Complementary Medicine Therapies That May Assist With Weight Loss: A Narrative Review

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ABSTRACT

Objective: The purpose of this study was to review the potential effects of traditional Chinese medicine—which includes acupuncture; electroacupuncture; plum blossom needle hammer; auricular acupuncture; herbs that balance hormones, regulate neurotransmitters, induce sedative effects, and increase thermogenesis; and functional foods that can suppress the appetite—as an adjunct therapy for weight loss.

Methods: A narrative review of the current literature was performed using searches of MEDLINE and 4 scholarly texts. The inclusion criteria for the review consisted of studies that were performed from 2005 to 2016.

Results: In general, some traditional Chinese medicine modalities claim to promote weight loss. Acupuncture, electroacupuncture, and herbs aim to reduce stress-related food cravings. These therapeutic approaches aim to downregulate dopamine and leptin levels, suppressing the appetite. Other attributes of these therapies are increasing uncoupling protein-1 activity promoting thermogenesis, which contributes to weight loss. In addition, acupuncture, electroacupuncture, and *Cimicifuga racemosa* may regulate estrogen, which could attenuate the appetite, assisting in weight-loss programs.

Conclusion: The literature reviewed includes information that describes how traditional Chinese medicine, herbal medicine, or functional foods as adjunct therapies may be beneficial for weight-loss programs. (J Chiropr Med 2019;18:115-126)

Key Indexing Terms: *Weight Reduction Programs; Weight Loss; Diet, Reducing*

INTRODUCTION

Obesity is a major problem in the United States, affecting two-thirds of the population. Individuals who are overweight or obese have a higher incidence of morbidity and mortality. Obesity is positively correlated with a higher incidence of cardiovascular disease, hypertension, cerebrovascular accidents, cancer, psychological and emotional conditions, arthritis, and a variety of other diseases.¹

The primary method for controlling weight gain and for prevention of obesity is regulating the diet and exercising. However, it is estimated that 63% of Americans have seriously tried to lose weight at one time in their lives.² Of

those, 29% are currently attempting to lose weight.² Although a large number of Americans try to lose weight, many will fail. This may be due to an inability to adhere to a healthy diet. In fact, the US Department of Agriculture found that only 1 in 5 Americans consume the recommended value of fruit and vegetables each day.³ The results of a study by Abo et al provides further evidence of the problem people have with eating healthily. According to their research, 33% of individuals have difficulty eating healthily in general and are unable to maintain a healthy diet.⁴

The reasons that a diet may fail could be multifactorial. One of the possible mechanisms that may be implicated is physiological stress causing food cravings.⁵ Another factor may be the pleasure that we experience from eating foods with high sugar or fat or from stress-related food cravings.⁶ Overconsumption of calories altering serum leptin levels, which interferes with satiety, could be another aspect involved. Lastly, an estrogen imbalance in women may affect appetite and adiposity.⁷

Traditional Chinese medicine (TCM)—which includes acupuncture, electroacupuncture, auricular acupuncture, and plum blossom needle hammer therapy; herbal medicine; and functional foods—could be used to attenuate the physiologic effects that may be responsible for interfering

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with the success of dietary programs. These therapeutic modalities may be effective adjuncts to assist with maintaining dietary habits and promoting weight loss. There are several studies that discuss the individual properties of these therapeutic strategies, yet a narrative review on the subject does not exist. The purpose of this paper is to explore the potential effects of TCM; herbs that balance hormones, regulate neurotransmitters, induce sedative effects, and increase thermogenesis; and functional foods that can suppress the appetite as adjunct therapies for weight loss.

METHODS

A narrative review of the current literature was performed in January 2017 using searches of the computerized database MEDLINE and scholarly texts.⁸⁻¹¹ The inclusion criteria for the review consisted of studies that were performed from 2005 to 2016 because there was limited information before 2005 related to each category researched. The relevant key word searches related to obesity; acupuncture; electroacupuncture; plum blossom needle hammer; auricular therapy; weight loss; appetite-suppressant functional foods; and herbs that balance hormones, regulate neurotransmitters, produce a sedative effect, and promote thermogenesis are specified in Supplementary Appendix Table 1. MEDLINE was the only academic resource used. The narrative review examined experimental animal studies and clinical trials and other experiments. Studies that did not meet the criteria of the particular key words were excluded, and studies with abstracts written in a language other than English were excluded. Meta-analysis studies, literature reviews, narrative reviews, and commentaries were excluded.

For the review of the academic literature, books printed between 2005 and 2016 were included. Three of the books chosen discussed TCM theory, which is often not expressed in evidence-based experiments. The primary books used were the *Physician's Desk Reference (PDR)*, *A Manual of Acupuncture*, *The Foundations of Chinese Medicine*, and *The Treatment of Modern Western Medical Diseases with Chinese Medicine*.⁸⁻¹¹ Hand searches were conducted for specific key words (as indicated in Supplementary Appendix Table 2) pertaining to obesity, acupuncture, acupuncture modalities, weight loss, functional foods, and herbs.

RESULTS

A total of 273 academic journal articles from MEDLINE and 4 academic textbooks were chosen for this review. Of those reviewed, 99 journal articles met the criteria for inclusion. Of the journal articles chosen for the review, 53 were clinical trials (see Supplementary Appendix Table 3) and 46 were experimental studies. The literature search

produced various scientific articles and textbooks with information pertaining to weight loss and the use of hormone balancing, neurotransmitter regulating, sedative and thermogenic herbs, functional foods, acupuncture, plum blossom needle hammer, electroacupuncture, and auricular acupuncture.

DISCUSSION

Dieting is an essential component for weight management programs. Unfortunately, statistics show that 33% of individuals fail to sustain healthy eating habits required by the diet. Natural therapies may act as an adjunct to assist with maintaining dietary patterns. In addition, these treatment strategies may augment weight loss through a variety of physiologic mechanisms.

There is evidence that acupuncture is effective for weight loss.^{12,13} In one study, electro-acupuncture and auricular acupuncture were compared with sham acupuncture for weight management. The investigators observed that the treatment group experienced a significant reduction in body mass index, total fat mass, waist circumference, and hip circumference with corresponding *P* values of less than .005 for all except waist circumference, which had a *P* value of < .05.¹²

Another study by Cha et al reported on administration of auricular acupressure and found that it reduced abdominal circumference and body weight with a *P* value < .001. The exact mechanism for weight loss and reduced adiposity was not determined in either of these studies.¹⁴ However, the authors theorized that the results may have been observed owing to the effects that acupuncture and electroacupuncture have on the appetite.¹² This seems plausible because 6 other studies included in this review have demonstrated that acupuncture and electroacupuncture can alter hormone levels and potentially affect the appetite.¹⁵⁻²⁰

TCM for Blood Glucose, Insulin, and Leptin Regulation

Another study performed on 104 obese women evaluated the efficacy of the combination of acupuncture with plum blossom needle hammer or plum blossom needle hammer as a monotherapy. The researchers evaluated body mass index, body fat percentage, obesity degree, serum lipid levels, fasting blood glucose, insulin levels, insulin resistance, and serum leptin. Treatment was administered once every 2 days for 3 months. The combination group and the monotherapy group both showed improvements in all parameters.¹³ The rate of effectiveness was 96.2% for the combination group and 84.6% for the monotherapy group, showing that both groups experienced beneficial effects for weight management with *P* values < .01 and .05 for all indices measured.¹³ In this case, a potential mechanism to explain the improvement of the outcome measures appears to be alterations in fasting hormone levels. Serum leptin and

insulin, fasting blood glucose, and insulin resistance were all improved.

Several other studies further support this data. These studies demonstrate that electro-acupuncture and acupuncture act on a cellular level to downregulate the release of serum leptin.¹⁵⁻¹⁷ ST 36 (*Zusanli*) and ST 44 (*Neiting*) are 2 points that are capable of producing leptin-lowering effects.¹⁶ When stimulated using electroacupuncture, these points increased the expression of leptin receptors in the hypothalamus, which enhanced fatty acid mobilization and reduced the size of adipocytes.¹⁶ ST 25 (*Tianshu*) and CV 12 (*Zhongwan*) are additional points that can reduce serum leptin levels and lower body weight.^{15,17}

Another study conducted by Wang et al found that electroacupuncture performed on ST 36 (*Zusanli*), SP 6 (*Sanyinjiao*), CV 4 (*Guanyuan*), and CV 12 (*Zhongwan*) could reduce serum leptin and insulin levels in addition to fat mass and adipose cell size.¹⁸ An analogous study using the same points determined that acupuncture alone reduced serum leptin and insulin levels.¹⁹ Both of these studies had *P* values < .05.^{18,19} In addition, ST 25 (*Tianshu*) demonstrated the ability to optimize the fat-to-weight ratio.¹⁷ These effects may all assist with the prevention of food cravings and weight loss.

An additional effect of ST 36 (*Zusanli*) and ST 44 (*Neiting*) that may be beneficial for controlling weight gain is the upregulation of the production of adiponectin, which is typically low in obese individuals and may contribute to insulin resistance.^{17,20} A study using ST 25 (*Tianshu*) produced similar results.¹⁷ Upregulating adiponectin and reducing insulin resistance may control food cravings controlling the appetite.

Traditional Chinese medicine reducing serum leptin may be beneficial for controlling food cravings. Leptin is a hormone that communicates with the hypothalamus to convey information pertaining to the extent of fat stored within the adipocytes. The hypothalamus uses this information to control satiety.²¹ Consequently, excessive levels of serum leptin cause the hypothalamus to become resistant to the signals that are sent by leptin, thus disrupting the appropriate feeling of fullness after a meal.²¹ The end result is an insatiable hunger, prompting individuals to eat a greater number of calories more often.¹⁸

In addition, an overconsumption of calories may also contribute to leptin resistance. Consuming a high-calorie diet leads to weight gain by increasing the production of acetyl coA carboxylase, which in turn increases the amount of fatty acids generated for storage in adipocytes.²¹ As the adipocytes enlarge, they produce leptin in greater amounts.²¹ As a person's body weight increases, the levels of leptin released simultaneously increases, which over time can result in leptin resistance.²¹ Therefore, controlling serum leptin levels using acupuncture, electroacupuncture, and plum blossom needle hammer can help to control food cravings, which could prevent weight gain.

There are 6 studies that demonstrate that acupuncture may possess the ability to regulate serum leptin and insulin. There is more information related to the benefits of acupuncture and electroacupuncture than plum blossom needle hammer therapy for controlling these hormones. Regardless, all 3 therapies were able to modulate leptin and insulin, which can positively influence blood glucose levels, reducing the potential for food cravings that could lead to excessive consumption of food and obesity.

Herbs for Blood Glucose, Insulin, and Leptin Regulation

The herbs *Cinnamomum cassia* (Chinese cinnamon) and *Gymnema sylvestre* have been shown to reduce food intake by regulating the appetite through the control of insulin, serum glucose levels, and leptin.²² These herbs also can control the appetite through the promotion of insulin secretion and regulation of blood glucose levels.²³⁻²⁵ Two other studies provide evidence that *G sylvestre* potentiated insulin sensitivity and reduced blood glucose.^{26,27} An experiment by Bhansali et al found that deacyl gymneic acid was the agent responsible for the improvement in insulin sensitivity with *P* values below .01 and .05.²⁶

In addition, *C cassia* has the potential to downregulate the expression of genes in adipocytes that are associated with obesity and helps control the appetite through the regulation of leptin and ghrelin.²⁸ It also inhibits the transcription of the enzyme fatty acid synthase.²³ Fatty acid synthase generates fatty acids that are transported into adipocytes, contributing to adiposity.²³ *G sylvestre* has also demonstrated the ability to reduce serum leptin and visceral fat adiposity, which can attenuate weight gain.²² Two additional studies demonstrated a reduction in adiposity, whereas a study by Kumar et al showed no significant difference in visceral adiposity.²⁸⁻³⁰

There are a few studies that support the prescription of *C cassia* and *G sylvestre* for controlling serum leptin, insulin, and glucose levels. However, the evidence suggests that *C cassia* produces additional effects that may be appropriate for weight management. The evidence presented in these studies is plausible for reducing adiposity through various mechanisms.

Stress-Related Food Cravings

A major problem with weight management may be stress-related food cravings. Stress is a physiological factor that has the potential to induce food cravings.⁵ Stress promotes the release of cortisol from the adrenal glands. Higher levels of cortisol in circulation stimulate the secretion of epinephrine from the adrenal medulla.²¹ Both hormones facilitate and upregulate the activity of enzymes associated with gluconeogenesis and glycogenolysis in the liver. Concurrently, an increase in amino acid catabolism in the muscle ensues, which creates a fasting state in which

energy stores are mobilized.²¹ During a fasting state, the body liberates nutrients that are stored as an energy reserve, causing it to perceive that it requires food, thus initiating cravings.²¹

TCM for Stress Reduction and Food Cravings

Auricular acupuncture, acupuncture, and herbs could reduce stress through cortisol regulation and attenuate stress-related food cravings, preventing excessive calorie consumption and weight gain leading to obesity. To exemplify this concept, a study was performed on health care workers to assess their level of perceived stress and anxiety. Auricular acupuncture was implemented. A significant reduction in the state anxiety index, trait anxiety index, burnout, and stress scores was observed, demonstrating that acupuncture is effective for the relief of stress and anxiety.³¹ The *P* values for the state anxiety and trait anxiety indexes and the burnout and compassion fatigue scores were .0, .007, .006, and .004, respectively.

One of the possible mechanisms that explain the reduction of perceived stress after acupuncture therapy is through the hypothalamic–pituitary–adrenal axis. A study by Eshkevari et al demonstrated that electroacupuncture lowered adrenocorticotrophic hormone (ACTH) and cortisol.³² Adrenocorticotrophic hormone is released from the anterior pituitary, initiating the release of cortisol. In this study, after induction of stress from an ice water bath, electroacupuncture was applied to the study cohort at ST 36 (*Zusanli*) for 30 minutes for 14 days.³² There were 4 groups in this study: unstressed control, stressed control, stressed sham acupuncture, and stressed electroacupuncture. Adrenocorticotrophic hormone and cortisol levels were assessed at baseline and on day 14. Upon cessation of the experiment, the serum levels of ACTH and cortisol in the electroacupuncture group was comparable to that of the unstressed control, whereas the stressed sham acupuncture and stressed control groups showed significantly higher levels of ACTH and cortisol with a *P* value less than .05.³² Reducing the levels of ACTH and cortisol suppresses the excretion of epinephrine, thus reducing the activation of enzymes associated with a fasting state.²¹ Therefore, certain acupuncture points treated using electroacupuncture may theoretically be employed to subdue stress-induced food cravings.

There were 6 additional studies investigating the effects of acupuncture, auricular acupuncture, and electroacupuncture on the hypothalamic pituitary axis.^{33–38} Each of these studies showed that these therapeutic modalities significantly reduced serum cortisol and ACTH.^{33–38} Most studies found that acupuncture therapies modulated glucocorticoid receptors, which affected hormone levels.^{32–38} One study demonstrated that acupuncture enhanced the expression of glucocorticoid receptors in different parts of the brain and reduced the expression of receptors on the adrenal cortex.³⁵ In addition, corticotrophin-releasing hormone levels were attenuated in another study, whereas a study by Le et al

showed that electroacupuncture reduced corticotrophin-releasing hormone mRNA gene expression with *P* values less than .01 and .05.^{35,37}

There are several studies that advocate the use of TCM for the reduction of stress. The mechanism by which this occurs is through the manipulation of the hypothalamic pituitary axis affecting ACTH, corticotrophin-releasing hormones, and cortisol levels. These studies provide evidence to support the use of TCM for the reduction of stress and stress-related symptomatology.

TCM for Stress Relief

There are several acupuncture points that are used to alleviate stress according to TCM textbooks, which were not extracted from research articles. Among these points are *Yintang*, DU 20 (*Baihui*) in combination with *Sishencong*, *Sun Simiao* ghost points, ST 36 (*Zusanli*), ST 40 (*Fenglong*), SP 4 (*Gongsun*), SP 6 (*Sanyinjiao*), HRT 5 (*Tongli*), KD 1 (*Yongquan*), KD 6 (*Zhaohai*), PC 6 (*Neiguan*), SJ 10 (*Tianjing*), and GB 12 (*Wangu*).^{9,10} The *Sun Simiao* ghost points include DU 16 (*Fengfu*), DU 23 (*Shangxing*), DU 26 (*Renzhong*), REN 24 (*Chengqiang*), LU 11 (*Shaoshang*), LI 11 (*Quchi*), ST 6 (*Jiache*), SP 1 (*Yinbai*), PC 7 (*Daling*), PC 8 (*Laogong*), and UB 62 (*Shenmai*).⁹ These points are classically used for mental–emotional conditions and “calming the spirit.”⁹

Unfortunately, much of the evidence for the use of particular points is empirical in nature rather than evidence based. However, 2 of the studies discussed above promote the use of ST 36 (*Zusanli*) for stress relief through the manipulation of the hypothalamic pituitary axis.^{32,37} Studies have also found that SP 6 (*Sanyinjiao*) and PC 6 (*Neiguan*) have an effect on the hypothalamic pituitary axis and can attenuate stress.^{35,38} Consequently, there is some evidence that exists to support the use of some of the points from a TCM-based text.

Herbs for Stress Reduction and Food Cravings

Herbs that have been used to alleviate stress are *Matricaria recutita*, *Passiflora incarnata*, *Piper methysticum*, *Valeriana officinalis*, *Lavandula angustifolia*, and *Melissa officinalis*. All of these herbs have the capacity to interact with enzymes involved with gamma-aminobutyric acid (GABA), which promotes relaxation.^{8,39} Six research studies showed that *P incarnata* was capable of attenuating GABA levels and reducing stress and anxiety with *P* values below .01, .05, and .08.^{40–45} There are 3 studies that demonstrate the anxiolytic effects of *V officinalis*.^{45–47} Two of these studies found that valerenic acid is the component that interacts with the GABA-ergic system, whereas the study conducted by Awad et al demonstrates an enhancement of glutamic acid decarboxylase, which increases the synthesis of GABA.^{45–47} *L angustifolia* and *Matricaria*

species have the additional benefit of reducing cortisol levels to instill a state of serenity.^{48,49} *L. angustifolia* was also shown to produce anxiolytic effects with *P* values below .001.⁵⁰ In addition, *P. incarnata* and *P. methysticum* possess serotonin and norepinephrine modulatory properties that enhance mood and reduce sympathetic activity, promoting rest and relaxation.^{8,42} Two additional studies indicated that *P. incarnata* had the ability to interact with the GABA-ergic system, influencing neurotransmitter release.^{51,52} In addition, *P. methysticum* simultaneously potentiates the release of dopamine and inhibits calcium and sodium channels to induce a feeling of calmness.⁸

There is a multitude of evidence supporting the use of herbs for reducing stress. Some of the data provided are empirical from the *PDR*. However, there are several research studies that make the information relevant. The primary mechanism observed is the interaction with GABA-ergic receptors and upregulation of GABA release, yet these herbs may decrease stress by other mechanisms as well. Unfortunately, there is less evidence available to support this and more research needs to be conducted.

Dopamine and Overeating

Another factor related to stress that exacerbates food cravings is the release of dopamine that occurs during consumption of high-fat or high-sugar foods. Dopamine is the pleasure hormone that is secreted in response to the gratification experienced during consumption of tasty foods.⁶ This catecholamine is released from the dorsal striatum in quantities that are equivalent to the amount of pleasure that occurs during feeding.⁶ Consuming foods that are high in sugar or fat stimulates the secretion of dopamine, thus conferring a feeling of gratification.⁶

TCM Effects on Dopamine

Traditional Chinese medicine can attenuate the effects of dopamine, which may reduce food cravings by a different mechanism. In one study, acupuncture was administered to parkinsonian-induced mice at GB 34 (*Yanglingquan*). Application of acupuncture to GB 34 stimulated the production and discharge of dopamine in the serum, thus increasing its bioavailability at the synapse.⁵³ There are 5 additional studies that demonstrate the ability of GB 34 to interact with dopamine receptors with *P* values less than .001 and .05. Of these studies, 2 administer LR 3 (*Taichong*) in conjunction with GB 34.⁵⁴⁻⁵⁸ In human participants, enhancing the production and secretion of dopamine using acupuncture therapy may reduce food cravings associated with stress eating. Another study revealed that ST 36 (*Zusanli*) and SP 6 (*Sanyinjiao*) are also capable of controlling dopamine levels.⁵⁹ These points were shown to reduce withdrawal symptoms in alcoholics through dopamine regulation.⁵⁹

There is a moderate amount of data advocating the use of acupuncture for the potentiation of dopamine levels. Unfortunately, only a few points have demonstrated this effect in the current research. However, it appears that acupuncture can increase the bioavailability of dopamine, which may act as an appetite suppressant. Controlling the levels of dopamine may mitigate food cravings, thus assisting with weight loss.

TCM for Appetite Suppression

Aside from stress-related food cravings, acupuncture may act as a general approach to attenuate food cravings and suppress the appetite to help with weight management. According to TCM literature obtained from textbooks and not from clinical or experimental studies, the acupuncture points that have been used for food cravings are ST 36 (*Zusanli*), PC 6 (*Neiguan*), ST 40 (*Fenglong*), and SP 9 (*Yinlingquan*).¹¹ ST 36 (*Zusanli*), PC 6 (*Neiguan*), and ST 40 (*Fenglong*) also have the ability to reduce stress and suppress food cravings, making them optimal for controlling overconsumption of foods in weight management programs. Although this evidence is empirical in nature, the study discussed above performed by Yang et al indicates that there may be some relevance to the TCM literature, making it potentially clinically applicable.⁵⁹

Functional Foods for Appetite Suppression

Functional foods can be introduced into the diet to downregulate the appetite. *Trigonella foenum-graecum* and *Spinacia oleracea* both promote satiety.^{60,61} In a study using *T. foenum-graecum*, the investigators observed a significant reduction in hunger in the obese participants who ingested an 8-g dose of the herb before lunch.⁶⁰ This study found that the individuals in the treatment group consumed less food than the control group with a *P* value < .05.⁶⁰

Two analogous studies were performed using *S. oleracea*. The first study used 60 overweight and obese participants. These individuals were tested on 2 separate occasions at least 1 week apart. The first time the patients were supplemented with an extract of *S. oleracea* and the second group received a placebo. The extract or placebo was administered at lunch followed by a pizza dinner 4 hours later. When hunger and cravings were assessed over the 4-hour period, the *S. oleracea* extract group had an increase in satiety and a reduction in food cravings, resulting in an intake of less food with a *P* value < .01.⁶¹

In the second study, 2 groups of randomly selected overweight women were divided into the treatment group, which received an extract of *S. oleracea*, or the control group, which received a placebo. Hunger, cravings for sweet and salty snacks, and enjoyment of sweets was evaluated. The group administered the *S. oleracea* extract recorded less hunger and greater levels of satisfaction with

meals and a reduction in cravings for salty and sweet snacks.⁶² The treatment group also experienced less enjoyment in the consumption of sweet foods and an overall reduction in food intake.⁶² However, the reduction in food intake was not considered significant with a *P* value less than .01.

The data from this study and the one conducted by Rebello et al indicate that *S. oleracea* may control the appetite to prevent overeating and possible weight gain. Unfortunately, there are only a few studies investigating the utilization of *T. foenum-graecum* and *S. oleracea* as functional foods for suppressing the appetite. Yet, the evidence suggests that these foods can potentially assist with controlling the appetite. Therefore, the incorporation of these foods into the diet may prevent deviations from the foods recommended by the weight-loss program through appetite control.

Thermogenesis

Another physiological activity that could regulate weight gain is through the manipulation of uncoupling proteins (UCP).⁶³ Brown adipose tissue is most abundant during infancy and is gradually replaced by white adipocytes.²¹ There is still some brown adipose tissue in the body after infancy, but only a fraction remains.²¹ Brown adipose tissue raises the core body temperature through the activity of UCP 1.²¹ UCP 1 is a protein that is associated with dissipation of the electrochemical gradient generated by the electron transport chain and the mitochondria.²¹ Disrupting the gradient of the electron transport chain causes energy to be released as heat in a process known as thermogenesis.²¹ Thermogenesis slightly increases the overall core temperature of the body, which in turn accelerates basal metabolic rate (BMR).

TCM Increase Thermogenesis

Using TCM could enhance the BMR, increasing energy expenditure and stimulating weight loss. Electroacupuncture using ST 36 (*Zusanli*) and ST 44 (*Neiting*) demonstrated an increase in UCP 1 activity and expression by 14 times in white adipocytes.⁶³ Furthermore, the physical properties of the white adipose tissue began to resemble that of brown adipose tissue, suggesting that electroacupuncture may have stimulated characteristic properties observed in brown adipocytes to manifest in white adipocytes.⁶³ White adipose tissue expressing properties that are analogous to brown adipose tissue can considerably increase thermogenesis by activating UCP, which may promote weight loss. Another study conducted by Li et al used auricular acupuncture, which significantly increased UCP 1 and reduced body weight and white adipose tissue.⁶⁴

There are limited data demonstrating the effectiveness TCM to increase thermogenesis. However, the studies that

have been conducted show that these modalities have the ability to potentiate UCP 1 protein activity, causing a mild increase in BMR. Enhancing BMR can lead to weight loss.

Herbs Increase Thermogenesis

Camellia sinensis is an herb that increases thermogenesis in the body and speeds up the BMR.⁸ This herb has demonstrated the ability to potentiate the effects of β -oxidation by as much as 41.5%, promoting the degradation of long-chain fatty acids.⁸ For example, in an animal study, rats were fed a high-fat diet and supplemented with *C. sinensis* or placebo. The rats that received *C. sinensis* experienced a reduction in the weight of total white adipose tissue.⁶⁵ The weight loss was attributed to the disruption of enzymes involved in fatty acid synthesis while promoting the efficacy of the carnitine shuttle, thus increasing lipid metabolism.⁶⁵

There are 8 additional studies that demonstrated the ability of *C. sinensis* to enhance weight loss with a *P* value below .05.⁶⁶⁻⁷³ However, these studies show that there are various mechanisms that may contribute to weight loss from the supplementation with *C. sinensis*. One study demonstrated an increase in insulin-like growth factor binding protein, which was negatively correlated with increases in white adipose tissue.⁶⁹ Another study concluded the polyphenol content of *C. sinensis* was responsible for the weight loss observed.⁷¹ In this study, polyphenols were shown to reduce serum leptin levels, quenching cravings.⁷¹ A study by Lee et al demonstrated that this herb interacts with peroxisome proliferator-activated receptors, inhibiting the activity of adipogenic cells.⁶⁸ Yan et al also found a reduction in peroxisome proliferator-activated center pathways and an increase in expression of genes responsible for β -oxidation.⁷⁰ Lee et al also observed a reduction in fatty acid synthase and an increase in carnitine shuttle analogous to Kim et al.^{65,68} However, Lee et al also observed an increase in UCP activity and the mobilization of fatty acids through the upregulation of hormone-sensitive lipase and adipose triglyceride lipase.⁶⁸ Four studies showed that *C. sinensis* effectively controls protein, carbohydrate, and fat metabolism through the reduction of insulin resistance.^{66-68,72}

Another study conducted by Santana et al using decaffeinated *C. sinensis* produced similar effects.⁷³ These investigators also found that *C. sinensis* activated hormone-sensitive lipase and augmented fatty acid mobilization.⁷³ In addition, Santana et al observed an increase in adiponectin levels and the inactivation of acetyl-CoA carboxylase reducing fatty acid synthesis.⁷³

Consequently, decaffeinated *C. sinensis* was shown to have analogous effects to its caffeinated counterpart. The reason for the similar effects observed may be explained by a study conducted by Han et al in which epigallocatechin-3-O-gallate, which is a major component of *C. sinensis*,

produced antagonistic effects to caffeine, reducing its physiologic activity.⁷⁴ These results were repeated in one other study showing that epigallocatechin-3-O-gallate counteracted caffeine-induced release of epinephrine, norepinephrine, and dopamine.⁷⁵ Consequently, caffeinated or decaffeinated *C sinensis* can promote weight loss.⁷⁴

An important consideration is that although caffeine is a stimulant with the potential to accelerate weight loss, weight loss is not always from adipose tissue during fasting.⁷⁶ During gluconeogenesis, which is potentiated by caffeine, amino acids from muscle will be mobilized, potentially contributing to the weight loss observed. Higher amounts of muscle tissue accelerate BMR.⁷⁷ Therefore, it may be counterproductive to use caffeine as a weight-loss agent. For example, in one study, the ability of caffeine and *C sinensis* to oxidize fatty acids was compared. The study concluded that *C sinensis* promoted fatty acid degradation through thermogenesis, but caffeine failed to produce a significant effect.⁸ The weight loss observed owing to caffeine was probably associated with prolonging gluconeogenic activity, which may contribute to the degradation of muscle proteins. Therefore, with caffeinated products, most weight loss will come from adipose tissue, but a small portion may come from the loss of other tissues, including muscle tissue.

There is a magnitude of research that exemplifies the effectiveness of *C sinensis* as a weight-loss enhancing agent. *C sinensis* is capable of promoting weight loss by many different mechanisms, including the manipulation of gene expression, leptin levels, and fatty acid activity. Regardless of its physiological effects, the evidence shows that caffeinated and decaffeinated *C sinensis* may help reduce adiposity with minimal impact on muscle tissue.

Functional Foods Accelerate BMR

Certain functional foods can upregulate the BMR by other mechanisms besides thermogenesis. *Citrus paradisi* is a functional food that has this ability.⁷⁸ Of the studies that were included in this narrative review, 5 of 6 demonstrated a significant reduction in weight compared with control with *P* values below .001, .01, and .05.⁷⁸⁻⁸³ The mechanism associated with increasing the BMR could be from an abundance of effects. One effect is the promotion of oxidative phosphorylation in the mitochondria, which expedites energy expenditure through β -oxidation.⁷⁸ *C paradisi* may also act on a genetic level to stimulate the expression of genes that facilitate β -oxidation and inhibit the expression of genes associated with lipogenesis in the liver.⁷⁹ Both of these effects can promote weight loss. An extra benefit of *C paradisi* is the capacity to modulate blood glucose levels, which can control food cravings.⁷⁸ Three additional studies demonstrate that *C paradisi* is capable of regulating insulin release and blood sugar levels.^{80,82,83} In addition, the experiment by Murase et al showed that *C paradisi* reduced serum leptin levels and improved physical performance.⁸¹

A study that demonstrates the effectiveness of *C paradisi* for weight loss used 91 obese participants. The participants were allocated into 4 groups: placebo capsules and 7 ounces of apple juice, *C paradisi* capsules with 7 ounces of apple juice, 8 ounces of *C paradisi* juice with placebo capsule, or half of a piece of *C paradisi* fruit with placebo capsules. The participants were not asked to change their diet or exercise more often. Each treatment protocol was administered 3 times a day for 12 weeks. At the end of the 12-week period, the group that lost the most weight was the group consuming half a piece of *C paradisi* fruit, which was followed by the *C paradisi* juice group, then the *C paradisi* capsule, and then the placebo group.⁸⁴ Weight loss for each group was 1.6 kg, 1.5 kg, 1.1 kg, and 0.3 kg, respectively, with a *P* value < .05.⁸⁴

There is sufficient evidence to support the use of *C paradisi* as an adjunct therapy for weight loss. This functional food can enhance weight loss by a multitude of mechanisms. However, the primary mechanism for weight loss appears to be through the modulation of insulin resistance and blood glucose levels. Therefore, *C paradisi* may augment weight loss by attenuating food cravings.

The Role of Estrogen in Weight Loss

Lastly, a possible contributing factor for weight gain in postmenopausal women is a reduction in estrogen levels. Estrogen may act as an appetite suppressant. One study demonstrated that estrogen suppressed the appetites of mice, causing them to consume less food.⁷ In addition, the mice concurrently showed a reduction in adiposity and the size of their adipocytes.⁷

One possible mechanism is that estrogen interacts with membrane-bound receptors ER- α and ER- β .⁷ The interaction of estrogen with these receptors may potentiate energy metabolism.⁷ Enhancement of energy metabolism may be through the stimulation of catecholamine and perilipin-induced lipolysis.⁷ The activity of these agents promotes a fasting state, which increases the release of free fatty acids into circulation.⁷ However, estrogen simultaneously down-regulates the gene expression of the transcription factors that initiate storage of fatty acids in adipose tissue.⁷ Because estrogen increases the release of fatty acids from adipocytes and prevents storage, the size of adipocytes are reduced.⁷

Potential Effects of TCM on Estrogen

Estrogen regulation using TCM may have an impact on weight loss in women. One study using electroacupuncture was performed on ovariectomized rabbits. The electroacupuncture group was compared with a group taking estrogen replacement therapy, a negative control group, and a positive control group. Both treatment groups experienced a significant elevation in serum estrogen levels and weight loss.⁸⁵

Diminished estrogen levels associated with menopause can interfere with weight management programs. Points that may help regulate estrogen, which as previously noted acts as an appetite suppressant, are GV 20 (*Baihui*), Yintang, HRT 8 (*Xiaohai*), KD 10 (*Yingu*), and LR 2 (*Rangu*).⁸⁶ These points were shown to effectively reduce hot flashes in women prescribed antiestrogenic therapy with a P value $< .001$.⁸⁶ Four additional studies demonstrated that acupuncture reduces the severity of hot flashes, and 2 other studies showed that electroacupuncture decreased these symptoms with P values less than .001, .0001, .03, and 0.026.⁸⁷⁻⁹² In 2 of the studies, hot flashes were reduced by almost 50%, and almost a 60% improvement in symptomatology was observed in another study.⁸⁷⁻⁸⁹ The participants experienced an improvement in well-being, mood, anxiety, and libido in 3 of the studies.^{88,90,91}

There are 12 studies that have demonstrated that acupuncture and electroacupuncture are capable of regulating hormones with P values less than .01 and .05.⁹³⁻¹⁰⁴ Of the 12 studies, 7 observe a positive change in estradiol levels; 4 of the studies showed altered luteinizing hormone, testosterone, and progesterone levels; 2 studies demonstrated an attenuation of prolactin; and 1 study found that acupuncture influenced follicle-stimulating hormone release.⁹³⁻¹⁰⁴ Although the mechanism of alteration is not discussed in all of the studies, the experiment conducted by Liu et al found that acupuncture affected gonadotropic-releasing hormone mRNA levels, and Yang et al noted the modulation of estrogen receptor protein expression after administration of electroacupuncture.^{94,101} The points that can be employed for conditions associated with hormonal dysfunction are UB 23 (*Shenshu*), KD 3 (*Taixi*), LI 4 (*Hegu*), SP 6 (*Sanyinjiao*), SP 8 (*Diji*), ST 36 (*Zusanli*), LR 3 (*Taichong*), CV 3 (*Zhongji*), CV 4 (*Guanyuan*), CV 6 (*Qihai*), CV 12 (*Zhongwan*), PC 6 (*Neiguan*), GV 2 (*Yaoshu*), GV 3 (*Yaoyangguan*), GV 4 (*Mingmen*), and Zi gong.^{93,94,97,99,101,103,104}

There is a substantial amount of data that exist advocating the use of TCM for the regulation of reproductive hormones including estrogen, although the exact mechanism is not clear. There is a multitude of evidence that supports the use, making it a potential adjunct therapy for balancing hormones and controlling the appetite.

The Effects of *Cimicifuga racemosa* on Estrogen

Cimicifuga racemosa can effectively regulate estrogen levels, which could enhance appetite suppression. Some evidence promotes the use of *C racemosa* for the modification of estrogen levels.⁸ Data suggest that it is capable of binding to estrogen receptors and upregulating or downregulating activity.⁸ The MEDLINE search generated 9 studies that met the parameters. Unfortunately, there were only 2 studies measuring estrogen levels. One study demonstrated that there were no significant changes in estrogen compared to placebo, and the other showed weak estrogenic effects.^{105,106} However, all 9 of the studies,

including the study by Wuttke et al that did not show significant changes in estrogen, found a significant reduction in symptoms with P values ranging from .001 to .56.¹⁰⁵⁻¹¹²

Another study found *C racemosa* was effective for improving menopausal symptoms by modulating estrogen levels with a P value $< .001$.¹¹³ In this study, *C racemosa* was prescribed to women who were experiencing vasomotor, psychiatric, physical, and sexual symptoms that were assessed via the Greene Climacteric Scale.¹¹³ *C racemosa* significantly reduced the severity of the symptoms of all patients. In addition, a study by Rachon et al demonstrated that supplementation with *C racemosa* in ovariectomized rats prevented weight gain and resulted in lower amounts of intra-abdominal fat.¹¹⁴ Analogous effects were observed in a study by Sun et al.¹¹⁵

The evidence promoting the utilization of *C racemosa* for estrogen regulation is less apparent because only 3 studies demonstrated effects on estrogenic activity and 1 study shows no significant effect. However, all of the data obtained in this review showed that *C racemosa* reduced symptoms associated with hormonal fluctuation, suggesting that it may have an impact on other steroid hormones. Consequently, it could potentially be used to balance hormones and control the appetite as an adjunct for weight loss.

Limitations

The search was conducted from 2005 to 2016, thus is limited. However, for many of the searches, there was minimal information before 2005. Another limiting factor for this literature review was that a small portion of the data selected was from TCM textbooks as opposed to research studies. However, only a minority of the information was extracted from these texts and some of the research obtained from the MEDLINE database supports the information, which indicates that it may be clinically applicable.

In addition, the *PDR for Herbal Medicine* contains a few references to articles that may be older than the specified period for the narrative review. However, most of the research included was from MEDLINE and not from the *PDR*. In addition, multiple articles from MEDLINE supported the information provided by the *PDR*.

CONCLUSION

Obesity is a problem in the United States, contributing to the morbidity and mortality of millions of Americans. The literature reviewed in this study includes information that describes how traditional Chinese medicine, herbal medicine, or functional foods as an adjunct therapies may be beneficial for weight-loss programs.

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CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research): B.R.M.

Design (planned the methods to generate the results): B.R.M.

Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): B.R.M.

Data collection/processing (responsible for experiments, patient management, organization, or reporting data): B.R.M.

Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): B.R.M.

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APPENDIX A. SUPPLEMENTARY DATA

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jcm.2018.10.004>.

Practical Applications

- Certain acupuncture points, modalities, functional foods, and herbs may help to reduce dopamine and leptin levels.
- Acupuncture, acupuncture modalities, functional foods, and herbs were found to increase the rate of fatty acid oxidation to help promote weight loss.
- Acupuncture and herbs were shown to help regulate estrogen and caused white adipose tissue to act analogous to brown adipocytes.

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