and Benowitz (2000) reviewed 140 reports of adverse events related to the use of dietary supplements. Their report indicated that the use of dietary supplements that contain ephedra alkaloids may pose a health risk to some persons. These findings indicate the need for a better understanding of individual susceptibility to the adverse effects of such dietary supplements.

Ma huang is usually available in dried branchlets and tablet form, in combination with Guarana (see below). Some commercial weight

reduction products (e.g., Metabolife) contain a combination of Ma huang and guarana. The usual dosage for Ma huang is 20 mg ephedrine equivalent, and for guarana is 200 mg caffeine equivalent, 3 times daily (Morelli and Zoorob, 2000).

### **Guarana**

Guarana is derived from the seeds of *Paullinia cupana*, and also known as Brazilian cocoa. It contains the chief alkaloid caffeine, in addition to small amounts of theophylline and theobromine. Guarana is used by Brazilian Indians in a stimulating beverage similar to coffee or tea. Several studies showed that Guarana may be effective in treating obesity when it is used with Ma huang.

A controlled study of 180 obese patients showed significantly greater weight loss using guarana, in combination with Ma huang, over a 24-week period (Astrup *et al.*, 1992). However, Breum *et al.* (1994) reported that 54 percent of patients treated with guarana and Ma huang combination experienced central nervous system side effects, especially agitation, but noted that these side effects declined markedly after the first month of the treatment. In another study, the hemodynamic side effects, such as increased systolic, but not diastolic, blood pressure and increased heart rate, were transient while the thermogenic effects on energy expenditure were persistent (Astrup and Toubro, 1993). As mentioned above, the usual dosage is for guarana is 200 mg caffeine equivalent 3 times daily.

### ***Garcinia cambogia* and *garcinia indica***

*Garcinia cambogia* and *garcinia indica* which is also known as Brindleberry is isolated from the fruit of Malabar tamarind. It is native to southern India where it is dried and used extensively in curries.

*Garcinia cambogia* and *garcinia indica* is now incorporated into many commercial weight loss products. Hydroxycitric acid is the active ingredient and it competitively inhibits the extramitochondrial enzyme adenosine triphosphate-citrate (pro-3S)-lyase. In many *in vitro* and *in vivo* studies, investigators demonstrated that hydroxycitric acid not only inhibited the actions of citrate cleavage enzyme and suppressed fatty acid synthesis

(Lowenstein, 1971), but also increased rates of hepatic glycogen synthesis (Sullivan *et al.*, 1974), suppressed food intake (Sullivan *et al.*, 1973), and decreased body weight gain (Nageswara *et al.*, 1988).

Six published human studies have examined hydroxycitric acid in weight loss. Of these studies, five some reported positive results, but all had experimental inadequacies (Heymsfield *et al.*, 1998). A randomized controlled study over a 12 week period found no differences in weight loss between a group of obese individuals given 3,000 mg of *Garcinia cambogia* (50% hydroxycitric acid) daily and a control group given placebo (Heymsfield *et al.*, 1998). However, this study did not measure either the appetite suppressant effect or the plasma concentration of hydroxycitric acid. Opponents of this study have postulated that the high fiber diet used in the study may have limited the bioavailability, thus rendering the study ineffective and leading to the disappointing results (Firenzuoli *et al.*, 1999). It appears that hydroxycitrate may offer a safe, natural aid for weight loss when taken at 500mg three times daily (Murray and Pizzorno, 1999).

### **Green Tea**

Green tea has been widely consumed in China and Japan for many centuries. Using *in vitro* interscapular brown adipose tissue system, Dulloo *et al.* (2000) showed that the effect of green tea on thermogenesis and fat oxidation may be attributed to an interaction between its high content in catechin-polyphenols and caffeine on sympathetic activity (Dulloo *et al.*, 2000). In *in vivo* animal experiments, Kao *et al.* (2000) demonstrated that green tea epigallocatechin gallate reduced food intake. Human studies by Dulloo *et al.* (1999) observed that administration of capsules containing the green tea extract resulted in a significant increase in 24 hour energy expenditure, thermogenesis, fat oxidation and urinary noradrenalin relative to placebo. These findings could be of value in assisting the management of obesity. The dosage used in the clinical study is green tea extract (50 mg caffeine and 90 mg epigallocatechin gallate). No adverse effects have been reported.

***Gymnema sylvestre (Gurmar)***

The leaves of *Gymnema sylvestre* have been highly valued as folk medicine for diabetes in India for more than 2,000 years (Nadkarni, 1982). Gymnemic acid, a mixture of triterpene glycosides extracted from the leaves of *Gymnema sylvestre*, can improve glucose tolerance and decrease the blood glucose level in diabetic patients (Baskaran *et al.*, 1990; Shanmugasundaram *et al.*, 1990). On the basis of this effect, gymnemic acid has been suggested as a useful agent in therapy for obesity (Terasawa *et al.*, 1994), since over ingestion of carbohydrates is a well documented cause of obesity. Wang *et al.* (1998) observed that gymnemic acid also potentially inhibits the oleic acid absorption in the rat intestine which was dose dependent and reversible. To date, no controlled studies have been conducted to evaluate the efficacy of *Gymnema* extract on obesity.

The recommended dose of *Gymnema* extract is 400 mg/day. An undesirable effect of this agent is that it reduces or abolishes the taste sensation of sweetness and bitterness (Mozersky *et al.*, 1999).

***Ginseng***

There are over a dozen articles reporting the effects of ginseng on animal body weight changes. However, in most cases, the report on ginsengs body weight effects was based on one of the measurements in the study, rather than being the primary goal of the project. Interestingly, these results are highly variable: six articles showed an increase in body weight effect, three showed a decreased effect, and another four showed no effect.

Several studies reported an increase in body weight after treatment with *Panax ginseng* root. Rats fed a diet containing purified ginseng saponin extract (Rhee *et al.*, 1982; Rim *et al.*, 1997), and ginseng root extract (Hong, 1972; Eui *et al.*, 1978) showed an increase in body weight. In addition, some studies reported that treatment with *Panax ginseng* extract or ginsenosides prevented stress-associated weight loss (Fujimoto *et al.*, 1989; Zierer, 1991). Other studies reported that *Panax ginseng* root had a body weight reducing effect. Park *et al.* (1998) observed that red ginseng total saponins caused a significant drop in the body weight of rats. A single high dose of red ginseng total

saponins significantly reduced the weight of rats and mice (Kim *et al.*, 1998). Administration of panaxatriol (isolated from *Panax ginseng* root) to healthy mice suppressed their maturity-associated increase in body weight (Kim *et al.*, 1990). Results of other studies failed to show an association between ginseng and body weight (Hong *et al.*, 1976; Hess, 1982, 1983; Murphy *et al.*, 1998). It is important to point out that these studies used different ginseng preparations and components in different animal species and models.

A clinical trial (Sotaniemi *et al.*, 1995) that investigated anti-diabetic effects of ginseng root reported that in addition to an improvement in fasting blood glucose levels, the subjects experienced a reduction in body weight. In this study of patients with type 2 diabetes, patients in both the control and ginseng-treated group were encouraged to reduce body weight by exercise and food intake control. Thus, patients in the ginseng-treated group as well as the placebo group lost weight. It appears that anti-obese effect of ginseng is inconclusive.

The recommended daily ginseng dosage is 1-2 g of the crude root, or 200-600 mg of standardized extracts (Schulz *et al.*, 1998). As the possibility of hormone-like or hormone-inducing effects cannot be ruled out, some authors suggest limiting treatment to 3 months (Schulz *et al.*, 1998).

***Kelp***

Kelp generically refers to seaweed species including *Laminaria*, *Macrocystitis*, *Nereocystis*, and *Fucus*. It has been used as anti-obesity agent presumably by supplying iodine, hence increasing thyroid hormone production with consequent increased metabolism and removal of fat. Iodine content is different in kelp products. Hyperthyroidism is reported after using kelp product (Foster and Tyler, 1999). Potassium iodide content may result in hypersensitivity reactions in sensitive patients. Concomitant use of kelp with levothyroxine could result in excessive replacement resulting in typical symptoms of hyperthyroidism (Miller, 1998). Since kelp and related seaweed products contain sodium, they should consequently be avoided by those who must restrict their salt intake. In addition, using any thyroid hormone-related

product to control body weight is inadvisable and should be discouraged.

### **Capsaicin**

Capsaicin is the major pungent principle in various species of capsaicin fruits such as hot chilli peppers and has long been globally used as an ingredient of spices, preservatives and medicines (Suzuki and Iwai, 1984).

Dietary supplementation of capsaicin in high fat diets lowered the peripheral adipose tissue weight and serum triglyceride concentration in rats due to enhancement of energy metabolism (Kawada *et al.*, 1986a; 1986b). Watanabe *et al.*, (1987; 1988) have investigated neurophysiological functions of capsaicin and have demonstrated that capsaicin increases energy metabolism by catecholamine secretion from the adrenal medulla through sympathetic activation via the central nervous system. In a human study, Yoshioka *et al.*, (1995) observed that energy expenditure increased immediately after the meal containing red pepper, where as this enhancement of energy metabolism by a red pepper diet was inhibited after the administration of  $\beta$ -adrenergic blocker, propranolol. In a recent human study, Matsumoto *et al.*, (2000) have investigated the effect of capsaicin on the sympathetic nervous system activity and energy metabolism in 16 lean and obese young women, age and height matched. Their observation supported previous investigations and reinforce the finding that the altered specific sympathetic function related to thermogenic capacity may be a significant sign reflecting the autonomic state in human obesity. However, data from their study also indicated that the reduced sympathetic responsiveness to thermogenic perturbation such as that found in capsaicin diet, which may cause impaired diet-induced thermogenesis and further weight gain, could be an important etiological factor leading to obesity in young women. The dose in the study was 3 mg of capsaicin in spicy yellow curry sauce.

### **Guggul gum (Gugulipid)**

This resin from the myrrh species, in addition to being used as a cholesterol lowering agent, is found in some over-the-counter diet products.

Gugulipid has been shown to stimulate the release of endogenous thyroid hormone in rats (Tripathi *et al.*, 1984), although there are no additional animal or human studies supporting this claim. Gugulipid is available in the extract form, powdered resin and concentrated tablets.

### **Nutritional supplements**

#### **Chromium**

Chromium has lately gained a great deal of public attention as an aid to weight loss. One of the key goals for enhancing weight loss is to increase insulin sensitivity of cells throughout the body, based on the fact that chromium plays an important role in cellular sensitivity to insulin (Anderson, 1998).

Preliminary studies with chromium demonstrated that chromium picolinate promoted an increase in lean body weight percentage and a decrease in percentage of body fat, which may lead to weight loss (Evans, 1993; Anderson, 1998). Greater muscle mass means greater fat burning potential. Chromium supplementation also improves blood sugar control and lowers cholesterol and triglyceride levels (Press *et al.*, 1993).

Several forms of chromium are available, such as chromium picolinate, chromium polynicotinate, chromium chloride, and chromium-enriched yeast. The recommended chromium dose is 200-400  $\mu$ g daily (Murray and Pizzorno, 1999). There have been reports of possible tissue accumulation and damage to DNA and renal damage following long-term ingestion of large doses of chromium (Sterns *et al.*, 1995; Cerulli *et al.*, 1998).

#### **5-Hydroxytryptophan (Serotonin)**

There are 3 clinical studies with 5-Hydroxytryptophan or 5-HT in overweight women (Ceci *et al.*, 1989; Cangiano *et al.*, 1991; 1992) and these studies showed that 5-HT appeared to promote weight loss by promoting satiety, leading to fewer calories being consumed at meals. Besides mild nausea, no other side effects were reported.

The recommended dosage to begin at is 5-HT at 50-100 mg 20 minutes before meals for 2 weeks, and then double the dosage to a maximum of 300 mg if weight loss is less than 1 pound per week.

Higher dosage of 5-HT is associated with nausea, but this symptom disappears after 6 weeks of use (Murray and Pizzorno, 1999).

### **L-Carnitine**

L-Carnitine is an amino acid found in meat and dairy products, made from the amino acids, lysine and methionine, in the liver and kidney. The proposed action is it increases the fat metabolism. Two studies have shown no changes in the rate of fat oxidation following L-Carnitine supplementation (Sulkers *et al.*, 1990; Vukovich *et al.*, 1994). Control studies examining the effects of L-Carnitine on weight loss have not been published. Oral supplementation may cause diarrhea, but no other major adverse effects have been noted.

### **Medium-chain triglycerides**

Medium-chain triglycerides (MCTs) are saturated fats (extracted from coconut oil) that range in length from 6 to 12 carbon chains. Unlike regular fats and long-chain triglycerides (LCTs), MCTs appear to promote weight loss rather than weight gain. MCTs may promote weight loss by increasing thermogenesis (Baba *et al.*, 1982). A study demonstrated that MCT oil given over a 6 day period can increase diet induced thermogenesis by 50% (Hill *et al.*, 1986). In order to gain the benefit from MCTs, a diet must remain low in LCTs. MCTs can be used as an oil for salad dressing, a bread spread, or simply taken as a supplement. Dosage recommendation for MCTs is 1-2 tablespoons per day. Diabetics and individuals with liver disease should be monitored very closely when using MCTs as they may develop ketoacidosis.

### **Coenzyme Q<sub>10</sub>**

Coenzyme Q<sub>10</sub> is an essential compound required in the transport and breakdown of fatty acids into energy. In one study, Coenzyme Q<sub>10</sub> levels were found to be low in 52% of overweight subjects tested. In the study, nine subjects (five with low Co Q<sub>10</sub> levels and four with normal levels) were given 100 mg/day of Co Q<sub>10</sub> along with low calorie diet. After 9 weeks, mean weight loss in the Co Q<sub>10</sub> deficient group was 29.7 pounds, compared with 12.8 pounds in those with initially normal levels of Co Q<sub>10</sub> (Van Gaal L *et al.*, 1984). The recommended

dosage is 100-300 mg/day.

### **Chitosan**

Chitosan is an amino polysaccharide derived from the powdered shells of marine crustaceans such as prawns and crabs. Some clinical studies have shown lipid lowering effects (Ventura, 1996), as well as weight loss (Maezaki *et al.*, 1993; Abelin and Lassus, 1994; Veneroni *et al.*, 1996). The proposed action of chitosan is it binds to dietary fat, preventing digestion and storage. However, in a recent controlled trial in 17 people, weight reduction effect of chitosan was not confirmed (Pittler *et al.*, 1999). Risks such as steatorrhoea and malabsorption of essential nutrients are possible.

### **Fiber supplements**

Increasing the amount of dietary fiber promotes weight loss. The best fiber sources for weight loss are psyllium, chitin, guar gum, glucumannan, gum karaya and pectin, which are rich in water-soluble fibers. When taken with water before meals, these fiber sources bind to water in the stomach to form a gelatinous mass, which induces a sense of satiety (Murray and Pizzorno, 1999). Fiber supplements have been shown to enhance blood sugar control, decrease insulin levels, and reduce the number of calories absorbed by the body (Spiller, 1994). The most impressive results in weight loss studies have been achieved with guar gum, a water soluble fiber obtained from the Indian cluster bean (*Cyamopsis tetragonoloba*).

The starting dose should be between 1 and 2 g before meals and at bed time and gradually increase the dosage to 5 g (Murray and Pizzorno, 1999). Water soluble fibers are fermented by intestinal bacteria; therefore, a great deal of gas can be produced, leading to increased flatulence and abdominal discomfort.

### **Acupuncture**

One indication for acupuncture is obesity (Cassell and Larocca, 1994). Ernst (1997) reviewed the results of sham/placebo-controlled clinical trials of acupuncture/acupressure for obesity. His goal was to determine whether or not these therapies have specific effects on appetite and body weight reduction. Two studies suggested a positive effect

of acupuncture on appetite and body weight (Giller, 1975; Shafshak, 1995), whereas two other trials showed no effect of acupuncture or acupressure (Mok *et al.*, 1976; Allison *et al.*, 1995). Richards and Marley (1998) studied the effectiveness of transcutaneous electrical nerve stimulation of specific auricular acupuncture points on appetite suppression. They observed that frequent stimulation of specific auricular acupuncture point is an effective method of appetite suppression which leads to weight loss. It has been postulated that acupuncture stimulation of certain parts of the ear can reduce appetite by activating the satiety center within the hypothalamus (Huang *et al.*, 1996), or control stress and depression via endorphin and dopamin production (Richards and Marley, 1998).

### CONCLUSIONS

Alternative therapies, especially herbal medicines, are increasingly used by obese people and some non-obese people who want to lose weight. Ephedra (Ma huang) and ephedra-containing products are often effective, especially at high doses of ephedra alkaloids. However, ephedra may cause significant cardiovascular and central nervous system adverse effects, particularly in individuals with increased susceptibility to these effects. Most herbs and nutritional supplements are used in conjunction with prescription anti-obese drugs. Thus, potential adverse herb-drug interactions should also be kept in mind for patients who are receiving conventional pharmacological agents. In addition, since a single herb (e.g., ephedra) may be used in different commercial anti-obese dietary preparations, consumers should not take more than one product simultaneously to avoid any undesirable additive effects.

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