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# Acupuncture for the Treatment of Simple Obesity: Basic and Clinical Aspects

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## 1. Introduction

Obesity is a serious, prevalent, and refractory health problem. Individuals who are overweight or obese are at greater risk for a variety of medical conditions including diabetes, hypertension, dyslipidemia, fatty liver, cardiovascular disease, and polycystic ovary syndrome.

Typical therapy for obesity includes: diet restriction, regulation of physical activity, behavior treatment, pharmacotherapy, operation, or the use of any of these methods in combination. The cost of treatment of obesity and obesity-related diseases is significant in general health expenditures of various countries. Moreover, pharmacotherapy and surgical operations have side effects and may be unsafe for some people. Even the behavioral treatments, including diet restriction and regulation of physical activity, seem to produce unfavorable psychological changes. The introduction of new therapies for obesity is in demand.

Acupuncture, practiced for several thousand years in China as monotherapy or complementary therapy that is safe and inexpensive, is increasingly used worldwide in the treatment of a wide spectrum of clinic symptoms and diseases. Acupuncture has been found effective in weight control since 1980s'. An increasing body of evidence demonstrates that acupuncture has good effects for weight loss without adverse reactions. Although relatively new, acupuncture therapy for obesity is increasingly accepted by more and more people around the world. In addition, acupuncture can help with the treatment of obesity-related diseases. Extensive research on acupuncture weight loss has been conducted in both basic and clinic areas in recent years. In this chapter we try to provide a comprehensive review of the most recent basic and clinical advances relating to acupuncture in the treatment of obesity.

## 2. Traditional chinese medicine view of obesity

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health. The major symptoms of obesity are excessive weight gain and the presence of large amounts of fatty tissue. People are considered obese if they weigh 20 percent or more above average for their height and build. A widely applied crude population measure of obesity is the body mass index (BMI), a person's weight (in kilograms) divided by the square of his or her height (in metres). A person with a BMI of 30 or more is generally considered obese. As Asian populations develop negative health

consequences at a lower BMI than Caucasians, some nations have redefined obesity; the Japanese have defined obesity as any BMI greater than 25 (Kanazawa et al., 2002) while China uses a BMI of greater than 28 (Beifan et al., 2002).

In the view of Western medicine, obesity is primarily caused by a combination of excessive food energy intake, lack of physical activity, and genetic susceptibility. Although excess food (calories) in any form can be converted into fat and stored, the amount of fat in a person's diet may have a greater impact on weight than the number of calories it contains. A sedentary lifestyle can contribute to positive energy balance and the spared calories are stored as fat (adipose) tissue. Eating habits and patterns of physical activity also play a significant role in the amount of weight a person gains. Genetic factors can influence how the body regulates the appetite and the rate at which it turns food into energy (metabolic rate). Psychological factors such as depression and low self-esteem may, in some cases, also play a role in weight gain.

Not surprisingly, the molecular biology of obesity is only partially understood. This is likely due to the heterogeneity of "garden variety" obesity and the fact that it is caused, like other complex diseases, not by a single genetic mutation but by multiple allelic defects, which determine susceptibility to environmental factors. Individuals who carry only one or some of these alleles may still not develop the disease, because they either lack another allele (gene-gene interaction) or are not exposed to the precipitating environment (gene-environment interaction). Furthermore, there is controversial evidence for a direct association between genotypes and lifestyle or anatomical phenotypes of obesity.

Obesity can be classified in several different ways: for example, by BMI intervals, by anatomic phenotypes or by the stage of life a person becomes obese. Most common form of obesity classification is done using BMI values. According to the World Health Organization (WHO), obesity is classified into 3 classes as listed in the below table.

BMI	Classification	BMI(for Asian)
< 18.5	underweight	< 18.5
18.5–24.9	normal weight	18.5–22.9
25.0–29.9	overweight	23.0–24.9
30.0–34.9	class I obesity	25.0–29.9
35.0–39.9	class II obesity	≥ 30.0
≥ 40.0	class III obesity	

Table 1. Obesity classification using BMI values

The most common anatomical characterization refers to a prevalently visceral or a prevalently subcutaneous deposition of fat. The ratio of waist circumference to hip circumference (WHR) has served the purpose of defining the degree of central (ie visceral) vs. peripheral (ie subcutaneous) obesity. It is known that visceral adiposity is a major risk factor for metabolic complications of obesity, while subcutaneous fat seems to be much more benign, and in some cases even protective against the development of metabolic complications.

At what stage of life a person becomes obese can affect his or her ability to lose weight. In childhood, excess calories are converted into new fat cells (hyperplastic obesity), while

excess calories consumed in adulthood only serve to expand existing fat cells (hypertrophic obesity). Since dieting and exercise can only reduce the size of fat cells, not eliminate them, persons who were obese as children can have great difficulty losing weight, since they may have up to five times as many fat cells as someone who became overweight as an adult.

## **2.1 Causes of obesity from a TCM perspective**

In Traditional Chinese Medicine (TCM), good health consists of the body's systems acting in harmony according to the individual's constitution. If all is working well, there will not be any weight problem. TCM takes a holistic approach to obesity by focussing on the underlying changes in the body. According to TCM principles, development of obesity is due to the following pathological changes (Integrated Chinese Medicine Holdings LTD. [ICMHL], Shen-Nong Info. a).

### **2.1.1 Dyspepsia causes stomach heat and poor spleen functioning**

Over consumption of heavy, greasy and spicy foods or alcohol facilitate production of heat evils in the stomach. Meanwhile, inadequate exercise after eating these types of foods damages the spleen function. The over-heated stomach will ripen an excessive amount of food. Therefore, the stomach will digest food easier and make an individual feel hungry, but the spleen cannot handle an excessive food load causing it to under function and be unable to carry out its transformation and transportation functions properly. As a result, the spare metabolic products turn into turbid fluid and phlegm which intermix with blood and qi (vital energy) filling up the organs, bones and muscles.

### **2.1.2 Exogenous evils giving rise to obesity**

Invasion of exogenous evils or over consumption of greasy foods leads to poor transformation and transportation functions of the spleen. Dampness evils then begin to accumulate in the middle burner, which is part of the triple burner (the passage through which water, food and fluid are transported). When dampness and turbid fat enter these passages, they are further distributed by the lungs, allowing penetration into all the organs internally. Additionally, exogenous evils can also penetrate the skin, subcutaneous tissue and muscles through the body's surface giving rise to obesity.

### **2.1.3 Qi (vital energy) stagnation causes turbid phlegm accumulation**

For those who are emotionally disturbed, experience trauma, have menstruation problems or are elderly, the liver can fail to regulate qi flow which in turn affects digestion and blood flow. The resulting sluggish qi and blood flow tend to block the meridians. Therefore, in these people, dampness is likely to endure in the body. Over time, this will congeal into phlegm and result in obesity.

### **2.1.4 Kidney essence exhaustion leads to disharmony**

Lifestyles, which consume kidney essence, such as being sexually over active can lead to the excitation of the internal ministerial fire. The excessive ministerial fire is a kind of "evil fire" which makes the body produce an over abundance of heat. This "evil fire" affects the middle

burner, leading to a malfunction of the stomach and spleen. When this persists over a long period, the vaporization processes in the bladder and triple burner are impaired causing more evils to accumulate and worsen the obesity condition.

From TCM experience, the above causes of obesity can appear together or separately. In short, the fundamental causes of obesity are spleen and kidney deficiencies, which manifest as an overflow of body fluids, accumulation of dampness and phlegm evils and stagnation in blood flow. Sometimes stomach heat and qi stagnation are associated. Moreover, improper vaporization of body fluids by the triple burner may also appear. All of these factors play an important role in the development of obesity.

## **2.2 Types of obesity from a TCM perspective**

Syndrome identification is the premise and foundation of TCM treatment. Currently there are still no standardized obesity patterns, ranging from 3 to 12 patterns by clinical reports. Most often, simple obesity was classified into deficiency syndrome and excess syndrome by syndrome differentiation of TCM, which further classified into four types (ICMHL, Shen-Nong Info.b).

### **2.2.1 Excessive internal phlegm and dampness due to spleen deficiency**

Phlegm is an important concept in TCM. TCM holds that fat or adipose tissue is mostly due to phlegm and dampness evils. The spleen is regarded to be at the root of all phlegm production. When the spleen becomes damaged, such as eating too many sweet foods and getting too little exercise, it will fail in its duty to move and transform waste fluids and foods. Instead these metabolic wastes will gather, collect and transform into evil dampness. If dampness evils endure, over time they will congeal into phlegm, and become fat tissue. The excessive internal phlegm manifests itself as excess weight, accompanied by tiredness, body heaviness, chest and/or stomach distension, and in some cases poor appetite. The tongue has a slimy covering of fur, while there is a rolling, taut pulse. This type of obesity is generally due to an eating disorder, or secondarily by some other illness.

Treatment revolves around sweeping away phlegm and removing stagnation. Once the phlegm is swept away, the qi can move smoothly and easily. This promotes the movement of phlegm and reduction of fat with the ultimate result of decreasing obesity.

### **2.2.2 Stagnation of qi and blood**

Patients exhibiting this condition may suffer from irritability or low motivation, chest or breast fullness, insomnia, a dreamy state, menstrual disorder or amenorrhea (absence of menstruation), and infertility. Some patients may complain of headaches. There may be dizziness and numbness of the four extremities; and the tongue is dark red with a white thin fur or a thin and greasy fur. The pulse is thready and rolling. This is because the movement of blood is not smooth or easily flowing. Stasis obstructs the vessels and inhibits the qi mechanism. Therefore, fat and dampness collect and accumulate within the vessels, making the blood more viscous. If this continues over time, obesity and arteriosclerosis (thickening and hardening of the arteries) will result.

The principle treatment is to speed up the blood flow and remove stagnation.

### 2.2.3 Yang deficiency of spleen and kidney

In the case of yang deficiency of spleen and kidney, there is not enough qi to transform or melt the phlegm. People in this category often feel exhausted or fatigued. They may experience lower back and knee weakness, shortness of breath, impotence or low libido. The pulse is deep and fine, the tongue is pale and without any fur covering. Genetic factors can play a part in this condition. It may also be the result of other illnesses, stress or an unhealthy lifestyle.

Treatment involves fortifying the spleen and rectifying the kidney deficiency.

### 2.2.4 Liver stagnation

Liver stagnation caused by prolonged strong emotions or depression leads to disharmony between the spleen and the liver and gives rise to fluid retention. Due to the liver being depressed, the gall bladder is also depressed and exhausted; the ebb and flow of these organs become unbalanced, and the qi mechanism does not flow freely. Hence fat turbidity is difficult to be transformed and over time it leads to obesity.



Fig. 1. Changes of tongue coating in different types of fat person(ICMHL, Shen-Nong Info.b)

People in this category tend to have excessive fatty material deposited in the abdomen. The physique is bloated and individuals feel drained of energy. Individuals may also experience excess sputum secretion, dizziness, vertigo, retching, a dry mouth, lack of desire for food or drink and discomfort in chest and abdomen. A white glossy or greasy coating usually covers their tongues. The pulse is rolling.

Treatment involves improving liver functioning, unblocking the gallbladder and moving stagnation.

## 3. Individualized acupuncture for the treatment of obesity: Effects and methods

In terms of more healthy and holistic methods of weight loss in Chinese medicine, the fundamental prescriptive methodology is to “bian zheng lun zhi” –base treatment on the patient's personal pattern discrimination. TCM doctors diagnose the name of a disease,

followed by the differentiation diagnosis of syndromes, for prescribing a treatment. Acupuncture treatment based on a patient's syndrome differentiation is both safe and effective because it addresses that person's own metabolic reasons for being overweight or obese. Using this method, each obese patient can receive his or her own individually tailored acupuncture treatment plan.

Very basically, acupuncture is the insertion of stainless steel filiform needles into precisely specified acupoints on the body's surface, in order to influence physiological functioning of the body.



Fig. 2. Acupuncture being applied to the abdomen

According to TCM, the meridian system provides the transportation channel for the fundamental substances of **qi**, **blood**, and **body fluids**, and along the fourteen **main meridians** there are a total of 365 acupoints have been identified, each point belongs to a particular meridian and connects to a corresponding organ that make it exert particular therapeutic properties.

TCM holds that obesity is caused by anomaly transportation and transformation of the body fluid, accumulation of water-dampness and phlegm turbidity, which are the result of disorders of zang-fu organs, stagnation of qi and blood, disharmony of the Thoroughfare and Conception vessels. Therefore the weight loss can be achieved by needling meridian points to balance yin-yang, regulate zang-fu organs, promote flow of qi and blood of the meridians, and eliminate the inner pathogenic factors by means of dredging meridian and collateral. Accordingly, different set of points would be used, depending on which organ(s) needed to be energized or inhibited. Furthermore, acupuncture needles can be twirled, electrically stimulated, penetrated to different depths and left in place for variable lengths of time.

### 3.1 Individualized acupoints selection

Acupuncture for weight loss refers to the therapeutic approach applying acupuncture or moxibustion on some special points under the guidance of meridian theory of the TCM. For point selection, the acupoints zhong-wan, xia-wan, liang-men and tai-yi were often used to regulate stomach qi, remove dampness to restore normal function of the spleen. Acupoints tian-shu and da-heng were selected to promote qi circulation and remove obstruction in the collaterals. Acupoints qi-hai and guan-yuan were used to reinforce the kidney. Acupoints wai-ling, shui-dao, qu-chi, zhi-gou and nei-ting were selected to eliminate the dampness and heat, induce diuresis to alleviate edema, and promote qi flow to relax the bowels.

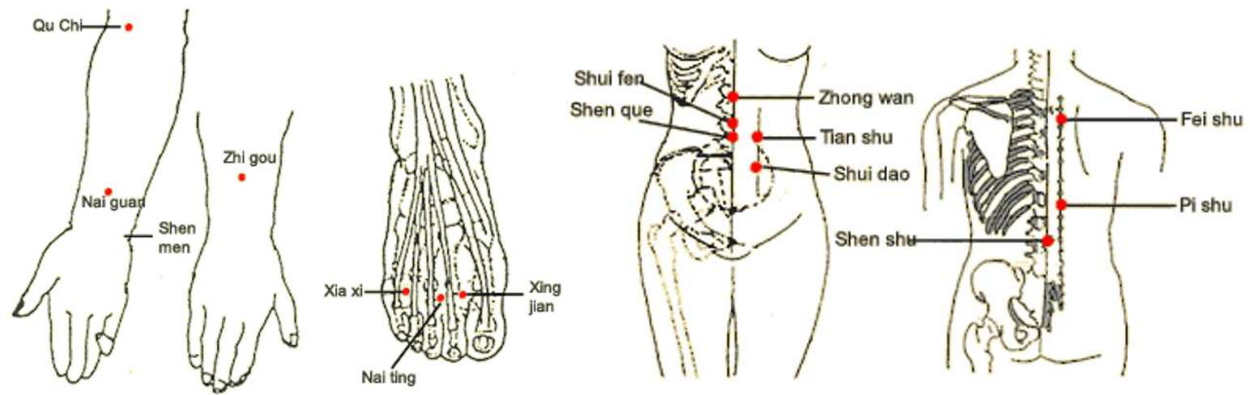


Fig. 3. Some examples of acupoints used for promoting weight loss (ICMHL, Shen-Nong Info. c)

Besides these routine points (mainly the points of Conception Vessel, Spleen, Stomach, Kidney, and Bladder Meridians) which were often selected as chief acupoints in the acupuncture treatment of obesity, different adjunct acupoints were added depending on the types of disharmony pattern.

Liu et al. (2004) used the following therapeutic principle and acupoints selection in their clinical practice:

- Pattern of excessive heat in the stomach and intestines:  
The treatment was designed to clear away heat from the stomach and intestines. The auricular points selected were external nose, small intestine and large intestine, and the body acupoints selected were nei-ting, shang-ju-xu, tian-shu, and qu-chi.
- Pattern of liver qi stagnation:  
The treatment was designed to soothe the liver, regulate qi, activate blood and disperse blood stasis. The auricular points selected were liver, heart, pancreas and gall bladder, and the body acupoints selected were gan-shu, ge-shu, tai-chong, and qu-quan
- Pattern of damp accumulation by spleen deficiency:  
The treatment was designed to clear away heat, remove dampness, dry up dampness and strengthen the spleen. To clear away heat, the auricular points selected were san-jiao, spleen and lung, and the body acupoints selected were shui-fen, qi-hai, yin-ling-quan, zu-lin-qi. To dry up dampness and strengthen the spleen, the auricular points selected were spleen, kidney and san-jiao, and the body acupoints selected were pi-shu, zhong-wan, zu-san-li and tai-bai.
- Pattern of deficiency in both heart and spleen:  
The treatment was designed to reinforce the heart and spleen. The auricular points selected were heart, spleen and endocrine, and the body acupoints selected were xin-shu, pi-shu, nei-guan and zu-san-li.
- Pattern of deficiency in both the spleen and kidney:  
The treatment was designed to tonify the kidney, strengthen the spleen and benefit qi. The auricular points selected were spleen, kidney and endocrine, and the body acupoints selected were shen-shu, pi-shu, tai-xi and zu-san-li.



- Pattern of yin deficiency in the liver and kidney:  
The treatment was designed to nourish the liver and kidney. The auricular points selected were liver, kidney and endocrine, and the body acupoints selected were gan-shu, shen-shu, guan-yuan and san-yin-jiao.
- Pattern of deficiency in both lung and spleen:  
The treatment was designed to tonify and benefit the lung and spleen. The auricular points selected were lung, spleen and san-jiao, and the body acupoints selected were fei-shu, pi-shu, zu-san-li and lie-que.
- Pattern of qi deficiency in the heart and lung:  
The treatment was designed to tonify and benefit the heart and lung. The auricular points selected were heart, lung and ear shen-men, and the body acupoints selected were xin-shu, pi-shu, fei-shu, nei-guan and dan-zhong.

In case of heart palpitations and shortness of breath add shen-men and nei-guan; for scanty urine add shui-fen and yin-ling-quan; for qi depression, nei-guan and tai-chong need to be added; for yin deficiency and heat, tai-xi and zhao-hai need to be added; for menopausal obesity, qi-hai, guan-yuan, pi-shu, shen-shu, tai-xi, or ming-men need to be added; for complications of high blood sugar (e.g., deficiency of both qi and yin), yang-chi, wan-gu, ran-gu, san-yin-jiao, yi-shu and shen-shu need to be added; for excessive appetite (e.g., excessive heat of spleen and stomach), liang-men, liang-qi, nei-ting, gong-sun, fei-shu and wei-shu need to be added.

### 3.2 Selection of acupuncture weight loss methods

Currently there are a variety of acupuncture weight loss methods being used in clinic practice, including body acupuncture, electric acupuncture, magnetic acupuncture, laser acupuncture, warming acupuncture, acupressure, auricular acupuncture, integrative acupuncture and herbal prescription, integrative acupuncture and tuina, integrative warming acupuncture and herbal moxibustion, elongated-needle therapy, catgut embedment, gua-sha (scraping), etc.

#### 3.2.1 Classical body acupuncture

The filiform needles with diameter of 0.25-0.30 mm and length of 40-75 mm were typically selected based on the case's obesity degree. In applying simple body acupuncture, needling maneuvers were stressed. The reducing method with twirling-rotating techniques was used for excessive syndrome, and the reinforcing method with twirling-rotating techniques was used for deficient syndrome.

For assessment of therapeutic effects of simple obesity, most acupuncturists and Traditional Chinese Medicine practitioners in China use the criteria stipulated at 3<sup>rd</sup> national conference on obesity by integrated Chinese and western medicine in 1991 (Wei, 1992).

Recent clinical cure: Body weight decreases to the standard level; BMI is near to 23.0 kg/m<sup>2</sup>.

Remarkable effect: Body weight decreases >5.0 kg, and BMI decreases  $\geq$  4.0 kg/m<sup>2</sup>.

Effect: Body weight decreases >2.0 kg but <5.0 kg, and BMI decreases  $\geq$  2.0 kg/m<sup>2</sup> but <4.0 kg/m<sup>2</sup>.

Failure: Body weight decreases <2.0 kg, and BMI decreases <2.0 kg/m<sup>2</sup>.

Needle Techniques	Reinforcement	Reduction
Lifting and Thrusting	After the needle is inserted into a given depth and the needling sensation appears, reinforcement is obtained by thrusting the needle heavily and then lifting it gently. This is repeated in a slow and delicate manner from shallow to deep.	After the needle is inserted into a given depth and the needling sensation appears, reduction is obtained by thrusting the needle gently and then lifting it heavily. This is repeated in a quick manner from deep to shallow.
Twirling and Rotating	After the needle is inserted into a given depth and the needling sensation appears, reinforcement is obtained by twirling in small amplitude with a gentle and slow pace, and only for a short duration.	After the needle is inserted into a given depth and the needling sensation appears, reduction is obtained by twirling in large amplitude with a fast, heavy and quick pace; manipulation should be of long duration.
Insertion and Withdrawing	Insert slowly, twirl the needle slightly, and then withdraw it quickly.	Insert quickly, twirl the needle vigorously, and then withdraw it slowly.
Keeping the hold open or close	Press the hold after the needle is withdrew.	Shake and enlarge the hold while withdrawing the needle.
Means of respiration	Insert the needle when the patient breathes out and withdraw the needle when the patient breathes in.	Insert the needle when the patient breathes in and withdraw the needle when the patient breathes out.

Table 2. Needle techniques in acupuncture treatment (ICMHL, Shen-Nong Info. d)

Zhang (2008) reported a 72 cases of obesity treated by body acupuncture which were divided into two groups: heng-gu, da-he, qi-xue, si-man, zhong-zhu and zhi-gou were used in the first group, and da-chang-shu, guan-yuan-shu, xiao-chang-shu, pang-guang-shu, bai-huan-shu and tai-xi were selected in the second group, among which bilateral points were alternately used. A lifting-thrusting and twirling reduction method was applied in the first two weeks, which was followed by a lifting-thrusting and twirling uniform reinforcing-reducing method with the intensity tolerable to patients. Needles were retained for 30 minutes, during which needles were manipulated twice. The treatment was given 5 times weekly in the first two weeks and then followed by 3 times a week, and 3 months of treatments constituted a therapeutic course. Short-term results showed that 16 cases were clinically cured, 18 cases markedly effective, 34 cases effective and 4 cases failed.

Sun (2008) treated 31 cases of abdominal obesity and 52 cases of symmetrical obesity with the same acupuncture methods for 3 months: zhong-wan, cheng-man, tian-shu, shui-dao, qi-hai, zu-san-li and san-yin-jiao were used as main points. A reinforcing maneuver was used for qi-hai, zu-san-li and san-yin-jiao, and an even maneuver for others. Liang-men, dai-mai, feng-long, ji-men, yin-bao, nao-hui and zhi-gou were selected as subordinate points and punctured with an even maneuver. The symptomatic points: liang-qiu and nei-ting for stomach heat, reducing; tai-chong for liver depression, reducing; yin-ling-quan for deficiency of spleen, reinforcing; and guan-yuan for deficiency of qi, reinforcing. Needles

were remained for 20 min, the treatment was given 3 times weekly, and one month constituted a course. In abdominal obesity group, body mass index (BMI), waist circumference (WC) and skin fat thickness (SFT) in the upper limbs, trunk and abdomen were very significantly reduced ( $P<0.01$ ) after the 1st and the 2nd course of treatment respectively, but no significant difference was found in all indices after the 3rd course of treatment ( $P>0.05$ ). In symmetrical obesity group, all the indices of BMI, WC and SFT were reduced in the successive 3 months of treatment ( $P<0.01$ ).

A majority of obesity patients have substantial accumulation of fat in abdomen and waist, and the more severe the accumulation, the higher relative risk of obesity-related diseases. Mu et al. (Mu & Yuan, 2008) applied abdomen acupuncture therapy to 30 obese patients with elongated needles (75 mm in length). After routine disinfection in the acupoints areas, needles were inserted into the abdominal points of zhong-wan, xia-wan, qi-hai and guan-yuan to reinforce the spleen and kidney; of bilateral hua-rou-men and wai-ling to regulate qi and blood; bilateral da-heng to reinforce spleen and dispel dampness; bilateral zhi-gan to regulate the body's qi movement; and of shui-dao to clear heat in triple energizer and downbear the urine and stool. After insertion, the needles were perpendicularly punctured into the earth level (deep level) and retained for 3-5 min to await qi, then the needles were manipulated with twirling-rotating techniques to produce needling sensation. The needles were retained for 30 min and manipulated once every 5 min to strengthen the needling sensation. The treatment was given once every day in the first 5 times, and once every other day in the latter 10 times. Fifteen treatments constituted a therapeutic course. Another 30 comparable obese patients receiving the same acupuncture treatment at the points of zhong-wan, tian-shu, da-heng, shui-dao, qu-chi, zhi-gou, yin-ling-quan, shang-ju-xu, feng-long and nei-ting were taken as body acupuncture control group in this randomized controlled trial. Before treatment, after 1 treatment course and after 2 treatment courses were selected as observation time point. The results showed that there was no significant difference in BMI between the two groups after 1-course treatment, but the BMI of abdomen acupuncture group was significant lower than body acupuncture group after 2-course treatment ( $P<0.05$ ). The cure and total effective rates in abdomen acupuncture group were also higher than those in body acupuncture group after 2-course treatment (see table 3), indicating the curative effect is better in the abdomen acupuncture group.

Abdomen acupuncture divides the insertion depth into three levels of heaven, earth and human. Heaven level (shallow needling) is for those with shorter duration or the pathogen in exterior. Human level (middle needling) is for those have long duration but the pathogen doesn't affect zang-fu organs or pathogen in interstices. For those have long duration and the pathogen involve zang-fu organs or the pathogen in interior, earth level (deep needling) is used.

De qi is viewed as essential to acupuncture's therapeutic effectiveness. The therapeutic depth is the depth to which a needle can be manipulated to achieve the characteristic de qi reaction. Although many studies have used computed tomography (CT) to measure the safe depths (the distance from the surface of the skin of the acupoint to the transverse fascia of the abdominal cavity) of acupoints, few studies have reported on the relative ratio between the therapeutic depth and the safe depth. This ratio may be of clinical importance because it may have an impact on the safety and the therapeutic effectiveness of acupuncture. Chen et al. (2009) analyzed the ratio between the therapeutic depth and safe depth of 12 abdominal

acupoints with factors sex, body weight, age, and waist girths by one-way analysis of variance and multiple linear regression analysis to show that the therapeutic depth of abdominal acupoints is closer to the safe depth in overweight and in older children aged 7 to 15 years old, ranged from 0.67 to 0.88 and increased significantly with body weight, age, and waist circumference, but there was no significant difference between genders.

Group	N	Time point	BMI ( $\bar{x}\pm s$ )	Recent clinical cure	Remarkable effect	Effect	Failure	Total effective rate(%)
Body acupuncture	30	Before treatment	28.36 $\pm$ 3.14					
		After 1-course treatment	27.47 $\pm$ 2.99	0	0	19	11	63.3
		After 2-course treatment	26.79 $\pm$ 2.86	0	11	14	5	83.3
Abdomen acupuncture	30	Before treatment	28.31 $\pm$ 2.99					
		After 1-course treatment	26.97 $\pm$ 2.89	0	7	20	3	90.0
		After 2-course treatment	25.95 $\pm$ 2.85	7	18	5	0	100.0

Table 3. Comparison of the therapeutic effects between two groups (Cases)

### 3.2.2 Classical auricular acupuncture

From a TCM viewpoint, the ears are an important pivot point for the meridians to communicate with each other. When the organs are in disharmony, it will be reflected on the auricle of the ear. Some of the common auricle acupoints selected for needling in weight loss are: large intestine, small intestine, lung, triple burner, endocrine, subcortex, hunger center, thirst center, constipation center, sympathetic, stomach, esophagus, mouth, adrenal gland and spleen (See Fig.4 for reference). Obese patient with spleen and kidney disharmonies, for instance, can be treated by stimulating corresponding acupoints on the ears to regulate these organs' functions.

Special stainless steel thumbtack form ear needles were used for auricular acupuncture. After sterilizing the acupoints with 75% alcohol, the ear needles were inserted into the auricular acupoints using forceps or fingers. In each treatment, three to five acupoints were needled to induce soreness, numbness, or heat sensation. The bilateral points can be simultaneously used and the needles retained for 30 minutes, once a day, or be alternately used and the needles be embedded with 3M ventilation tape and kept on the ear for several days. Moreover, Cowherb seeds instead of ear needles can be fixated on the auricular acupoints (acupoint embedding) and the points were pressed several times a day or press when hungry by the patients themselves to cause pain sensation.

Although both body acupuncture and auricular acupuncture were effective for weight reduction in obese subjects, combining the application of both body acupuncture and otopuncture has a better result in reducing body weight with its reliable short-term and stable long-term effect.

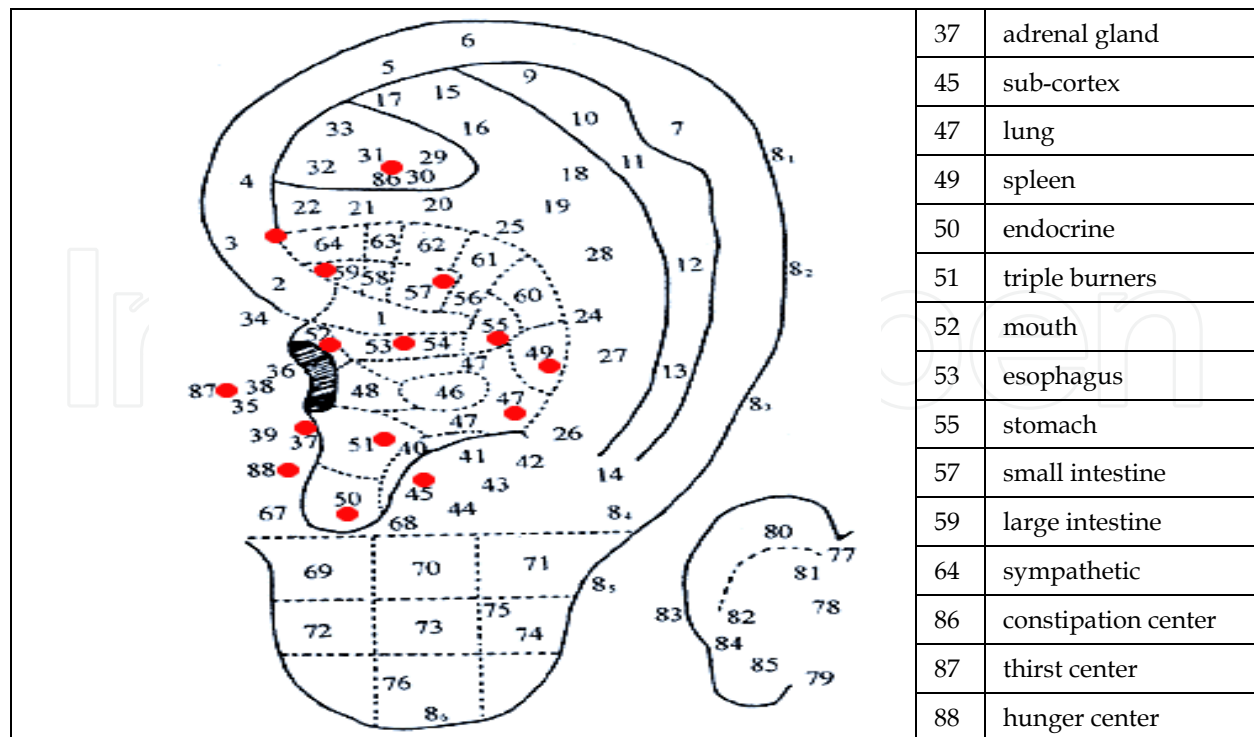


Fig. 4. Selected aural acupoints in weight loss (ICMHL, Shen-Nong Info. e)

### 3.2.3 Electroacupuncture

Meng et al. (Zhang, 2008, as cited in Meng et al, 2002) treated 180 cases of female simple obesity by using electroacupuncture (EA) and 60 cases by manual acupuncture as control. Zhong-wan, tian-shu, guan-yuan and zu-san-li were selected as main points in both groups. In the EA treatment group, bilateral tian-shu were stimulated by a G6805 electric apparatus with disperse and dense wave and the intensity tolerable to patients. Needles were retained for 40 minutes, and the treatment was given 5 times a week followed by a 2-day-interval in both groups, and 20 sessions made up of a therapeutic course. The total effective rate of 97.8% and 88.0% was achieved in the EA treatment and control group respectively. Yin (Zhang, 2008, as cited in Yin, 2000) selected zhong-wan, da-heng, guan-yuan and san-yin-jiao as main points, and added secondary points according to differentiation of symptoms and signs. After the arrival of qi by lifting and thrusting for reinforcing and reducing, a G6805 electric apparatus was applied to the main points with continuous waves and 20/sec in frequency and intensity tolerable to patients. The treatment was given once every other day, and 10 treatments constituted a therapeutic course with an interval of 3 days between two courses. The total effective rate after two courses of treatments was 87.5%.

As the parameters of the EA can be precisely characterized and the results are more or less reproducible, an attempt was made by Han Jisheng's research team to clarify whether EA of strictly identified parameters is effective to suppress the simple obesity induced by high energy diet in a rat model. In the diet-induced obese rats, EA was applied at the hind leg acupoints three times per week for 4 weeks with high energy diet and water provided ad

libitum. A significant reduction of the body weight accompanied by a reduction in food intake was observed. 2 Hz EA was more effective than 100 Hz EA (Tian et al., 2005).



Fig. 5. An electric apparatus for electroacupuncture stimulation

As was known to all, diet-induced obese rats showed an increased level of plasma cholesterol and triglyceride. EA stimulation produced a reduction of plasma level of total cholesterol and triglyceride. In this respect, 100 Hz EA was more effective than 2 Hz EA. If it is verified that 2 Hz EA is more effective in body weight loss and 100 Hz EA more effective in decreasing plasma lipid content, it may be worthwhile to try the 2/100 Hz alternative mode of stimulation to cover both sides of the disorder.

### 3.2.4 Laser acupuncture

One of the latest developments in acupuncture stimulation methods are laser needles, which are applied to the surface of the skin but are not inserted into the skin. This non-invasive, painless laser stimulation can induce reproducible peripheral and specific cerebral changes that can be measured in different ways, for example, cerebral blood flow velocity. Several studies show that the cerebral effects induced by laser needles are similar to those evoked by manual needle acupuncture. The “low-power” segment of the beam was postulated to be responsible for the clinical therapeutic effects. Laser devices were manufactured in which power densities and energy densities of laser were lowered to a point where no photothermal effects occurred; but the photoosmotic, photoionic, and photoenzymatic effects were still operative. The latest new laser devices are designed at infrared wavelength combined with highfrequency pulses that allow the photons to penetrate deep into tissue without heat effect.

It has been observed that laser acupuncture application to obese people increases excitability of the satiety center in the ventromedial nuclei of the hypothalamus, thus suppressing appetite. John et al (2008) made a randomized controlled pilot study on the effects of laser acupuncture on body weight with subjects divided into control and experimental groups. The experimental group was treated with an activated laser and received 16 J of laser energy output to the he-gu and qu-chi. The control group was given a sham low-level laser therapy

treatment with no power output. During the treatment period, each subject received 2 treatments per week for 12 weeks with 4 minutes of active laser or sham treatment to the acupoints in each treatment. Perhaps due to the subjects recruited were not overt obese and the limited laser acupoint stimulation time in this study, no significant weight reduction was observed after the laser acupoint treatment. More studies are needed to investigate the effect of laser acupuncture therapy on body weight.

For the first time, laser needle acupuncture allows simultaneous optical stimulation of individual point combinations. Systematic, double-blind studies of acupuncture can also be performed using optical stimulation because the patient does not notice the activation or deactivation of red or infrared laser needles.

### 3.2.5 Warming acupuncture

Yang (Zhang, 2008, as cited in Yang, 2002) used moxibustion with warming needle to treat 32 cases of simple obesity of deficiency type by selecting qi-hai, guan-yuan, zu-san-li, tian-shu, yin-ling-quan, and san-yin-jiao as the main points and secondary points according to differentiation of symptoms and signs. Following the arrival of qi, 1-2 lighted moxa sticks about 2 cm in length were consecutively put on the handles of the needles of the 2-3 main points, and the other needles were retained as usual. The treatment was given 6 times weekly, and 30 sessions constituted a therapeutic course. A total effective rate of 90.6% was achieved after one course of treatments.



Fig. 6. A pattern of warming needle moxibustion

Shi et al. (2008) investigated the clinical effect of acupuncture-moxibustion therapy on simple obesity due to spleen deficiency. Sixty-eight cases of simple obesity of deficiency syndrome types, including internal dampness due to spleen deficiency, qi deficiency of lung-spleen, yang deficiency of spleen-kidney, were randomly allocated into two groups, treatment group (36 cases) and control group (32 cases). The former group was treated with warm needling moxibustion method, and the latter was treated with electroacupuncture. Zhong-wan, shui-fen, qi-hai, zhong-ji and bilateral tian-shu, shui-dao, nei-guan, he-gu, xue-hai, zu-san-li, feng-long, san-yin-jiao were selected as main points in both groups, Bilateral

da-heng, fu-jie, yin-ling-quan, gong-sun, pi-shu, wei-shu and qi-hai-shu were added as adjunct acupoints for pattern of internal dampness due to spleen deficiency; dan-zhong and biliteral chi-ze, lie-que, yin-ling-quan, fei-shu, pi-shu, gao-huang-shu were added for pattern of qi deficiency of lung-spleen; guan-yuan, ming-men and bilateral gui-lai, shou-san-li, tai-xi, fu-liu, pi-shu, shen-shu were added for pattern of yang deficiency of spleen-kidney. After the needling sensation was obtained by routine acupuncture, the main acupoints were connected to the electroacupuncture apparatus in the control group, with continuous wave and at frequency of 2 Hz, by the intensity of stimulation within the patients's tolerance. For the treatment group, warming needle moxibustion was done on 3-4 pairs acupoints for each pattern [qi-hai and biliteral shui-dao, yin-ling-quan, san-yin-jiao were selected for pattern of internal dampness due to spleen deficiency; shui-fen and biliteral chi-ze, zu-san-li, san-yin-jiao for pattern of deficiency of lung-spleen qi; shui-fen, guan-yuan and biliteral tai-xi, zu-san-li for pattern of yang deficiency of spleen-kidney]. Two cones of moxa roll with length of 1.5-2.0 cm were inserted into the needle handle and light it. The needles were retained for 30 min. The treatment was done every other day and 15 times made up of a course. After one course of treatment, the therapeutic efficacy was analyzed and indicated that the weight losing value of treatment group was obviously higher than that of control group. It indicated that for treating simple obesity due to spleen deficiency, warming needle moxibustion method has more advantage than electroacupuncture method. Some cases in two groups were followed up to 6 months after the treatment ended, no obvious rebound phenomenon of body weight were found in two groups, moreover, for some cases treated by warming needle moxibustion, their body weight continued to decrease in different degrees.

Warm acupuncture is the combination of needling and moxibustion. Acupuncture has better effect in dredging the channels and collaterals, qi and blood; moxibustion has the double function of warm-dredge and warm-tonify. The combination of acupuncture and moxibustion can give both reinforcing and reducing, address both the symptoms and root causes.

Usually acupuncture weight loss consists of such three phases as fast, stable, and slow weigh-loss phases (Xu et al., 2004). Clinically most people showed marked effect in the first several times of treatment, followed by a stable phase, which may last different time period for different individuals, as the new metabolic balance was being reconstructed by the acupuncture stimulation. Some TCM doctors consider that formula of the points as well as the reinforcing or reducing manipulations need to be regulated during this phase according to the syndrome differentiation, and then the third phase may come smoothly.

#### **4. Mechanisms of acupuncture on weight loss**

The mechanisms of acupuncture's therapeutic effects for simple obesity are not completely understood. TCM holds that obesity belongs to the mixture of root-deficiency (mainly qi deficiency) and symptoms excess (excess of phlegm-dampness). Acupuncture acts to strengthen the function of spleen, stomach, liver and kidney, supplement antipathogenic qi and remove pathogenic qi by stimulating points and regulating meridians. Syndrome differentiation is especially important for the treatment. According to the syndrome differentiation of TCM theory, combination of both chief and supplementary points can



regulate qi and blood of meridians, correct yin-yang disorder of zang-fu organs and make lasting force with marked effect.

Although the exact mechanism by which acupuncture works is often unknown, the mechanism that helps to suppress appetite in patients who use acupuncture has been of interest to researchers. Ear has close relation with both meridians and zang-fu organs. There have been reports of reduced appetite or craving for food from subjects wearing auricular acupuncture devices (Dung, 1986; Richards & Marley, 1998). The conclusion was usually obtained according to subjective reports rather than quantitative analysis of the food intake. Wang et al (2008), in their animal study, measured daily food intake of the rats, and found a reduction of food consumption in the electroacupuncture (EA) treatment group compared to control group subject to restraint only ( $P < 0.001$ ). This reduction was positively correlated with weight loss. It was noticeable that when rats were administered with 2 Hz EA every other day, a reduction of food consumption was observed only on the day of EA administration, suggesting that the effect of EA on appetite suppression lasted for  $< 24$  h. Considering the fact that most of the food consumption occurred in the dark phase, the researchers compared the effect of EA treatment delivered in the dark versus light. 2 Hz EA delivered just before the dark phase was more effective than that at the end of the dark phase, suggesting once again that the effect of EA in reducing food intake was immediate and short lasting.

Shiraishi et al. (1995) reported that auricular acupuncture applied to rats produced a reduction of the neural activity of lateral hypothalamus (LH, considered as the "feeding center") and an increase of the neural activity of ventral medial hypothalamus (VMH, considered as the "satiety center"). Because of this, it could help to control the sense of hunger. Furthermore, it has been determined that auricular acupuncture suppresses the appetite by stimulation of the auricular branch of nervous vagus, which has been shown to increase tone in the smooth muscle of the stomach, thus suppressing appetite (Richards & Marley, 1998).

Steyer and Ables (2009) reported that acupuncture affected the ventromedial nucleus of the hypothalamus. Rats that were stimulated with acupuncture needles demonstrated decreased levels of tyrosine and dopamine and increased levels of 5-hydroxytryptamine and 5-hydroxyindoline in this area of the brain. In a study by Wei and Liu in 2003, levels of tryptophan and 5-hydroxyindoleacetic acid were increased, and 5-hydroxytryptamine were decreased in the raphe nuclei of acupuncture treated rats. Thus, acupuncture appears to work on neurotransmitters within the brain to suppress appetite levels and thus help with weight loss.

Electroacupuncture stimulation of the somatic acupoints Zu-san-li and Nei-ting can also increase excitability of the satiety center in the ventral medial nucleus of the hypothalamus (Zhao et al., 2000). The arcuate nucleus of hypothalamus (ARH) is a crucial integrative center for modulation of food intake (Niswender & Schwartz, 2003; Cowley, et al. 2001). The ARH contains at least two populations of neurons that have opposite influence on food intake. One population expresses the anorexigenic peptide "alpha-melanocytostimulating hormone" ( $\alpha$ -MSH). The other population expresses the orexigenic peptide "neuropeptide Y (NPY)". It was demonstrated that in obese rats with

hyperphagia, the expression of  $\alpha$ -MSH in ARH was significantly decreased (Lin et al., 2000; Tian et al., 2004). 2 Hz EA treatment produced an increase in the expression of mRNA encoding  $\alpha$ -MSH as well as an increase of the peptide level of  $\alpha$ -MSH (Tian et al., 2003). In the meantime, there was a downregulation of NPY expression (Tian et al., 2006). Thus, an increase of  $\alpha$ -MSH expression and a reduction of NPY expression in the hypothalamic arcuate nuclei may constitute at least part of the mechanisms underlying the effect of 2 Hz EA for decrease of appetite and reduction of body weight.

Wenhe and Yucun (1981) observed that the level of serotonin (5-HT) in the central nervous system increased with acupuncture application. Serotonin has been implicated in the control of eating behavior and body weight. It is thought that an increase in the level of serotonin in the central nervous system with acupuncture application can provide weight loss, as it has a role in both reducing food intake and arranging the psychomotor balance.

It has been shown that uncoupling protein 3 (UCP3) in the muscle accelerates the utilization of fatty acids as energy substrate and UCP3 mRNA expression is positively associated with energy expenditure (Costford et al., 2007). The expression of UCP3 could be up-regulated by the activation of 5'-AMP-activated protein kinase (AMPK) (Suwa et al., 2003), and a deletion of AMPK $\alpha$  resulted in a decrease of UCP3 expression in muscle [Jorgensen et al., 2005]. Several studies had implied that UCP3 may serve as a new target in reducing body weight by up-regulating energy expenditure (Schrauwen et al., 1999; Tiraby et al., 2007; Yoon et al., 2007). Wang et al. (2008) reported no significant change in the content of UCP3 protein in the muscle of obese rats was observed after 2 Hz EA treatment, and, in consistent with this, neither phosphorylated nor total protein level of AMPK $\alpha$  were changed. Therefore, the effects of 2 Hz EA in reducing body weight seem to be a result of decrease of food intake rather than an increase of energy expenditure through AMPK-UCP3 pathway.

In many studies it has been observed that electroacupuncture application caused an increase in the levels of beta endorphin both in serum and in the central nervous system (Jin et al., 1996; Takeshige et al., 1992, 1993; Fu, 2000; Petti et al., 1998). It also has been observed that low current frequency (2 Hz) electroacupuncture application increases the concentration of endomorphins, enkephalins, and beta endorphin but high current frequency (100 Hz) electroacupuncture application increased the concentration of dynorphin in the central nervous system (Han et al., 1999). Richter et al. (1983) investigated the lipolytic activity of beta endorphin in the isolated fat cells of rabbits *in vivo*. It was determined that as a result of the effect of beta endorphin on fat cells, the levels of free fatty acid and glycerol increased in the rabbit plasma. Vettor et al. (1993) studied the lipolytic activity of beta endorphin in isolated human fat tissue to observed that beta endorphin application caused the increase of glycerol secretion from isolated fat cells. According to the results obtained from these studies, it is thought that electroacupuncture, which increases the plasma beta endorphin levels, can contribute to the weight loss by increasing the lipolytic activity (Cabýoglu et al., 2006a).

As was reported before, diet-induced obese rats showed an increased level of plasma cholesterol and triglyceride. Sun (2005) applied ear- and body-acupuncture to obese subjects, and found a decrease in plasma levels of triglyceride, total cholesterol and LDL

cholesterol as well as an increase in the HDL level. Since the manipulation of the needle according to traditional Chinese medicine is difficult to characterize, Wang et al. (2008) took advantage of using precisely identified frequency and intensity of the electrical stimulation applied on needles inserted into the acupoints. EA produced a reduction of plasma level of total cholesterol and triglyceride. In this respect, 100 Hz EA was more effective than 2 Hz EA. If it is verified that 2 Hz EA is more effective in body weight loss and 100 Hz EA more effective in decreasing plasma lipid content, it may be worthwhile to try the 2/100 Hz alternative mode of stimulation to cover both sides of the disorder.

Leptin is a peptide known to decrease the body weight and appetite. Kim et al. (2006) applied 100 Hz EA to ad libitum fed normal rats and revealed a significant increase of plasma leptin level. You et al. (2005) found that 100 Hz EA produced a significant decrease of plasma leptin in obese rats. These results suggest that the effect of EA in modulating plasma level of leptin depends on the energy balance state of the animal. On the other hand, the subject's sensitivity to leptin should be regarded as a more important factor in determining the occurrence of obesity than the plasma level of leptin (Kim et al., 2006; You et al. 2005). In other words, resistance to leptin is more important for the induction of obesity than the insufficient supply of leptin. Therefore, study should be proceeded to characterize whether the sensitivity of leptin can be improved by EA treatment.

In sum, the weight loss function of acupuncture might work through the following three means: 1) Regulating nerve system. It is believed that when needling certain acupoints, peripheral nerves were stimulated to regulate the autonomic nerve of the internal organs and make the intercoordination between sympathetic and parasympathetic nerve, which can inhibit gastric emptying and correct abnormal appetite on one side, and promote intestinal peristalsis and reduce the food absorption on the other side; It has been observed that acupuncture application causes changes in the concentrations of  $K^+$ ,  $Na^+$ , and  $Ca^+$  in the neurons (Deng, 1995), and the amount of neuropeptides like beta endorphin, leucine, enkephalin, and neurotransmitters like aspartate in the central nervous system (Fu, 2000). Researchers strongly support the opinions that the effect of acupuncture is arranged by the brain (Futaesaku et al., 1995) and that EA application causes a great change in the action potential of nerve cells (Fu, 2000). 2) Regulating endocrine system. Actually endocrine disorder is both the cause and result of obesity. Acupuncture can restore normal endocrine by regulating the two systems of "hypothalamus-pituitary-adrenal cortex" and "sympathetic adrenal cortex" (Shi & Zhang, 2005). It has been determined that endomorphin-1, beta endorphin, enkephalin, and serotonin levels increase in plasma and the central nervous system through acupuncture application. Enkephalins as well as serotonin has an effect on feeling well, producing happiness, being pleased, producing a normal level of appetite, and achieving psychomotor balance. These effects play a role in the arrangement of psychological behaviors, including dietary behavior (Cabýoglu et al., 2006b). 3) Regulating lipid metabolism. It has been observed that the increases of endomorphin-1, beta endorphin, enkephalin, serotonin, and dopamine cause lipolytic effects on metabolism. Needling certain points can reduce the content of lipid peroxide in the blood and accelerate the fat decomposition. In addition, acupuncture can regulate water and salt metabolism and thus correct the condition of water-salt retention (Sun et al., 1996).

## 5. Reflection about acupuncture weight loss research approach

Most of the literature on acupuncture for the treatment of obesity is based on uncontrolled trials. Among the controlled trials with positive results, the interpretation of these results is limited by such methodological problems as short duration, inadequate placebo controls, and nonstandard treatment protocols. A recently conducted systematic review and meta-analysis of acupuncture for obesity by Lee et al. (2009), which included a total of 31 randomized controlled trials (RCTs) and 3013 individual cases, reported that: Compared to control of lifestyle, such as diet, exercise or *qigong*, acupuncture was associated with a significant reduction of average body weight (95% confidence interval, CI) of 1.72 kg (0.50–2.93 kg) and associated with an improvement in obesity (relative risk =2.57; 95% CI, 1.98–3.34). Acupuncture significantly reduced a body weight of 1.56 kg (0.74–2.38 kg), on average, compared to placebo or sham treatments. Acupuncture also showed more improved outcomes for body weight (mean difference =1.90 kg; 1.66–2.13 kg), as well as for obesity (relative risk =1.13; 1.04–1.22), than conventional medication.

However, most studies have been of short duration, varying from 4 to 12 weeks. Noting that obesity is a chronic condition, it is likely to require longer periods of acupuncture treatment. Moreover, obesity may wax and wane with or without treatment, and thus a longer follow-up period with serial measurements of outcomes is suggested to determine the genuine effect of acupuncture as well as its long-term efficacy. Acupuncture may also be considered during the maintenance phase of weight loss programs to prevent relapse. In addition, attrition data at each phase of treatment would provide a more thorough evaluation of this alternative treatment (Lacey et al., 2003).

Concealing allocation of treatment vs control is uniquely challenging. When a nonacupuncture point ('sham') is used, it is important for the treatment to be blinded by all except the acupuncturist, since a needle is applied to the same depth and for the same duration as the treatment group but in a location that has no known effect. Although blinding of the therapist who applies acupuncture would be difficult, blinding of patients and other care providers, as well as outcome assessors should be attempted to minimize the performance and assessment bias of trials. Standardized controls should be used in all future clinical trials of acupuncture treatment in obesity. Nevertheless, there have been studies showing that up to 50% of individuals treated by 'sham acupuncture' processes show some physiological effect (Liang & Koya, 2010). The more recently developed placebo needle may be a more appropriate method to ensure validity in assessing the effectiveness of acupuncture. This placebo needle, with a nonpenetrating, blunt tip, held in place by a bandaid and plastic ring, was shown to be perceived by volunteers as similar to the true penetrating acupuncture needle (also held in place via bandaid and ring), and was significantly less effective (Liang & Koya, 2010). With or without appropriate blinding and placebo controls, expectations about the credibility (usefulness and efficacy) of unconventional methods such as acupuncture may influence outcome. Such moderating variables may obscure real differences between groups especially in small samples. One suggested mechanism to control for patients' expectations is the treatment credibility assessment, adapted from Borkovec and Nau (Lacey et al., 2003, as cited in Borkovec & Nau, 1982), which is a simple series of four questions designed to measure the individual's belief

in the efficacy of treatment. Ideally, the mean scale scores should be equivalent for both treatment and control groups to ensure that the groups are comparable.

Laser acupuncture is currently being used in double-blind studies (Liang & Koya, 2010). In this technique, a laser needle is rather fixed onto the skin than pricked into the skin, to deliver the laser power to the acupoints, and the precise power intensity can be determined by using the intensity curve (Litscher & Schikora, 2002). In this way, the patient can hardly feel the stimulation and the operator may also be unaware of whether the laser needle system is active, and therefore true double-blind studies in acupuncture research can be performed. In this regard, previous studies indicated that laser acupuncture applied to the placebo points did not produce marked cerebral changes compared with that applied to the acupoints (Litscher et al., 2004).

To assess accurately any potential benefits for treating obesity, the art of acupuncture must be effectively bridged with the science of evaluation. Standard algorithms need to be developed, based on principles used by practitioners, for example, criteria for selecting and changing point locations, and spacing of treatments (Lacey et al., 2003).

Several randomized controlled trials have suggested that acupuncture has a positive impact on short-term weight loss. These positive effects are typically not observed when acupuncture is used in the absence of dietary and/or behavioral interventions. Therefore, future studies should include a behavioral component across conditions in order to maximize success, provide an active treatment for the controls, and decrease attrition in the comparison groups (Lacey et al., 2003).

The 31 RCTs results in Lee's systematic review (Lee et al., 2009) do not make any consistent suggestions about which form of acupuncture may be the most effective for various types of obesity. So, in light of the evidence, it is a fair summary that acupuncture is an effective treatment for obesity, and further studies, especially rigorous long-term RCTs, are justified to overcome a number of challenges such as effective evaluation of acupuncture while meeting research standards required for evidence-based medicine, to provide conclusive evidence as to the efficacy of acupuncture for weight loss and which particular type of acupuncture should be offered in accordance with the syndrome differentiation of obesity.

Animal research studies are of great importance to identify the underlying mechanism of acupuncture in treatment of obesity. Originating in China centuries ago, acupoints were described in human body rather than in animals. Animal research of acupuncture was initiated in China in the early 1950s and various mammals such as monkey, horse, dog, mouse, rabbit and rat have been applied in acupuncture studies. Although there have been standardized acupoints in human body (WHO Regional Office for the Western Pacific, 2008), no such acupoints have been defined in animals. Most animal studies applied acupoints corresponding anatomically to their original locations in humans. A recent report on transpositional acupoint location in mice and rats may be supplied as a reference (Yin et al., 2008).

Mapping the precise location of needles at specific acupoints, including insertion points, depth, direction and angle will definitely have impact on the effect of acupuncture. Further studies are needed to clearly map the site and depth of needle prick/insertion at acupoints (Liang & Koya, 2010).

Since the manipulation of the needle according to TCM is difficult to characterize, a wide spectrum of high-tech methods including Laser Doppler flowmetry and imaging, multidirectional transcranial ultrasonography, cerebral near infrared spectroscopy as well as functional magnetic imaging and a range of bioelectrical methods have been utilized for research in the field of modernization of acupuncture (Liang & Koya, 2010; Litscher et al., 2004; Litscher & Schikora, 2002). Today it is possible to perform transcontinental studies, for example, using teleacupuncture (Litscher, 2009). Slowly but surely the secrets of acupuncture will be demystified.

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## 7. References

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