Psychosomatic medicine research of obesity and TCM countermeasures

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Author contributions
Chuan-Yan Zha, Rong-Cui Zhou and Jia-Li Fan drafted the manuscript. Tian-Cheng Xu contributed to the conception of the study. The authors critically reviewed the manuscript.

Competing interests
The authors declare no conflicts of interest.

Acknowledgments
This work was supported in part by National Natural Science Foundation Youth Program (82305376), Innovation Training Program of Nanjing University of Chinese Medicine (10315202011).

Peer review information
Psychosomatic Medicine Research thanks all anonymous reviewers for their contribution to the peer review of this paper.

Abbreviations
MHO, Metabolically Healthy Obesity; MAO, Metabolic Abnormal Obesity; SNS, Sympathetic Nervous System; ANS, Autonomic Nervous System; SES, Socioeconomic Status; MDD, Major Depressive Disorder; AS, Atherosclerosis; RAS, Renin-Angiotensin; NAFLD, Non-Alcoholic Fatty Liver Disease; IBD, Inflammatory Bowel Disease; IR, Insulin Resistance; SC, Scutellaria-Coptis; T2DM, Type 2 Diabetes Mellitus; TCM, Traditional Chinese Medicine; SCFA, Short Chain Fatty Acids; RAS, Reactive Oxygen Species; ARC, Arcuate Nucleus; POMC, Pro-Opiomelanocortin; α-MSH, α-Melanocyte-Stimulating Hormone; NPY, Neuropeptide Y; VMH, Ventral Medial Hypothalamus; LHA, Lateral Hypothalamus Area; COX, Cholecystokinin; WHR, Waist-to-Hip Ratio; HC, Hip Circumference; HFD, High-Fat Diet; BMI, Body Mass Index.

Citation

Abstract
As an epidemic disease, obesity is on the rise globally, seriously jeopardizing human health. China now has the largest overweight or obese population in the world. In addition to causing the typical physical symptoms of obesity, obesity is often accompanied by a variety of psychosomatic diseases, which are not only closely related to health behaviors, but also psychosocial plays an important role in them. Although there are differences in the symptoms exhibited by the major systems, most of the modern research has been interpreted from the inflammatory and immune responses, which provides a direction to find the mechanism of obesity physical and mental diseases. After researching and explaining the mechanism, we give the countermeasures of Chinese medicine in treating obesity from both pharmacological and non-pharmacological treatments and explore the mechanism, hoping to build a bridge between Chinese medicine treatment and the mechanism of the above mentioned physical and mental diseases, and to provide scientific evidence for the efficacy of Chinese medicine.

Keywords: psychosomatic medicine; obesity; acupuncture; traditional Chinese medicine; type 2 diabetes mellitus
Epidemiology of obesity

Morbidity and trends of obesity worldwide

One of the three most significant epidemics that endangers human health and survival, obesity is a increasing global public health issue [1]. Since 1980, the prevalence of obesity has risen worldwide, with one-third of the population on earth being classified as overweight or obese [2]. The obesity epidemic is a situation of globalization that exists in every region except parts of Africa [3]. According to data [4], the two regions with the greatest rates of overweight and obesity are the Americas and Europe.

In the Americas, Europe, and Africa the incidence of obesity and overweight increased significantly between 1980 and 2015. Overweight prevalence climbed from 45.3% in 1980 to 64.2% in 2015 in Americas, while obesity prevalence grew from 12.9% in 1980 to 28.3% in 2015. The rates of overweight and obesity in the Americas are highest in the United States and Mexico.

In addition to analyzing the incidence of obesity by area, the findings of investigating the incidence of obesity by gender and age reveal that the prevalence of obesity is rising [5], which might reflect the prevalence of obesity and the rate of obesity increasing.

The incidence of obesity in China

In fact, obesity rates are accelerating in developing regions with large populations [6].

And as China is the world’s most populated developing country, the obesity epidemic has gained attention and investigation. Obesity has become a serious public health issue in China, where obesity rates in both adults and children have been rising since the 1990s. Today, more than half adults and one-fifth of children are overweight or obese, making China the country with the most overweight or obese people in the world [6].

Although China is located in the Western Pacific region, which has the lowest obesity prevalence, its obesity rate has increased at an accelerated rate of 90% in the decade from 2009 to 2019 [6-8]. And by 2019, the prevalence and burden of obesity in China had not yet reached a statistical high, and is anticipated to climb for some time to come [9].

More studies have revealed that the development of obesity is not only connected to health behaviors (e.g., daily dietary structure, exercise habits, etc.), but also to psychosocial factors, with psychosocial stress is increasingly being recognized as a risk factor for obesity [10]. The continued rise in obesity prevalence in recent years may be attributed to changes in dietary patterns caused by COVID-19, an increase in anxiety and depression due to the economy's downward pressure [11], which has resulted in a significant acceleration in the prevalence of obesity.

Psychosomatic diseases associated with obesity

Physical symptoms of obesity

In general, obesity is characterized by increased body weight and girth, reduced joint mobility, and, psychologically, loss of self-esteem and cognitive function. At the same time, it is frequently accompanied by different clinical manifestations of multiple systems, such as respiratory distress and asthma in the respiratory system, and abdominal distension and reflux of digestive juices caused by gastric pain, dyspepsia, constipation, and so on in the digestive system. And, due to the endocrine system, it may be accompanied with baldness, infertility, and other symptoms. It may be accompanied by bladder dysfunction and erectile dysfunction in the urinary system [12].

Obesity is categorized into two forms based on the condition of metabolic function:

1. Metabolically Healthy Obesity (MHO)

There were no metabolic abnormalities, such as type 2 diabetes mellitus, dyslipidemia, and hypertension.

Circulating levels of Complement C3, hCRIPTNF-aIL-6, and Plasminogen Activator Inhibitor-1 were decreased, and Adiponectin was increased.

2. Metabolic Abnormal Obesity (MAO)

Defined by the two main factors of BMI (body mass index) and metabolic status.

Psychosocial stress of obesity

Psychosocial stress is the organism’s psychological and physiological response to situations such as social stress. It is linked to the human heart and physical wellness. The notion that psychosocial stress is a risk factor for obesity development is becoming more widely accepted [13].

Low socioeconomic position, problems in interpersonal interactions, stressful work conditions, a lack of appropriate social support, low self-esteem, balancing family and work life, and enduring rapid changes are all common psychosocial stresses. Psychosocial stress can raise the risk of obesity via both biological and behavioral mechanisms [14].

From a biological perspective, The “fight or flight” reaction is the term used to describe the acute sympathetic nervous system (SNS) activation that occurs when the body experiences stress. SNS activation raises respiration rate, blood pressure and heart rate, as well as activating catabolic pathways in the body. Catecholamines bind to beta-adrenergic receptors in adipocytes and can activate hormone-sensitive lipase, causing lipolysis. Such a stress reaction is temporary in healthy people. The autonomic nervous system (ANS) quickly counteracts SNS activity. Chronic SNS activation, on the other hand, is frequently assumed to be connected with the development of obesity in persons who have been consistently exposed to a stressful environment for an extended length of time. The organism is under chronic high pressure, the SNS is constantly activated, and high levels of catecholamines induce down-regulation or desensitization of adrenergic receptors in adipose tissue; as a result, SNS activation, when it occurs, restricts lipolysis and leads to insulin resistance.

In terms of behavioral pathways, stress may cause people to reduce their physical activity and increase their inactive time [15]. In reaction to stress, appetite increases, and most individuals consume meals heavy in sugar, fat, and calories to activate the reward system in the brain and reduce the stress response [16]. Psychosocial stress tends to decrease energy for physical activity while increasing hunger to stimulate food consumption [17]. Obesity can occur as a result of a combination of diminished exercise and increased food intake.

Potential social factors. (1) Social discrimination. Weight prejudice and stigma occur in many aspects of our culture and are frequently viewed as a socially acceptable and ubiquitous type of discrimination [18]. Pre-obesity and obesity as a disease states are difficult for people to understand and accept in a western cultural context, and it is widely perceived as a type of excessive weight gain caused by a lack of willpower or self-control, and as a result, we find that implicit and explicit biases are perpetuated in a wide range of scenarios when discussing weight. Prejudice against obesity is an underlying result people’s weight bias, which refers to people making negative or unreasonable judgments about others based on their own body size or weight [19].

Some minorities face additional biases as a result of other societal issues, such as lesbian, gay, or bisexual communities, who are sexual minority and are at risk of obesity owing to homophobia, social prejudices, and elevated stress levels [20-22]. Overweight and obesity in children and adolescents are also associated with social discrimination, such as prejudice and discrimination from the public and peers for reasons such as poor self-image, reduced quality of life, and poor academic performance, which may lead to an increased risk of obesity.

(2) Socio-economic status. Socioeconomic status (SES) is a significant risk factor for obesity. Education, income, and employment are all factors that influence socioeconomic status, with education being the most consistent variable across time [22]. Shorter sleep duration has been linked to weight growth, and shorter sleep duration is frequently related with longer working hours, low socioeconomic status, and low educational attainment [23].
Poverty generates stressful situations that frequently encounter issues such as a lack of material supplies, work prospects, adequate education, and municipal amenities. Such stressful situations can lead to increased financial stress and a poorer socioeconomic position... Residents in high poverty, for example, may suffer greater levels of psychological stress as a result of several kinds of distress, such as social situations, family connections, economic anguish, safety worries, and discrimination or unjust treatment [24].

**Direct psychophysiological effects.** Obesity is also a risk factor for major depressive disorder (MDD). Individuals with a greater BMI have a slightly higher risk of depression than those with a normal BMI [25]. Obesity and depression are linked in both directions. There is a bidirectional relationship between overweight (BMI ≥ 25–29.99) and the development of depression in both men and women, with a vicious cycle established by low mood, overeating, and lack of physical activity, which exacerbates the severity of obesity and many of the associated health risks [26].

The relationship between obesity and depression is also mirrored in food choices, with sugar intake offering short-term respite from stress and discomfort to alleviate negative affect and mood states [26]. Chronic consumption of high-sucrose or fructose diets can result in anxiety and depression-like behaviors, as well as motivational deficiencies [27].

A research that looked at the association between bullying and BMI discovered that overweight or obese teenagers are more likely to be victims of rumors, verbal abuse, taunting, and even physical abuse and isolation [25]. Such encounters can jeopardize the mental health of obese teenagers, increasing their risk of sadness and making their obesity worse.

Aside from the interactions that can occur between obesity and depression, antidepressant drugs used to treat depression also have the potential to exacerbate obesity [28]. The causal challenges to weight's involvement in mental health are obvious.

**Other psychosomatic disorders associated with obesity**

Obesity, as a complicated chronic health condition, can result in metabolic syndrome and comorbidities [29], most of these processes are described in terms of inflammatory and immunological responses. Excess adiposity, particularly visceral adipose releasing factors, causes multiple metabolic disruptions and activates pro-inflammatory physiological pathways, resulting in an imbalance between the pro-inflammatory and anti-inflammatory environments, resulting in persistent systemic inflammation and decreased immune function [30]. This pathological process has been elaborated in detail and is mainly related to obesity-induced pro-inflammatory increase in macrophages, insulin resistance and leptin secretion affecting immune function [31–33]. Among these is the induction of a pro-inflammatory state by increased obesity leading to macrophage aggregation, which in turn predisposes to the promotion of hyperglycemia, hyperinsulinemia, and thus insulin resistance, as well as the development of T2DM (type 2 diabetes mellitus). Clinically, in addition to insulin resistance and hyperinsulinemia, this pathophysiology predisposes to vascular endothelial cell damage, atherosclerosis (AS), and, eventually, hypertension and thrombosis.

Furthermore, the risk of cardiovascular disorders such as improper lipid metabolism and left ventricular remodeling is raised [31, 34]. The effects of obesity on the cardiovascular system are thought to cause vessel wall thickening, increased platelet aggregation, hemodynamic changes (including increased blood volume and cardiac output and decreased systemic vascular resistance), activation of the renin-angiotensin-aldosterone system and sympathetic nervous systems, and accumulation of myocardial fat with fibrosis [35]. Diseases of the cardiovascular system often spread to organs throughout the body, affecting all systems and producing a variety of comorbid physical and mental disorders. It has been shown that there are two key factors in obesity-induced urological disorders; the first is the presence of obesity-related glomerulopathy, and the second is the presence of fat deposits in the kidneys that have an impact on renal hemodynamics and intrarenal regulation [36]. Its hemodynamic factors are similar to those of cardiovascular diseases.

Physical compression of the kidneys by peri-organ adipose tissue accumulation involves both vascular (the vasa recta) and tubular (the Henle's loops) aspects, leading to RAS (renin-angiotensin) activation and increased sodium reabsorption, and a high fat intake may have a direct lipotoxic effect on the kidneys, inducing the formation of ectopic lipid deposits, which result in structural and functional changes of the mesangial cells, podocytes, and proximal tubular cells [37, 38].

The respiratory system is affected in the same way as the urinary system is. On the one hand, obesity has significant mechanical effects on lung function, causing major changes in lung and chest wall mechanics, which often increase respiratory resistance, causing airway narrowing and closure leading to gas stagnation and uneven ventilation, and manifestation of asthma and asthma-like symptoms (e.g., dyspnea, wheezing, and airway hyper-responsiveness) [39–41].

On the other hand, there is evidence to support a causal relationship between obstructive sleep apnea in obese individuals and the prevalence and incidence of hypertension, coronary heart disease, arrhythmias, hyperlipidemia and stroke [42]. Furthermore, obesity-related pulmonary dysfunction may raise the risk of serious respiratory infections [43]. Obesity is closely linked to an increase in both the prevalence and severity of non-alcoholic fatty liver disease (NAFLD) in the digestive system.

Obesity can cause adipose tissue to expand and disintegrate, and if intrahepatic fat accumulation is not successfully managed, The invasion of immune cells by the liver results in a low-grade but persistent intrahepatic inflammatory process, which advances the liver's development of cirrhosis due to hepatitis [44]. Adipose tissue also interacts with the gut, and inflammatory markers produced by adipose tissue can trigger morphological dysfunction in the gastrointestinal tract and increase IBD (inflammatory bowel disease) disease activity. IBD is strongly associated with metabolic outcomes such as insulin resistance and dyslipidemia, and obesity increases these alterations [45, 46].

In terms of effects on the reproductive system, it has been shown that obesity can negatively impact on female fertility, with effects on conception (obesity affects ovulation, but also adversely affects endometrial development and implantation), embryo conception, and delivery. Due to dysregulation of the hypothalamic-pituitary-ovarian axis, obese women are more likely to experience ovulatory dysfunction, and altered levels of adipokines (e.g., leptin) in obesity can affect steroid formation and directly impact embryonic development, with some studies indicating a higher incidence of miscarriage, stillbirth, and pre-eclampsia in the obese population. Numerous research in the literature have examined the impact of obesity on female fertility in terms of hormones, ovulation/ovaries, and endometrium [47, 48]. The effects of obesity on the organism are most intuitively manifested in musculoskeletal complications, with studies showing that in the event of obesity, the mechanical overload generated leads to bone deformation, which triggers a series of transduction signals, but can only increase the quantity but not the quality or strength of bone, and thus susceptibility to fracture, and there are also studies that attempt to prove the correlation between leptin, lipocain and bone mineral density, but the results are still controversial [49].

In all systems, obesity may indirectly contribute to the development of tumor and cancers, and a study from the UK showed a strong association between BMI and oesophageal, thyroid, colon, renal, endometrial and gallbladder cancers, taking into account factors such as gender, smoking, and age in linear data [50]. Obesity-related variables have been linked to the development and progression of cancer. These factors, such as hormones and cytokines, lead to hyperinsulinemia, inflammation and adipose tissue malfunction. A significant amount of study has been devoted to the influence of these illnesses on cancer development and progression.

The complications of obesity in various systems are shown in Figure 1.
Figure 1 Clinical manifestations of obesity in various systems: main signs and symptoms
Chinese medicine countermeasures

Pharmacological treatment

Nowadays, most individuals have adequate amounts of food. A typical daily diet exceeds the nutritional threshold and comprises excessive amounts of fat and oily foods. The amount of exercise and consumption of energy are also decreased. Excessive energy buildup causes an increase in adipose tissue, which is a sign of internal humid or “dampness” and internal hot or “heat” in TCM. Obesity is classified as a “dampness-heat syndrome” in TCM. “Dampness” disrupts circulation and induces hypoxia in adipose tissue and the small intestine, resulting in unfavorable metabolic consequences such as insulin resistance (IR) and non-alcoholic fatty liver disease (NAFLD) [51].

Gegen Qinlian Decoction is a classic formula from Zhang Zhongjing’s “Treatise on Febrile Diseases” for treating DH. Gegen Qinlian Decoction contains the following herbs: Pueraria lobata (Wild.) Ohwi (Gegen), Scutellaria baicalensis Georgi (Huangqin), Coptis chinensis Franch (Huanglian), Glycyrrhiza uralensis Fisch (Gancao) [52].

In TCM, the Scutellaria-coptis (SC) herb pair in the “Treatise on Febrile Diseases” has the effect of clearing heat and dampness, purging fire, and removing toxin. According to the “Compendium of Materia Medica,” “Scutellaria baicalensis Georgi tastes bitter and causes internal cold, cures dampness and heat, the effect is similar to that of Coptis chinensis”. SC has been shown to enhance IR in type 2 diabetes mellitus (T2DM) [53]. By reducing macrophage-mediated inflammation, Scutellaria baicalensis Georgi enhanced IR [54].

Traditional Chinese medicine (TCM) has thousands of years of clinical experience in the treatment of obesity and its advantages are safe, mild and long-lasting. The active components in TCM interact with the gut microbiota when they reach the gastrointestinal system, stimulating or inhibiting the growth and proliferation of certain microbial species.

The gut microbiota is an important environmental component that influences the prevalence and progression of obesity [55]. Traditional Chinese medicine has been found to comprehensively manage the gut microbiota with numerous targets and limit the development of obesity by restoring microbial equilibrium and healing damaged intestinal mucosal barriers [56]. The active ingredients of traditional Chinese medicine affect energy metabolism absorption by increasing the quantity of intestinal microbial species [57] and the expression of related signaling pathway proteins, managing the equilibrium of gut microbiota and metabolites, resulting in a reduction in fatty accumulation in high-fat diets [58]. They can also significantly improve the gut surroundings, increase intestinal barrier integrity, and reduce the development of obesity related inflammatory markers throughout the gut metabolic process [59].

Regulating the abundance of intestinal flora and lipid metabolism. Chinese herbal formulas can cure obesity by modulating gut flora and lipid metabolism. Controlling the distribution and relative richness of the intestinal microbiota, strengthening the tiny intestinal villi, and modifying the metabolic pathways associated with obesity are all approaches to combat obesity.

Linggui Zhuan Decoction (composed of Poria cocos (Schw.) Wolf (Fulin), Cinnamomum cassia Presl (Guizhi), Atractylodes macrocephala Koiz (Bai Zhu), Glycyrrhiza uralensis Fisch (Gancao)) contributes to weight loss [60–62].

Erchen decoction (Pinellia ternata (Thunb.) Breit (Banxia), Citrus reticulata Blanco (Juhong), Portia cocos (Schw.) Wolf (Fulin) and Glycyrrhiza uralensis Fisch (Gancao)) improves lipid metabolism disorders and modifies the functioning of the intestinal microflora, leading to weight loss [63].

Modulating gut microbiota abundance and reducing chronic inflammation. The Sijinzi decoction, which contains Panax ginseng C. A. Mey (Renshen), Atractylodes lancea (Thunb.) DC (Cangzhu), Portia cocos (Schw.) Wolf (Fulin) and Glycyrrhiza uralensis Fisch (Gancao), may modulate immune function by modulating the quantity of gut microbiota and SCFA (short chain fatty acids) levels [64].

Shenling Baizhu Powder (composed of Nelumbo nucifera Gaertn (Lianzi), Coix lacryma-jobi L.var.ma-yuen (Roman.) Stapf (Yiyiren), Anomum villosum Lou (Sharen), Portia cocos (Schw.) Wolf (Fulin), Panax ginseng C. A. Mey (Renshen), Glycyrrhiza uralensis Fisch (Gancao)) decreases serum total cholesterol levels, heals the intestinal mucosa, and its mechanism may be linked to lowering the expression of TLR4-related proteins, lowering the levels of inflammatory factors such as TNF-α and IL-1, and increasing the relative abundance of the intestinal microbiota [65].”

The Gegen Qinlian decoction might interfere from inflammatory response through numerous targets and multiple channels to modify the balance of intestinal mucosal flora [66].

Non-pharmacological treatment

Acupuncture treatment. Acupuncture has been nationally approved as an important TCM treatment and has been agreed upon by the American Institutes of Health and the World Health Organization as an effective method for a variety of diseases. Aside from effectively reducing parameters such as body weight, BMI, degree of obesity or waist-to-hip ratio, many clinical trials have shown that acupuncture treatment improves obesity-related complications such as dyslipidemia, inflammation and altered plasma leptin concentrations, indicating that acupuncture is an efficient and secure therapy for obese patients [67].

Acupuncture reduces oxidative stress as one of its mechanisms for treating obesity. Oxidative stress, triggered by an imbalance between scavenging and production of ROS (reactive oxygen species), is a key etiology of obesity. Excessive production of ROS frequently results in damage to proteins, lipids and nucleic acids. At the same time, antioxidants including catalase, glutathione, superoxide dismutase and glutathione peroxidase decrease with the production of ROS. In addition, excess ROS can act as signaling molecules for inflammation and apoptosis. Therefore, increasing antioxidants or decreasing oxidative stress may be an effective method to curing obesity.

In obese subjects, acupuncture treatment significantly decreased serum pro-oxidant antioxidant balance values, which have been shown to positively correlate with body weight and were elevated in obese patients, thus illustrating acupuncture; reduction of oxidative stress as a mechanism for weight loss [68]. Among that, moxibustion can effectively reduce blood lipid indicators and levels of leptin and resistin in patients with obesity and hyperlipidemia [69]. By repeatedly stimulating acupoints to regulate the levels of central nervous system neurotransmitters, it can reduce the accumulation of blood lipids and fats [70].

Studies have shown that neurostimulation is effective in treating inflammation in obesity. According to the available evidence, the hypothalamic ARC (arcuate nucleus) is the primary focus of acupuncture treatment for obesity. Its potential mechanism is to upregulate the expression of POMC (pro-opiomelanocortin) and α-MSH (α-melanocyte-stimulating hormone) in ARC, while decreasing the expression of NPY (neuropeptide Y) in ARC, enhance the excitability of VMH (Ventral Medial Hypothalamus) neurons, inhibit the activity of LHA (lateral hypothalamus area) neurons and the expression of leptin or insulin, increase the sensitivity of leptin and insulin, as well as the expression of CCK (cholecystokinin) [71]. In most of these studies, surgical isolation of a given nerve for direct electrical stimulation has been used, which interferes with normal neuromodulation while treating obesity. Non-surgical percutaneous nerve stimulation with electroacupuncture can be an alternative non-invasive nerve stimulation strategy to conveniently and safely control inflammation and prevent inflammation-induced organ damage [72].

A meta-analysis of electroacupuncture for the treatment of simple obesity showed that in the treatment of simple obesity, electroacupuncture was superior to simple acupuncture, acupuncture and basic therapy in improving body fat percentage, body mass index, waist circumference, WHR (waist-to-hip ratio) and Chinese medicine symptom score, but was not obvious in improving...
HC (hip circumference), in which ST36 was one of the most effective acupoints in electroacupuncture for the treatment of obesity [73].

**Acupoint catgut embedding.** Acupoint catgut implantation has become a successful measure in the treatment of obesity in recent years, and a range of combined treatments have proven strong clinical results and are thus extensively utilized, and a variety of combined treatments have shown good clinical results and are therefore widely used [74]. The principle of this technique is mainly the use of needle insertion to cause tissue injury, adipocyte cell death, or a small area of fat liquefaction, and to a certain extent, to reduce the cellular Number. In a comparative trial, it was shown that the use of acupoint catgut embedding in conjunction with other therapeutic techniques was more beneficial than a single treatment approach, with significant weight loss results [75]. The fact that the technique is also clinically effective makes it regardless of being promoted.

**Dietary therapy.** Obese people frequently have a very significant TCM symptom known as “dampness heat,” which is defined as internal “heat” or more particularly “dampness heat” (Shi Re in Chinese) [76]. There are also some views that obesity is related to the presence of phlegm in the body. To address this, TCM dietary therapy focuses on reducing the intake of fat, fatty and sugary foods while increasing the intake of cooling foods that assist remove moisture from the body, such as bitter melon, lotus leaf and green tea [77]. The TCM dietary therapy is supported by a wealth of modern research, which has shown that consuming fruits and vegetables and having a healthy diet are essential for good health [78], and that foods rich in soluble dietary fibers (SDFs) are effective in reducing the risk of obesity, diabetes and cardiovascular disease [79]. Some commonly used foods for the treatment of obesity, such as mulberries, have also been shown through modern experimental methods to have the effect of lowering body weight and visceral fat induced by a (high-fat diet) HFD in the treatment of obesity and are accompanied by a lipid-lowering effect, which provides a strong support for dietary therapies supporting TCM [80].

**Qi-gong and Tai-Chi.** The practices of qi-gong and Tai-Chi are ancient Chinese exercises rooted in traditional self-healing and self-cultivation techniques. People who are overweight or obese can use exercise to enhance their physical health and improve other aspects of physical fitness, such as flexibility, balance, walking speed, and overall fitness [81]. Additionally, the two most popular preventive and therapeutic practices for long-term metabolic illnesses are qi-gong and Tai-Chi [82]. These two qong techniques are low-impact exercises that are suitable for most people, and their practice improves cardiovascular fitness, muscle strength and flexibility, and contributes to weight loss and overall health. These techniques can help control obesity by reducing insulin resistance [69]. In terms of the characteristics of the gong method itself, the qi-gong exercise was created with the features of diabetic patients in mind and is based on the meridian theory of traditional Chinese medicine. Dredging different meridians to prevent and control various diseases of internal organs [76].

**Massage therapy.** Massage, through manipulation of specific areas of the body surface, can help regulate qi (qi is the most basic substance that makes up the human body and sustains its vital activities) and blood, improve digestion, eliminate pathogenic factors, strengthen the body, promote lymphatic drainage, and contribute to the reduction of body fat and improvement of metabolic function [69, 83]. Obesity is considered to be the result of stagnant qi, accumulation of dampness, and weakness of the spleen and stomach [69], so massage is mostly related to this in the selection of acupoints, and through the massage of the ST36, GB39, KI1, and L11, it can control the transport and digestive functions of the spleen, stomach, liver, gallbladder, and the lateral channels of the large intestine, which is conducive to the metabolism of lipids in the human body [84]. Modern medical experiments have proved that massaging the ST36 can decrease the content of cholesterol and triglycerides in the blood, which can significantly reduce blood lipids and blood pressure [85], providing modern medical proof for weight loss with massage. When the techniques are performed, they are varied, involving pressure, friction, pinching, kneading, pushing, shaking, etc. And the efficacy is better when used in conjunction with other techniques [86].

**Other methods.** In addition to the above techniques for treating obesity, there is also cupping, Gua Sha and moxibustion, which also treat obesity. The principle of action is similar to that of massage, for example, cupping adsorbs an implement to the skin, which helps to stimulate blood flow and lymphatic drainage, which helps to eliminate excess fat and toxins from the body. Gua Sha uses smooth-edged instruments to scrape the skin, which helps to enhance blood circulation, reduce inflammation and promote healing [69]. In a random controlled trial, results were produced to prove that cupping therapy is effective for obesity. Among the most commonly used acupoints for cupping were CV12 and ST25, and most of the acupoints used to treat obesity were located in the abdomen, which has implications for guiding cupping therapy for obesity [87].

**Chinese medicine’s holistic effect**

According to traditional Chinese medical thought, the human body functions as an organic whole, with diverse systems interacting with one another to produce a state of equilibrium. A key idea in the theory of traditional Chinese medicine is qi (qi is the most basic substance that makes up the human body and sustains its vital activities), which is directly tied to health [88]. When the body’s qi is out of balance due to pathological circumstances, traditional Chinese medicine procedures and consuming internal and external interference to bring the body back into balance and produce a comprehensive therapeutic result. Treatment with Chinese medicine doesn’t just target one symptom; it also has positive regulatory effects on the body as a whole. Therefore, traditional Chinese medicine has positive therapeutic effects on a variety of issues in addition to managing obesity.

The treatment of obesity and the many associated disorders is greatly aided by the synergistic effects of Chinese medicine. Huang Jian, Ohwi, Ginseng, and other substances have the combined impact of enhancing lipid metabolism, lowering fat formation, raising insulin sensitivity, and increasing insulin secretion [89]. Additionally, through a signal pathway modulation mechanism, ginsenoside, a potent component of ginseng, contributes to the prevention of heart disease and issues associated with nonalcoholic fatty liver disease and obesity [90]. Through comparable brain pathways, acupuncture and moxibustion can decrease bodily inflammation, control hunger and metabolism, and control blood sugar levels [71]. In addition, moxibustion and acupuncture help reduce pain brought on by a number of diseases and pathological situations [91]. The lipid-lowering effects of various foods high in dietary fiber can effectively minimize the risk of obesity, diabetes, cardiovascular disease, and other linked metabolic disorders as dietary therapy manages and improves human intake [79]. In order to control the body’s qi, which has a positive regulatory impact on physical functions like bone health and cardio-pulmonary function as well as psychological affects like anxiety and depression, practitioners of qi-gong and Tai-Chi mix internal meditation with external bodily motions [92]. Another key benefit of qi-gong and Tai-Chi as therapeutic techniques is their affordability and safety during self-exercise. In order to create a balance of qi (qi is the most basic substance that makes up the human body and sustains its vital activities), massage directly affects the human body by regulating and stimulating the internal qi of the body at the meridians and acupoints. According to contemporary medical mechanisms, it can also control the amounts of neurotransmitters and hormones [93].

In conclusion, treating obesity and its associated complicating diseases can be accomplished using a variety of traditional Chinese medicine techniques. Combining several traditional Chinese medicine procedures can produce a comprehensive therapy impact from various angles when treating various patients’ physical symptoms. **Summary**

As the global incidence of obesity continues to rise, posing a serious
threat to human health, a variety of obesity research is also advancing, and people’s understanding of obesity is constantly deepening. However, when we reviewed the literature, we discovered that there is more literature on a single obesity-associated disease, with metabolic diseases as a high-frequency direction of the discussion. In response to this phenomenon, we hope to reverse the summary based on system division. We collect the occurrence mechanism of obesity-associated diseases in various systems, and then summarize and reveal the universal laws and interconnections, in the hope of establishing a more complete system and approaching the essence of obesity-associated physical and mental diseases to the greatest extent possible. According to the available research, immunological and inflammatory responses explain the great majority of etiological variables, which may offer light on secondary illness prevention.

In this approach, we intend to emphasize the involvement of psychological variables in the development and subsequent physiological effects of obesity, to improve the relationship between physiology and psychology, and to avoid separate studies. And we assess obesity in terms of a biopsychosocial model. In addition to macroscopic grasping from a Western medical standpoint, we provide a large variety of Chinese medicine techniques for the treatment of obesity, which emphasizes the concept of holism, which coincides with our emphasis on macroscopic grasping. Whether it is the treatment of visceral diseases or emotional diseases, they all depend on regulating qi and blood. So for physical and mental diseases caused by obesity, Chinese medicine treatment focuses on the spleen and stomach, dampness and heat treatment. Spleen and stomach is the postnatal foundation. It’s the source of qi (qi is the most basic substance that makes up the human body and sustains its vital activities) and blood. Adjusting the spleen and stomach can often play a double effect, taking into account both physical and mental disease treatment. A combination of Chinese medicine procedures can typically boost efficacy and intensify the therapeutic impact.

One major advantage of showing both Chinese and Western medical perspectives on obesity is that they can be easily compared. Both therapies stress the importance of nutrition and exercise, demonstrating some cognitive consistency. However, as evidenced by the research, Western medicine for the treatment of obesity is still difficult to ensure safety and has the issue of greater costs. The most regularly used medications and bariatric surgery have significant negative effects on the body, and the majority of them are currently in clinical trials [94–97]. In comparison to TCM, which is handy, tested, and has fewer side effects, much more research and development of modern obesity treatment is required. This is another reason why we recommend TCM remedies on this site. TCM therapy demonstrates its strong potential in the treatment of obesity with the backing of its own theoretical system generated over thousands of years, as well as the confirmation and clinical efficacy data of modern medicine. This article summarizes the research on psychosomatic medicine and Chinese medicine countermeasures for obesity in recent years. We sincerely hope that it will contribute to expand the research ideas related to the treatment of obesity.

References

5. Boutari C, Mantzoros CS. A 2022 update on the epidemiology of obesity and a focus on its twin COVID-19 pandemic appears to be receding, the obesity and dysmetabolism pandemic continues to rage on. Metabolism 2022;133:155217. Available at: http://doi.org/10.1016/j.metabol.2022.155217


44. Polyzos SA, Kountouras J, Mantzoros CS. Obesity and nonalcoholic fatty liver disease: From pathophysiology to therapeutics. *Metabolism* 2019;92:82–97. Available at: http://doi.org/10.1016/j.metabol.2018.11.014


at: http://doi.org/10.1371/journal.pone.0243989


