

Research Progress of Massage Therapy for Obesity-Induced Insulin Resistance

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Abstract By searching the relevant literature in recent ten years, this paper summarizes the research progress of massage in the treatment of obesity-induced insulin resistance, in order to provide more basis for massage in the treatment of obesity-induced insulin resistance.

Key words Massage, Obesity, Insulin resistance, Review

0 Introduction

With the development of economy, people's living standard is improving day by day, the intake of high-fat and high-sugar diet is increasing, and lack of exercise and life pressure are increasing, so the incidence of obesity is increasing, and the related diseases caused by obesity are also increasing. Insulin resistance refers to the decrease in the sensitivity of various organs and tissues in the body to insulin during the action of biological effects, resulting in the body's biological response to insulin being lower than normal. This phenomenon weakens insulin's ability to promote the uptake and utilization of glucose by target cell groups, causing an abnormal increase in blood sugar concentration^[1]. Obesity with insulin resistance is a disease in which the original physiological efficacy of insulin in obese patients in the body is reduced^[2]. Obesity is closely related to insulin resistance. The accumulation of body fat and the change of adipocytes in obese patients are important risk factors for insulin resistance^[3–6]. In recent years, the number of obese patients with insulin resistance has increased year by year. The main treatment methods are oral administration of drugs, surgical therapy, exercise therapy, *etc.*, but there are certain problems and risks such as toxic and side effects, surgical sequelae, and poor compliance. In recent years, TCM massage has become a new method for preventing and treating obesity-induced insulin resistance, and is increasingly applied in clinic. It is widely respected because of its characteristics of relative safety, no toxic side effects, no sequelae, low cost and remarkable curative effect. It provides a relatively safe and effective treatment option for obese patients with insulin resistance^[7].

1 Understanding of obesity-induced insulin resistance in traditional Chinese medicine

The obesity-induced insulin resistance is equivalent to the spleen-warm syndrome in traditional Chinese medicine^[8]. *Plain Questions · Strange Diseases* records^[9]: "This overflow of five qi is called the spleen-warm syndrome. Under normal circumstances, food enters the stomach, undergoes preliminary digestion, and is then distributed from the spleen to the whole body. If there is spleen heat and spleen loses its normal function, the body fluid will stay and overflow upward, which will cause symptoms of sweetness in the mouth. This is a disease caused by excessive diet. Most people with this disease like to eat greasy and sweet food. The greasy food makes body warm, and the sweet taste makes people feel stuffy. Therefore, the overflow of qi will lead to sweetness in the mouth, and then turn into thirst over time." The obesity-induced insulin resistance is mostly due to excessive eating of sweet and greasy food, causing damage to the spleen and stomach, and it is closely related to phlegm-dampness constitution. The formation of phlegm-dampness constitution often leads to dysfunction of the spleen and stomach. The spleen and stomach play an important role and function in the human body, converting food into nutrients absorbed by the body. These nutrients are important for maintaining human life activities. If the spleen and stomach function is out of order, it will lead to internal stagnation of water and dampness, which will transform into phlegm and dampness over time, leading to obesity^[10]. It will turn into internal heat and abdominal distension over time, and further develop into obesity-induced insulin resistance^[11].

The treatment of obesity-induced insulin resistance in traditional Chinese medicine is mainly based on the holistic concept and the principle of syndrome differentiation and treatment, and achieves the therapeutic effect by regulating qi and blood, dredging meridians and harmonizing viscera. Commonly used treatment methods include massage, acupuncture, moxibustion, acupoint application and oral administration of traditional Chinese medicine^[12].

2 Modern medical understanding of obesity complicated with insulin resistance

Modern medicine believes that the etiology and pathogenesis

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of obesity-induced insulin resistance are the result of multiple factors, including abnormal changes in adipose tissue, inflammatory response, oxidative stress, increased levels of free fatty acids and decreased secretion of adiponectin^[13]. These factors interact together and lead to the occurrence of this disease. Obesity, especially central obesity, can cause white adipose tissue to release a large quantity of free fatty acids and adipose-derived factors, which can interfere with insulin signaling, thus causing insulin resistance^[14]. Abnormal lipid accumulation in adipose tissue is one of the important factors leading to insulin resistance caused by obesity. When adipose tissue cannot effectively store fat, excess fat will be transferred to non-adipose tissues, such as liver and muscle, which can lead to impaired insulin signaling in these tissues, causing the disease. Obesity can also lead to increased inflammatory response in adipose tissue and increased secretion of inflammatory factors, which will further interfere with insulin signaling pathway and weaken the response of adipocytes to insulin^[15-16]. It is also an important factor causing obesity-induced insulin resistance. Furthermore, oxidative stress and hypoxic states in adipose tissue can also exacerbate the development of insulin resistance^[9]. Eating habits and lifestyle also have important effects on obesity and insulin resistance, and unhealthy lifestyles such as high sugar and high fat diets and lack of exercise can aggravate the incidence of obesity-induced insulin resistance^[17].

3 Application of massage in the treatment of obesity-induced insulin resistance

3.1 Massage therapy As an external treatment method of traditional Chinese medicine, massage has the functions of regulating qi and blood circulation in the body and improving fat metabolism, and has therapeutic effects on obesity, insulin resistance and related diseases^[18]. In animal experiments, Zhang Xin *et al.*^[19] randomly divided 60 rats into blank control group, model control group and massage intervention group, and the massage intervention group was treated with abdominal massage therapy. The results showed that abdominal massage therapy could effectively regulate the homeostasis of glucose and lipid metabolism and optimize islet function, thus significantly reducing the insulin resistance of obese rats, and the difference between groups was statistically significant ($P < 0.05$). Wang Yuan *et al.*^[20] treated 80 obese children with insulin resistance by massage manipulation. 80 children were randomly divided into control group and study group, with 40 cases in each group. The control group was treated by diet and exercise. The study group was treated with TCM massage on the basis of the control group. After treatment, the total effective rate of the study group was significantly higher than that of the control group, and the difference between the groups was statistically significant ($P < 0.05$). The study demonstrated the positive efficacy of massage therapy in the treatment of obesity-related insulin resistance.

Therefore, commonly used massage techniques, such as "meridian dredging abdominal manipulation" and "abdominal

massage for reducing turbidity", are regarded as important means to effectively intervene in obesity and obesity-induced insulin resistance. The method of "meridian dredging abdominal manipulation" can regulate the leptin level of obese patients to a healthy range, reduce the blood sugar level, improve fat metabolism and insulin sensitivity index^[21-22], and can curb the release of inflammatory cytokines in adipose tissue by regulating related conduction pathways, optimize the morphology and structure of adipocytes, and finally achieve the therapeutic purpose^[23]. The method of "abdominal massage for reducing turbidity" has remarkable effects in treating obesity, diabetes, hyperlipidemia and other diseases, can improve glucose and lipid metabolism disorder and inflammatory reaction of patients, can stimulate specific acupoints and meridians on the body surface, promote abdominal qi and blood circulation, help remove turbid qi, turbid water and stool in the body, improve the sensitivity of the body to insulin and improve obesity^[24], thereby treating obesity-induced insulin resistance.

3.2 Massage combined with oral administration of traditional Chinese medicine In animal experimental studies, Zhang Xiaolin *et al.*^[25] randomly divided 32 successfully modeled obese rats with insulin resistance into model group, massage group, drug group and massage + drug group, with 8 rats in each group. Among them, the model group was not given treatment, the massage group was given "meridian dredging abdominal manipulation" treatment, the drug group was fed metformin hydrochloride aqueous solution, and the massage + drug group was given "meridian dredging abdominal manipulation" treatment, and at the same time, fed metformin hydrochloride aqueous solution. The overall effect of treatment intervention was evaluated in multiple dimensions. The research showed that compared with the control group treated with only drugs, the rats treated with the massage + drug method as the adjuvant treatment method underwent more significant improvement in the TCM syndrome score of alleviating obesity-induced insulin resistance, the massage + drug method could improve the effect of drugs on obesity-induced insulin resistance, and the massage + drug method could reduce the incidence of side effects and adverse events caused by the drug group treatment. The difference between the groups was statistically significant ($P < 0.05$). This study further demonstrates the potential value and application prospect of massage therapy in the treatment of obesity and insulin resistance. In clinical research, Yuan Gang^[26] randomly divided 108 patients into metformin group, metformin + massage group (massage + drug group) and metformin + massage + Xiaoxianxiong decoction group (comprehensive treatment group), with 36 people in each group. After treatment, the total effective rates of metformin group, massage + drug group and comprehensive treatment group were 69.44%, 80.56% and 88.89%, respectively ($P < 0.05$).

The above studies have shown that combining the method of "abdominal massage for reducing turbidity" with drugs can significantly improve the TCM syndrome score and overall treatment efficiency of obese patients with insulin resistance, and achieve better

therapeutic effects. The massage therapy mainly acts on the stomach meridian of foot-yangming and the spleen meridian of foot-taiyin. By strengthening the transportation and transformation function of spleen and stomach, it can effectively remove phlegm and dampness accumulated in the body and help glucose and lipid metabolism return to normal, thus achieving the treatment goal^[27]. The combination of massage and drug therapy not only embodies the principle of holistic view and syndrome differentiation of traditional Chinese medicine, but also provides more new ideas for the treatment of obesity-induced insulin resistance and related metabolic diseases.

4 Discussion

To sum up, the TCM pathogenesis of obesity-induced insulin resistance is spleen and stomach dysfunction, endogenous phlegm-dampness, stagnation and long-term heat, damp-heat interaction, and internal heat and abdominal distension. The massage therapy can be applied alone or combined with other treatment methods such as oral administration of drugs to further improve the curative effect of this disease. Although massage has certain potential and advantages in the treatment of obesity and insulin resistance, the existing related studies are still insufficient. For example, the treatment of obesity-induced insulin resistance by massage is mostly limited to small sample studies, and there is a lack of large-scale and long-term clinical trials to verify its mechanism and effect; moreover, the existing studies mostly focus on short-term curative effect, and the long-term effect of massage in the treatment of obesity-induced insulin resistance is not clear. Therefore, more high-quality studies are still needed in the future to verify the effect of massage in the treatment of this disease, and to further explore its specific mechanism of action and more application schemes.

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sources before class. Teachers ask questions according to knowledge points in class, students discuss and analyze them, and then teachers evaluate them to mobilize students' learning initiative; (iii) it is recommended to apply intelligent classroom teaching mode^[6], grasp students' learning process from multiple dimensions (classroom performance, teamwork, interactive discussion, online testing), and improve the quality of classroom teaching.

2.3 Strengthening the process assessment and establishing a diversified evaluation system In the process of teaching, it is recommended to form a diversified and whole-process evaluation method. (i) Through questionnaires, classroom feedback, interviews and other means, teachers can understand students' suggestions on curriculum content, teaching methods and textbooks, and adjust the curriculum design in a timely manner. (ii) It is recommended to adjust the proportion of final examination results and attendance results to 60% and 40%, respectively. The final examination strengthens the assessment of students' ability to analyze and solve problems by designing innovative open questions, and assesses the whole learning process of students by means of comprehensive training (engineering case design), course examination (innovative open questions, basic theoretical knowledge, concepts, principles) and process assessment (online test, homework, group discussion)^[7-8]. According to the evaluation results, the course implementation process is adjusted and improved to improve the teaching quality and effect.

3 Conclusions

According to the requirements of new engineering disciplines construction for the cultivation of applied talents, based on the concept of OBE, we analyzed the problems and shortcomings in the process of Environmental Engineering Microbiology teaching. It is recommended to revise the syllabus according to the indicators of graduation requirements, set the teaching objectives of "trinity" of knowledge, ability and literacy, optimize and update the teaching content, and reform the teaching methods. In addition, it is recommended to establish the "whole process and diversified"

evaluation system, realize the transformation from teacher-led to student-centered teaching mode, promote the comprehensive development of students' learning theoretical knowledge, innovative practical ability and comprehensive quality, enhance their innovative consciousness and practical ability, and achieve the purpose of improving the quality and effect of course teaching.

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