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Clinical and Mechanism Research Progress of Acupuncture Therapy for Simple Obesity

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Abstract: ***Recent studies have shown that acupuncture therapy for simple obesity has been extensively investigated and has achieved remarkable results. Acupuncture therapy mainly includes filiform needles, electro-acupuncture, acupoint embedding, warm acupuncture, and auricular acupuncture. Acupuncture can regulate various active substances and multiple metabolic pathways, increase the basal metabolic rate, and accelerate the consumption of accumulated fat. The mechanism of action may be related to the combined effects of acupuncture on the hypothalamus, lymphatic system, endocrine system, inflammatory response, etc. This is summarized for future clinical and research purposes to provide more rigorous theoretical basis. Some mechanisms are still under research, and in the future, efforts should be made to further explore the mechanism of acupuncture in the treatment of simple obesity, so as to make the theoretical basis for acupuncture treatment of this disease more complete.***

Keywords: Simple Obesity, Acupuncture Therapy, Review, Mechanism, Research Progress**.**

1. Introduction

Simple obesity is a common chronic metabolic disease that occurs due to excessive food intake and nutritional excess, without any obvious underlying causes, resulting in excessive and abnormal accumulation of fat throughout the body [1]. Currently, the prevalence of metabolic syndrome among Chinese adults is 24.2%, with 24.6% in men and 23.8% in women. Compared to the 18.7% prevalence among adults 10 years ago (9.8% in men and 17.8% in women), it has shown a rapid growth trend [2,3]. The latest statistics show that there are nearly 100 million obese people in China, with simple obesity accounting for approximately 95% [4]. Beyond affecting patients' daily activities and external appearance, it even becomes a high-risk factor for diseases such as hypertension, diabetes, and heart disease. Currently, Western medicine employs treatment methods such as exercise, diet control, medication, and surgery for this disease, but patients have difficulty adhering to the treatment, the costs are high, there are many adverse reactions, and the recurrence rate is high. Acupuncture therapy has the effects of tonifying deficiency and eliminating excess, as well as unblocking meridians. Modern research has found that by stimulating acupuncture points on the body, regulating the central nervous system, and improving the endocrine function of the human body, it can accelerate the metabolism of the body and enable rapid fat burning within the body. It can also improve the gastrointestinal condition, prolong the emptying time of the stomach, suppress appetite, reduce food intake, and improve constipation. Acupuncture therapy for obesity has the advantages of safety, simple operation, and other benefits, making weight loss more acceptable to people. In recent years, there have been many studies on acupuncture therapy for obesity. The following are the summaries:

2. The Understanding of Simple Obesity in Traditional Chinese Medicine

Based on the clinical manifestations of simple obesity, it falls within the category of obesity in the field of traditional Chinese medicine. The understanding of the causes and mechanisms of obesity in traditional Chinese medicine originated from "The Yellow Emperor's Inner Classic" [5]. "The excessive fat and delicious food are the cause of this condition. This person must have eaten a lot of sweet and delicious food and consumed a lot of fatty substances." "The Western people... They eat rich and fatty food." It has recognized that overeating of greasy and sweet foods can lead to obesity. "Medical Reality Easy - Volume 4" also states: "Those with a natural constitution that is strong, due to the congenital nature... Generally speaking, a strong natural constitution does not cause any suffering, except that there is a lot of damp phlegm." It is believed that obesity is closely related to the congenital constitution. "The True Essence of Medicine - Chapter 12" states: "All dampness swelling and fullness belong to the spleen." "Medical Reality Easy - Volume 4" also states: "Those with a strong natural constitution, due to the congenital nature... Generally speaking, a strong natural constitution does not cause any suffering, except that there is a lot of damp phlegm." "The Theory of the Stomach and Spleen" records: "If the stomach and spleen are strong, one can eat and become fat. If the stomach and spleen are weak, one cannot eat and is thin or eats less but becomes fat. Although fat, the limbs do not lift." "Jing Yue Quan Shu" proposes: "Why is it reversed to be qi deficiency? It is because the human body's form, the bone is the leader, the fat person is soft and strong, yin is stronger than yang. And the flesh and blood are formed, all are of the yin category, so fat people often have qi deficiency." "Shi Ci Mi Lu - Treatment Methods for Fatness" states: "Fat people have phlegm, which is due to qi deficiency. Weak qi cannot circulate, so phlegm is produced." "Blood Syndrome Theory" states: "The nature of wood is to promote and regulate. Food enters the stomach... Grains and liquids are transformed. If the clear yang of the liver does not rise, then it cannot promote the transformation of grains and liquids, and the symptoms of stagnation in the middle jiao are inevitable." Later medical experts believe that the pathogenesis is overeating rich and greasy foods, being lazy and avoiding labor, or being affected by seven emotions, resulting in damage to the spleen and stomach, dysfunction in transportation and transformation, water retention and dampness accumulation, which turns into

phlegm turbidity. In addition, patients have an unbalanced diet, overeating cold and raw foods, causing dampness to accumulate in the spleen, cold dampness affecting the middle jiao, and subsequently damaging the transformation function, blocking the triple burner, spreading throughout the skin and pores, and over time, leading to obesity [6].

3. Methods of Acupuncture Therapy for Simple Obesity

Acupuncture therapy, as a wisdom passed down by ancient people, has played an irreplaceable role in helping obese patients recover. Currently, the acupuncture therapy used for treating simple obesity in clinical practice mainly includes filiform needles, electro-acupuncture, acupoint embedding, warm acupuncture, and ear acupuncture, all of which have good clinical efficacy.

3.1 Filiform Needles

Acupuncture with fine needles has a good effect in improving simple obesity. Studies have shown that acupuncture can stimulate the nervous system and gastrointestinal functions, thereby slowing down the gastric emptying rate, reducing appetite, decreasing food intake, and reducing the total food consumption of patients. Moreover, acupuncture can lower triglyceride (TG), total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C) levels, and regulate fat factors to treat obesity [7].

Bi Jieyu [8] selected 76 patients and divided them into the control group and the treatment group according to the random number method, with 38 patients in each group. The control group received physical therapy treatment, while the treatment group received acupuncture combined with physical therapy treatment. After treatment, the body weight, LDL-C, TC, TG, endothelin (ET-1), and von Willebrand factor (vWF) levels of both groups decreased, while the levels of HDL-C and protein increased. Moreover, the total effective rate of the control group was higher than that of the treatment group. This indicates that acupuncture combined with physical therapy can improve the body shape, body composition, lipid indicators, and vascular endothelial factor levels of obese patients, reduce the risk of metabolic syndrome, and is safe and reliable. Qian Hong [9] collected 50 patients with simple obesity and divided them into the electro-acupuncture group (25 cases) and the acupuncture combined with auricular acupoint group (25 cases). After 12 weeks of treatment, the body weight, body mass index (BMI), and waist circumference of both groups decreased, and the decrease in each index in the acupuncture combined with auricular acupoint group was greater than that in the electro-acupuncture group. It shows that the adjustment of spirit and spleen strengthening acupuncture method combined with auricular therapy for simple obesity has a definite therapeutic effect, can reduce the body weight, BMI index, hip circumference, and improve lipid levels of patients. All the above studies have confirmed that acupuncture can adjust various metabolic functions of the body, promote fat breakdown, and achieve the effect of weight loss and lipid reduction. After acupuncture, it can inhibit the peristalsis of the gastrointestinal tract and has the effect of inhibiting gastric acid secretion, thereby reducing hunger and achieving the purpose of acupuncture weight loss.

3.2 Electro-acupuncture

Electro-acupuncture therapy is a traditional Chinese medical method that applies electrical stimulation to corresponding acupoints to treat diseases on the basis of acupuncture. It has always been a major, commonly used, and effective traditional Chinese medical intervention method, and has been widely applied in the treatment of various human system diseases. Existing clinical data and experimental studies have shown that electro-acupuncture has a significant effect on obesity [10]. Electro-acupuncture can regulate appetite, control energy intake, reduce the weight of patients, lower the BMI index and hip circumference of patients, and improve lipid levels.

Si Yuancheng [11] et al. selected 100 SPF C57BL/6 mice, and selected 6 mice as the normal group (N), and the remaining experimental mice were used to establish a nutritional obesity model, obtaining 30 obese mice. They were randomly divided into the model group (M), the electro-acupuncture 7-day group (A7), the electro-acupuncture 14-day group (A14), the electro-acupuncture 21-day group (A21), and the electro-acupuncture 28-day group (A28). After electro-acupuncture treatment, the body weight and Lee's index, the content levels of tumor necrosis factor-α (TNF-α) and IL-6, and the SLAMF4 gene and protein levels of the experimental mice significantly decreased. It was found that electro-acupuncture can reduce the body weight of obese mice with nutritional obesity, improve the chronic inflammatory response of intestinal mucosa, regulate the expression of SLAMF4 gene and protein, and thereby achieve the effect of weight loss. Ji Yuan Yuan [12] et al. selected 60 SPF SD rats, 10 rats (half male and half female) were set as the blank group, and the remaining 50 rats were used to model as obese rats, obtaining 30 obese rats. They were randomly divided into the obesity model group, the electro-acupuncture group, and the bifidobacterium group, and were treated with electro-acupuncture and intragastric administration of bifidobacterium solution respectively. After 4 weeks, the body weight of the electro-acupuncture group and the bifidobacterium group was lower than that of the model group, and the levels of intestinal source signal substances [enterochromaffin cell (ECC), 5-hydroxytryptamine (5-HT), histamine (HIS)], serum TC, TG, and LDL levels were also lower in the electro-acupuncture group and the bifidobacterium group than in the model group, and the effect of electro-acupuncture on simple obesity rats was better than that of bifidobacterium. Electro-acupuncture may adjust the stimulation of intestinal source signal substances on the hypothalamus of simple obesity rats, reduce food intake, accelerate lipid metabolism, and slow down obesity. To sum up, electro-acupuncture can enhance the sensation of the needle, promote the body's metabolism, facilitate the circulation of qi and blood in the human body, increase the tension within the abdominal wall, accelerate gastrointestinal peristalsis, and reduce food intake.

3.3 Acupuncture Thread Implantation

Acupuncture thread implantation is a product of the

combination of modern technology and traditional acupuncture techniques. By inserting absorbable surgical sutures into the acupuncture points, it provides long-term stimulation to the acupuncture points to prevent and treat diseases. Acupuncture thread implantation has good clinical efficacy in treating obesity, which can improve the body's nutritional metabolism, regulate lipid levels, reshape body shape by stimulating the acupuncture points, thereby improving the balance of the body in all aspects, and reducing the occurrence of other internal diseases complications.

Chen Xia [13] divided 60 patients with simple obesity into an observation group and a control group. The observation group received acupuncture thread implantation treatment, while the control group was given acupuncture needle insertion followed by electro-acupuncture stimulation of abdominal acupuncture points with sparse and dense waves at a frequency of 2/100Hz. After two treatment courses, the BW, BMI, waist circumference (WC), waist-to-hip ratio (WHR), skin fold thickness, and TCM syndrome score of liver depression and qi stagnation in both groups decreased significantly compared to before treatment, and the acupuncture thread implantation group was superior to the electro-acupuncture group. Therefore, acupuncture thread implantation can reduce the BW, BMI, WC, WHR, and skin fold thickness of patients with liver depression and qi stagnation type simple obesity, effectively improve the manifestations of liver depression and qi stagnation-related symptoms. Ge Shuying [14] et al. randomly divided 60 patients with simple obesity into an acupuncture thread implantation group and a control group, with 30 cases in each group. The control group received health management intervention, while the acupuncture thread implantation group added acupuncture thread implantation treatment on the basis of health management. After intervention, the BMI, WC, WHR, TC, TG, LDL-C, thyroid stimulating hormone (TSH), leptin (Leptin), and insulin (INS) levels of both groups decreased, while HDL-C increased; and the changes in various indicators in the acupuncture thread implantation group were more obvious. Thus, it was concluded that acupuncture thread implantation can effectively reduce the weight, waist circumference, and waist-to-hip ratio of patients with simple obesity, improve the symptoms related to leptin and insulin resistance, and improve lipid metabolism levels. From the above studies, it can be concluded that the embedding therapy is effective, has fewer clinical adverse reactions and can be controlled, has high safety, is simple to operate, saves patients' medical time and energy, and is worthy of clinical promotion.

3.4 Warm Acupuncture

Warm acupuncture is an effective external treatment method for obesity in traditional Chinese medicine. Warm acupuncture combines the therapeutic effects of traditional acupuncture and moxibustion. Studies have shown that the infrared radiation produced by the burning of the moxa stick has a strong penetration effect, which can promote the metabolism of cells in the affected area and accelerate fat consumption [15]; acupuncture has a good therapeutic effect in the treatment of simple obesity, can reduce body weight, BMI, WHR, and improve lipid levels. Applying warm acupuncture to the Zhongwan, Qihai, and Tianqiu acupoints can promote the yang qi of the spleen and stomach, and applying warm acupuncture to the Zusanli and Fenglong acupoints can accelerate the metabolism of body fluids.

Zeng Yixian [16] randomly divided 81 female patients with simple obesity of spleen-kidney yang deficiency type into a warm acupuncture group, a Shenzhuo acupoint application group, and a combined treatment group. After 4 weeks of continuous treatment, the weight, BMI, waist circumference, and hip circumference of the three groups decreased, and the TCM syndrome score improved compared to before treatment. The total effective rate of the warm acupuncture combined with Shenzhuo acupoint application group was the highest, and the overall efficacy was the best, followed by the warm acupuncture group, and the Shenzhuo acupoint application group was the lowest. This indicates that warm acupuncture can effectively improve the weight, waist circumference, and hip circumference of patients with simple obesity of spleen-kidney yang deficiency type and the TCM syndrome. Wang Jing [17] et al. selected patients with spleen deficiency and dampness obstruction abdominal obesity and divided them into a control group and an observation group according to the random number table method. The control group received dietary and exercise therapy, while the observation group was given Tui-guan warm acupuncture combined with dietary and exercise therapy. Eight weeks later, the BMI, fat percentage (F%), waist circumference (WC), waist-to-height ratio (WHTR), TC, TG, HDL-C, LDL-C, and syndrome scores of both groups of patients were all improved compared to before treatment, and the changes in the observation group were more significant. This indicates that the combined therapy of regulating the triple orifices with warm acupuncture and dietary exercise can improve the symptoms of patients with spleen deficiency and dampness obstruction type obesity. All the above studies show that the efficacy of warm acupuncture is definite. When combined with dietary control and exercise intervention, warm acupuncture can significantly improve the abnormal indicators caused by simple obesity.

3.5 Auricular Acupuncture

Auricular points are the acupoints and corresponding reaction points on the ear, which reflect the lesions of the body or internal organs. When there is a lesion, various pathological reactions usually manifest in the corresponding area of the ear. For example, there may be obvious tenderness, color change, papules or nodules. Based on the phenomenon and the patient's symptoms and signs, it can be used as a clinical diagnostic basis; at the same time, these reaction points can also become stimulation sites to prevent and treat diseases. Auricular acupuncture selects the triple orifices to promote diuresis and turbidity elimination, selects the spleen and stomach to benefit qi, strengthen the spleen and eliminate fat and dampness, and selects the endocrine and subcortical areas to improve the dysfunction of the nervous and endocrine systems.

Wang Haili [18] collected 72 patients from the acupuncture outpatient department and randomly divided them into a treatment group of 36 cases and a control group of 36 cases. The control group received warm acupuncture therapy, and the treatment group received warm acupuncture therapy on

the basis of the control group, in addition to auricular point insertion and pressing treatment. After treatment, the BMI, weight, waist circumference, hip circumference, and syndrome scores of both groups of patients improved. The total effective rate of the treatment group was 93.55%, and that of the control group was 84.38%. The therapeutic effect of the treatment group was better than that of the control group. This indicates that warm acupuncture combined with auricular acupuncture is superior to warm acupuncture therapy alone for simple obesity (spleen deficiency and dampness obstruction type). Wang Siyi [19] selected 72 patients with simple obesity (spleen deficiency and dampness obstruction type) from the outpatient department and randomly divided them into a treatment group (36 cases) and a control group (36 cases). The treatment group received auricular point pill pressing combined with umbilical acupuncture treatment; the control group received conventional acupuncture. Both groups were treated based on a reasonable planning of exercise and diet. After 8 weeks of treatment, the weight, BMI, waist circumference, hip circumference, and other effective indicators of both groups of patients improved. The total effective rate of the treatment group was 90.63%, which was better than 77.42% of the control group. Conclusion: The effect of auricular point pill pressing combined with umbilical acupuncture for simple obesity (spleen deficiency and dampness obstruction type) is better than conventional acupuncture, and it is safer and more effective, and worthy of further research. Therefore, in clinical practice, auricular acupuncture therapy can be added to the routine treatment of simple obesity to provide safe, effective, simple, and non-invasive treatment methods, and to exert the advantages of traditional Chinese medicine characteristic therapies.

4. Mechanism of Acupuncture Therapy for Simple Obesity

Acupuncture therapy is simple to operate, has no side effects, and is highly safe. In recent years, studies on acupuncture therapy for simple obesity have made significant progress, all indicating that acupuncture improves body fat significantly. Acupuncture mainly regulates the hypothalamus, lymphatic system, endocrine system, and inflammatory response to improve obesity.

4.1 Effect on the Hypothalamus

Acupuncture for weight loss mainly regulates the hypothalamus. On the one hand, it can increase energy consumption by stimulating peripheral and central nerves to promote endocrine metabolism and break down excess fat in the body. On the other hand, it can reduce energy intake by inhibiting the patient's strong appetite and slowing down gastrointestinal digestion and absorption [20].

Wanbao Nian [21] randomly divided male Wistar rats into the normal group, the model group, and the electro-acupuncture group, with 10 rats in each group. The rats were fed with a high-fat diet to establish an obesity model. After successful modeling, the electro-acupuncture group was given electro-acupuncture stimulation at Zusanli, Fenglong, Guanyuan, and Zhongwan acupoints on their feet. After 4 weeks of intervention, the food intake of the electro-acupuncture group was significantly lower than that of the model group, and the body weight of the electro-acupuncture group was significantly lower than that of the model group. The expression of POMC protein and gene in the hypothalamus of the electro-acupuncture group was significantly increased; the expression of AgRP protein in the hypothalamus of the electro-acupuncture group was lower than that of the model group, and the gene expression was significantly decreased. This indicates that electro-acupuncture can improve the protein and gene expression of orexin peptides in the hypothalamus of obese rats, up-regulate the protein expression and gene expression of orexin POMC in the hypothalamus, and down-regulate the protein expression and gene expression of AgRP in the hypothalamus. It significantly reduces the appetite of obese rats, reduces their food intake, controls weight gain, and improves the obesity state. This may be one of the central mechanisms by which acupuncture improves obesity-related energy metabolism. Zhuang Shuting, Li Rui [22] et al. performed electro-acupuncture intervention on the bilateral "Stomach Lower Yu", "Spleen Yu", "Zusanli", and "San Yin Jiao" of rats. The electro-acupuncture group showed a significant decrease in fasting plasma glucose (FPG), serum fasting insulin (FINS) levels, and homeostasis model assessment of insulin resistance (HOMA-IR). The expression of SOCS3 in the hypothalamus was decreased, and the expression of IRS-1 was increased. This indicates that electro-acupuncture can reduce fasting blood glucose levels, improve pancreatic morphology, alleviate insulin resistance, and its mechanism may be related to the inhibition of lymphatic vessel proliferation, improvement of lymphatic vessel function, and the regulation of peripheral glucose metabolism by the hypothalamus.

4.2 Effects on the Lymphatic System

The lymphatic system is widely distributed throughout the body, and the lymphatic system distributed in the intestine plays an important role in the occurrence of obesity [23]. Patients with simple obesity have an increase in new intestinal lymphatic vessels, which is an important factor for fat accumulation and obesity [24]. Serum vascular endothelial growth factor-C (VEGF-C) is an important factor promoting lymphatic vessel formation, and the content of VEGF-C in the serum of simple obesity patients is significantly increased. The overexpression of this substance is an important factor for the extensive formation of lymphatic vessels and the occurrence of obesity [25].

Zheng Langhua, Liang Lichang [26] et al. observed that the levels of VEGF-C, Delta-like ligand 4 (DLL4), and adrenomedullin (ADM) were significantly lower after acupuncture treatment than before treatment. This indicates that acupuncture treatment for spleen-kidney deficiency type simple obesity can effectively reduce the TCM syndrome score, alleviate obesity, and improve IR. The mechanism may be related to the inhibition of lymphatic vessel proliferation, improvement of lymphatic vessel function. Xia Ming [27] randomly divided 55 male SD rats into a high-fat group and a blank control group. After successful modeling, the obese rat models were randomly divided into the electro-acupuncture combined with pressing needle group, the electro-acupuncture group, and the model group. The results showed that after

electro-acupuncture treatment, the number of intestinal lymphatic vessels in obese rats was significantly reduced, the vessel diameter was smaller, and the number of regular vessel walls was more. The mRNA expression levels of VEGF-C and vascular endothelial growth factor receptor-3 (VEGFR-3) were significantly down-regulated; after electro-acupuncture combined with pressing needle treatment, the number and diameter of lymphatic vessels were further reduced and smaller, and the mRNA expression levels of VEGF-C and VEGFR-3 were further decreased and significantly lower than those in the electro-acupuncture treatment group. This indicates that electro-acupuncture combined with pressing needle treatment may have a more significant advantage in weight loss and fat reduction compared to simple electro-acupuncture treatment. The weight loss effect of electro-acupuncture combined with pressing needle may be achieved by regulating the VEGF-C/VEGFR-3/ phosphatidylinositol 3-kinase (PI3K)/protein kinase B (Akt) signaling pathway to inhibit lymphatic vessel proliferation, improve lymphatic vessel endothelial permeability, and reverse intestinal lymphatic vessel dysfunction.

4.3 Regulation of Endocrine Functions

Simple obesity is a chronic metabolic disease related to sugar and lipid metabolism, characterized by excessive fat accumulation in the body due to excessive calorie intake and insufficient energy expenditure. The abnormal secretion of related endocrine hormones [such as leptin (Leptin), insulin (INS), adiponectin (ADP), and neuropeptide Y (NPY)] is an important pathogenesis of this disease.

4.3.1 Acupuncture Regulation of Leptin

Leptin is an important indicator reflecting body fat storage. Leptin mainly participates in regulating the homeostasis and metabolism of energy throughout the body, maintaining a constant level of fat storage in the body [28].

Ge Shuying and Chen Jie [29] found that acupuncture embedding reduced the levels of Leptin, INS, TC, TG, LDL-C, TSH, and increased the level of HDL-C in patients with simple obesity. This indicates that acupuncture embedding can effectively improve leptin and insulin resistance, thereby reducing the weight, waist circumference, etc. of patients with simple obesity. Li Xiaomin [30] selected 60 patients with simple obesity and divided them into the experimental group and the control group. The experimental group was further divided into group A (gastrointestinal damp heat syndrome), group B (spleen deficiency phlegm turbidity syndrome), and group C (spleen and kidney deficiency syndrome) according to different traditional Chinese medicine syndromes. The control group received health guidance, while the experimental group received symptomatic acupuncture treatment on the basis of health guidance. After 4 weeks of treatment, the levels of leptin and prostaglandin E in the bodies of the 4 groups decreased; the effective rates of A, B, and C groups were 100%, 90.00%, and 90.00% respectively; the effective rate of the control group was 45.16%; the experimental group was significantly better than the control group. This indicates that different traditional Chinese medicine syndromes of simple obesity patients can be effectively treated with corresponding acupuncture therapy, which can effectively improve the levels of blood lipids, leptin, and prostaglandin E in the body, and will not increase the occurrence of adverse reactions.

4.3.2 Acupuncture Regulation of Insulin

The occurrence of simple obesity is closely related to long-term high-fat diet and unhealthy lifestyle. Patients with insulin resistance (IR) have a higher probability of occurrence. The sensitivity of tissues and organs to insulin is relatively low, and fasting blood glucose monitoring (FPG), fasting insulin levels (FINS), and insulin resistance index (HOMA-IR) all increase significantly, becoming the basis for the occurrence of diabetes, hyperlipidemia, hypertension, cardiovascular and cerebrovascular diseases, etc. [31].

Tao Lina [32] collected 72 patients with simple obesity as the research subjects and randomly divided them into the acupuncture treatment group, the auricular point pressing treatment group, and the acupuncture combined with auricular point pressing treatment group. The changes in fasting insulin, insulin resistance index, fasting blood glucose, and body weight, BMI, visceral fat area (VFA), and body fat rate (BF%) before and after treatment in the 3 groups were compared. After treatment, the fasting blood glucose, fasting insulin, and insulin resistance index in the 3 groups were lower than those before treatment, and the efficacy of the acupuncture combined with auricular point pressing group was significantly better, indicating that acupuncture can effectively improve the fasting insulin and fasting blood glucose levels of patients with simple obesity and reduce body weight. Song Yanjuan and Huang Qi [33] et al. randomly divided rats into normal group, model group, electroacupuncture group, and electroacupuncture combined with inhibitor group. After treatment, compared with the model group, the body weight, serum C-reactive protein (CRP), tumor necrosis factor-α (TNF-α), lipopolysaccharide (LPS) content, and small intestinal Chiu's score of the rats in the electroacupuncture group and the electroacupuncture combined with inhibitor group were significantly lower, the glucose infusion rate (GIR) was significantly increased, the relative expression and positive expression area percentage of Toll-like receptor 4 (TLR4) protein were significantly lower, and the pathological damage and inflammatory cell infiltration of the small intestinal mucosa were significantly reduced; it indicates that electroacupuncture can improve the body weight of obese IR rats, increase peripheral insulin sensitivity, and its mechanism may be related to regulating the silent information regulator 1 (SIRT1)/TLR4 signaling pathway in small intestinal tissues and reducing the release of inflammatory factors. 3.3 3ADP adiponectin

ADP has the effects of lowering blood sugar and blood lipids, improving atherosclerosis and insulin resistance. The peripheral ADP level is negatively correlated with BMI and positively correlated with insulin sensitivity index.

Jin Youyou et al. [34] found that acupoint embedding can inhibit the secretion levels of leptin and insulin, thereby achieving the regulation of excessive appetite to reduce fat and energy intake, correcting the sugar and lipid metabolism disorder of the body, and improving the endocrine function of the pancreas and the metabolism of fat cells, so as to achieve

the effect of weight loss and lipid reduction. Luo Benhua [35]

et al. randomly divided 58 obese patients into the embedding group and the western medicine group. After 3 months of treatment, the BMI, WC, and WHR of both groups were smaller than those before treatment, the serum NPY level was lower than that before treatment, ADP was significantly higher than that before treatment, and the improvement of each index in the embedding group after treatment was better than that in the western medicine group. The acupoint embedding of the Three Jiao regulation method can benignly regulate the serum NPY and ADP levels, which may improve the leptin resistance and insulin resistance mechanism and achieve the effect of weight loss.

4.3 4 NPY neuropeptide Y

Neuropeptide Y (NPY) is the main hormone regulating nutrient intake and metabolism, affecting physiological processes such as circadian rhythm, stress response, and metabolism. Modern research shows that NPY is closely related to the occurrence of obesity and can stimulate appetite, promote obesity and metabolic syndrome; in addition, it has been found that NPY can promote abdominal obesity and the formation of fat vessels through increasing the stress response produced by glucocorticoid effects [36].

He Rensheng [37] successfully modeled obese rats and randomly divided the rats into the control group, the acupuncture group, and the model group. After 4 weeks of acupuncture treatment, it was found that the NPY, body weight, food intake, and leptin levels in the serum of the acupuncture group were significantly lower than those of the model group. This indicates that acupuncture stimulation of acupoints may regulate the NPY and leptin levels in the body, exerting the effect of reducing body weight and inhibiting appetite. Yin Gang [38] et al. randomly divided 40 simple obese rats into the model group, the Zhongwan group (electroacupuncture at Zhongwan), the Weiyu group (electroacupuncture at Weiyu), and the Weiyu Mu group (electroacupuncture at Zhongwan combined with Weiyu). After 3 weeks of continuous electroacupuncture, the acupuncture at Zhongwan and the acupuncture at Weiyu had significant effects on reducing the Lee index, serum TG, and the interaction of hypothalamus and serum NPY, and the mechanism was related to the reduction of hypothalamus and serum NPY. The pairing of Mu 穴 and Mu 募 acupoints had a significant synergistic effect on weight loss and reducing serum TG and hypothalamus and serum NPY.

4.4 Effects of Inflammatory Factors

Acupuncture can reduce the expression levels of inflammatory factors such as TNF-α, CRP, interleukin 6 (IL-6), and interleukin 18 (IL-18) in the blood of obese patients, and has a good intervention effect on the body shape, blood lipids, and inflammatory factor index of obese individuals [39].

Liu Yi and Shu Qing [40] et al. gave electroacupuncture treatment to “Zusanli”, “Fenglong”, “Zhongwan”, and “Guanyuan” of mice. It was found that the food intake, body weight, and Lee’s index of mice were significantly reduced; the contents of IL-2, IL-6, interleukin-17A (IL-17A), gamma interferon (IFN-γ), and (TNF-α) in serum were significantly reduced, and the contents of IL-4 and IL-10 were increased; the percentage of Treg in spleen tissue and the mRNA expression of forkhead box protein P3 (Foxp3) mRNA increased, and the percentage of Th17 and retinoic acid-related orphan receptor w (ROR-γt) mRNA expression decreased. This indicates that electroacupuncture may improve the obesity state of obese mice by regulating the balance of regulatory T cells (Treg) and helper T cell 17 (Th17) in the spleen and the expression of inflammatory factors in the serum. Wanbao Nian [41] used high-fat diet to feed male C57b1/6 mice for 10 weeks to establish the model. Then, the mice were randomly divided into 3 groups: the high-fat sham-needle embedding group, the high-fat acupuncture-needle embedding group. Needle embedding was performed once a week for a total of 6 times. Results: 1. The weight change of the sham-needle embedding group was 1.4 ± 0.9 g, while that of the acupuncture-needle embedding group was -0.6 ± 0.7 g; 2. After extracting and separating the serum from the mice in both groups, PRM mass spectrometry was used to verify 6 target proteins. It was found that there was a significant difference in the expression of the binding protein (HP). This indicates: 1. After 6 weeks of acupuncture-needle embedding treatment, acupuncture-needle embedding can improve the weight of obese mice; 2. HP is an important participant in triggering inflammation in white adipose tissue. In the initial stage of obesity, HP is expressed in adipose tissue cells, and its expression increases with the increase in body weight. This study suggests that acupuncture-needle embedding regulates the changes in HP protein, which may regulate the inflammatory changes in white adipose tissue, thereby treating simple obesity. 3. The regulation of HP protein changes by acupuncture-needle embedding may be one of the therapeutic mechanisms of simple obesity.

5. Summary

Acupuncture treatment for simple obesity has a significant clinical effect, and the acupuncture therapy is simple to operate, green, and has no side effects, with broad clinical application prospects. However, there are still some shortcomings in the clinical application of acupuncture therapy: 1) There are various acupuncture methods, but the operation standards (such as needle insertion technique, stimulation intensity, and retention time) and evaluation standards for efficacy, as well as the treatment course are not unified, resulting in poor comparability of research results; 2) The sample size selected in clinical studies is generally small, and there are still no multi-center, large-sample randomized controlled studies, and some research designs have unreasonable grouping, uneven intervention measures, and lack of long-term follow-up problems; 3) Research on the mechanism of acupuncture treatment for simple obesity has made certain progress, but there are relatively few studies on the mechanism of different acupuncture methods, and some mechanisms still need further research. Therefore, in the future, more multi-center, large-sample, scientifically designed, and rigorous clinical trials should be carried out to provide a basis for the formation of objective and standard treatment plans; at the same time, more comprehensive and in-depth studies on the pathogenesis of simple obesity from

the aspects of nerves, physiology, and pathology should be conducted to further explore the exact mechanism of acupuncture treatment for simple obesity, in order to improve the theoretical basis for acupuncture treatment of simple obesity and better guide scientific research and clinical application.

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