

TYPE 2 DIABETES MELLITUS

WHY TREAT DIABETES WITH A HOLISTIC APPROACH?

Type 2 diabetes mellitus (T2DM) is a metabolic disorder that occurs when insulin resistance and eventual insulin deficiency lead to high blood glucose. Extensive research is currently underway to better understand the causes of insulin resistance in the body. Numerous factors, such as obesity, toxin exposure, infections, and emotional stress all contribute to chronic inflammation and the development of this chronic condition and its many negative sequelae.

Several large clinical trials have shown that control of hyperglycemia alone does reduce the microvascular (small blood vessel) complications of diabetes but it does not definitively reduce the macrovascular (large vessel) complications, such as cardiovascular disease (CVD). It also does not decrease mortality. This suggests, then, that only focusing on treating blood glucose numbers in diabetics is not sufficient. Additional focus should be given to reducing inflammation and improving lifestyle factors, which can have microvascular benefits and lengthen lifespan. This Whole Health tool offers evidence-based suggestions on how the Whole Health approach can enhance T2DM care.

PREVENTION

Patients need to know that T2DM is a preventable—and reversible—disease in most cases. It is estimated that 90% of diabetes is preventable through changes in diet and exercise, elimination of smoking, and moderation of alcohol intake.[1]

SUMMARY OF TREATMENT RECOMMENDATIONS

FOOD AND DRINK

Low glycemic index (GI) diet. The low-GI diet focuses on carbohydrate type. GI measures how quickly a carbohydrate affects postprandial glucose levels. Low GI foods result in a more gradual rise in glucose and insulin release versus high GI foods. More insulin release in a short time period can lead to more abrupt drops in glucose levels and promote chronic inflammation. Over time, the low-GI eating can result in a 0.4% to 0.5% reduction in hemoglobin A1c (HgbA1c).[2,3] For more information, refer to the [“Glycemic Index.”](#) Whole Health tool.

Mediterranean diet. The Mediterranean diet is anti-inflammatory and has been found to counteract the chronic inflammation associated with many chronic diseases. Patients should be encouraged to decrease proinflammatory fats and enhance omega-3 intake while reducing the intake of omega-6 fats. This can result in an 83% reduction in diabetes incidence, with 0.1%-0.6% reduction in HgbA1C.[4] For more information, refer to [“The Anti-Inflammatory Lifestyle”](#) and the [“Choosing a Diet”](#) Whole Health tool.

Vegetarian diet. Plant-based diets may be associated with lower circulating levels of insulin-like growth factor (IGF-1). They have been found to lead to a 1.23% reduction in HgbA1C, according to one randomized controlled trial (RCT).[5]

Very Low Energy Diets (VLEDs). A 2020 review and meta-analysis of intermittent and continuous VLEDs suggested that this approach to eating is an effective therapy for rapid weight loss and glycemic control, as well as improved lipid metabolism, specifically in T2DM populations that are overweight and obese. Further research is still required to determine long-term benefits or risks of this dietary choice.[6]

Plant-Based diets: A 2018 review of studies related to the implementation of plant-based diets with people diagnosed with T2DM showed some statistically significant health associations. These include improved emotional well-being, physical well-being, depression, quality of life, general health, hemoglobin A1c levels, weight, and both total and LDL cholesterol.[7]

Specific food and drink choices. While there is limited high-quality evidence at this time, one review of 15 RCTs suggested that there may be a benefit of drinking water or mineral water as a way of supporting glycemic control. The data are favorable in animal models at this point in time.[8] One of the many areas that is discussed in the literature is the role that increasing omega-3 or polyunsaturated fats in the diet of people diagnosed with diabetes. A 2019 review and meta-analysis of 83 randomized trials concluded that increasing these types of foods in the diet has little or no effect on the prevention or treatment of T2DM.[9] That being said, a 2018 meta-analysis concluded that omega-3 polyunsaturated fatty acids do, in fact, produce favorable hypolipidemic effects, reduce proinflammatory cytokines, and improve hyperglycemia. Another whole food that has been researched with regard to its role in incorporating into a diet is ginger. A 2019 review and meta-analysis of 8 studies showed that while there was no significant change in fasting blood sugar, there was a statistically significant improvement in hemoglobin A1c in these studies from baseline to follow-up.[10] Another 2019 review suggested that blueberry and cranberry consumption may also have potential positive effects on glycemic control.[11]

WEIGHT LOSS

Weight loss is recommended for overweight and obese patients with T2DM, independent of the type of diet a person follows.[12] Moderate weight loss (5% of body weight) can improve insulin action, decrease fasting blood glucose (FBG) concentrations, and reduce the need for diabetes medications.[13,14] When weight loss is not achievable, weight maintenance should be stressed.

Studies suggest patients with diabetes and insulin resistance will lose more weight on low GI, high protein diets.[15-18]

DIETARY SUPPLEMENTS

Note: Please refer to the [Passport to Whole Health](#), Chapter 15 on Dietary Supplements for more information about how to determine whether or not a specific supplement is appropriate for a given individual. Supplements are not regulated with the same degree of oversight as medications, and it is important that clinicians keep this in mind. Products vary greatly in terms of accuracy of labeling, presence of adulterants, and the legitimacy of claims made by the manufacturer.

Substituting supplements for drug therapy is rarely helpful for the disease process and may be dangerous in some cases. Supplements can be helpful to patients who want to maximize their health as part of a comprehensive health plan.

Supplements which may benefit diabetic patients include the following:[19]

- Fish Oil
- Cinnamon
- Chromium
- Alpha-Lipoic Acid (ALA)
- Vitamin D
- Magnesium
- Vitamin E
- Pycnogenol
- Fiber

In general, fiber, fish oil, and vitamin D can be recommended routinely, as most diabetics will benefit from these supplements for overall health. Chromium and cinnamon can be recommended in patients who have pre-diabetes or early diabetes and want to avoid medications. For more detailed information on this topic, refer to "[Supplements to Lower Blood Sugar](#)" Whole Health tool.

MOVING THE BODY

Exercise is a fundamental component of diabetes care that helps weight reduction and glucose uptake. The American Diabetes Association (ADA) recommends 150 minutes of moderate-intensity aerobic physical activity weekly, over at least 3 days a week, with no more than 2 consecutive days without activity. Resistance training provides additional benefit and is recommended at least twice weekly for the 5 major muscle groups.[20]

Yoga. Two systematic reviews concluded that yoga likely benefits patients with T2DM by lowering blood sugars, LDL, triglycerides, body weight, waist to hip ratio, and HbA1c, as well as raising HDL.[21,22] A 2017 review of 12 randomized controlled trials totaling 864 patients re-demonstrated these physiological benefits of yoga practice.[23] A 2016 review also noted that there was some limited evidence suggesting other health benefits of yoga practice in people with T2DM, including lower oxidative stress and blood pressure, as well as enhanced pulmonary and autonomic function; it also demonstrated improved mood, sleep, and quality of life, as well as reduced medication use.[24] A 2017

review and meta-analysis of 23 studies with 2,473 participants also showed that yoga improved glycemic control.[25] Interestingly, a 2018 review of studies comparing yoga with physical exercise (the control group), showed that yoga practice was associated with a significant reduction in fasting blood glucose, post-prandial blood glucose, A1c, and BMI compared to the control group.[26] Despite the greater number of studies and reviews being published, there is still significant heterogeneity across the research, and further study is still needed.

Tai chi and qi gong. A 2018 systematic review of 8 studies on tai chi showed that a tai chi practice of at least 150 minutes per week was associated with lowering hemoglobin A1c on average by 1.48%. Fasting blood glucose and body mass index (BMI) were also significantly reduced, while quality of life was improved. This same review also analyzed 12 studies on Ba Duan Jin qi gong (Eight Brocades qi gong). This particular qi gong practice was associated with a decrease in hemoglobin A1c on average by 0.77%, while also improving fasting blood glucose, BMI, and depression.[27] Another 2018 meta-analysis corroborated these benefits of tai chi practice on significantly reducing A1c, and even suggested that tai chi showed marginally better reduction than other aerobic exercises.[28] A more extensive 2018 review and meta-analysis of 39 randomized controlled trials (11 tai chi, 6 general qi gong, 22 Eight Brocades qi gong), further supports the conclusion that these forms of movement significantly lower hemoglobin A1c and fasting blood glucose.[29] Lastly, a 2019 review and meta-analysis showed that tai chi practice in people with T2DM also significantly reduced blood pressure and improved quality of life.[30]

Structured exercise training programs lead to greater glycemic control than unstructured exercise in diabetic patients

POWER OF THE MIND

Biofeedback. One RCT involving 30 participants found improvement in HgbA1c with biofeedback techniques Biofeedback can, among other things, produce clinically significant toe temperature elevations which is associated with increased circulation, improvement of claudication pain, increased physical activity, more rapid healing of diabetic ulcers, and improved overall functional status.[32]

Meditation. Several RCTs show improvement in glucose control with different meditation techniques. There is compelling evidence for an association between mental stress and hypothalamic-pituitary-adrenal axis hyperactivity. Increased catecholamine levels released by the adrenal glands affect glucose transport and insulin resistance, suggesting a mechanism by which reduced stress levels might improve diabetes control.[33,34]

SURROUNDINGS

It has been suggested that diet and exercise cannot fully explain the current T2DM epidemic throughout the world, and that the prevalence of toxins, including the exponential rise in production and release of organic and inorganic chemicals into the environment during the last half-century, is a major contributing factor.[35-37] Refer to Figure 1.

Patients with diabetes or at risk of developing diabetes should be encouraged to limit toxin exposure when possible. For more information, refer to the “[Food Safety](#)” Whole Health tool and the “[Surroundings](#)” Whole Health overview.

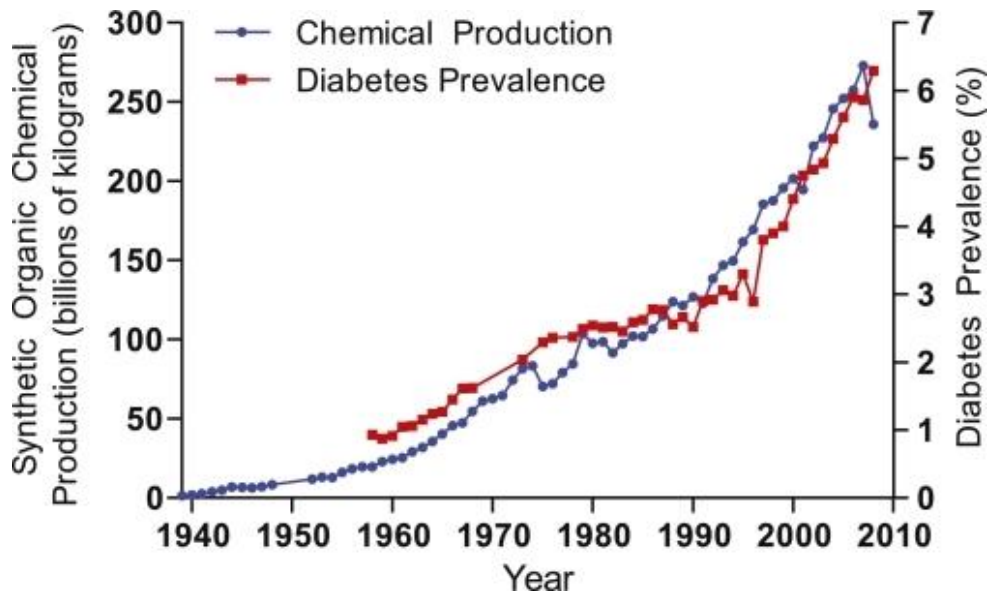


Figure 1. U.S. Synthetic Chemical Production and Diabetes Prevalence.[38]
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COMPLEMENTARY AND INTEGRATIVE HEALTH APPROACHES

Acupuncture. Acupuncture to improve glycemic control in diabetes and pre-diabetic states has been reported in the literature for over half a century, but the evidence is limited and of poor quality.[39,40] A 2019 review and meta-analysis of 21 studies with a total of 1,943 participants suggested that acupuncture could be effectively used as a supplementary treatment in managing T2DM, especially in people with obesity and metabolic disorders. At this point in time, the quality of the evidence is still limited, though it does suggest there may be a reduction in fasting blood glucose, 2-hour blood glucose, and A1c associated with acupuncture plus standard of care treatments.[41] There is some evidence that acupuncture reduces symptoms of diabetic complications (discussed in the next section).

MANAGING DIABETES COMPLICATIONS

CARDIOVASCULAR DISEASE

It is widely agreed that diabetes increases a patient’s risk of developing cardiovascular disease (CVD). Patients should be counseled that the lifestyle interventions most helpful for management of diabetes will also reduce their morbidity and mortality from CVD. This includes weight loss, increasing physical activity, following a Mediterranean diet, and stress reduction.

PERIPHERAL NEUROPATHY

The following interventions can be considered in patients with diabetic neuropathy:

- **Acupuncture.**[42,43] A number of masked studies support the use of acupuncture. In one study, the benefits of acupuncture lasted for up to six months and reduced the use of other analgesics.
- **Alpha-lipoic acid (ALA).**[44] This free radical scavenger antioxidant has been shown to be efficacious in the management of painful neuropathies when administered parenterally. It can also be given orally. Oral dose is 300 mg daily.
- **Magnet Therapy.**[45] Static magnetic sole inserts have been found to reduce neuropathic pain when administered daily over three to four months.
- **Capsaicin.**[46] This alkaloid, which is found in red pepper, depletes tissue of substance P and reduces chemically induced pain. Capsaicin is applied topically.
- **Acetyl-L-carnitine (ALC).**[47] Studies have shown ALC supplementation reduces pain and improves nerve fiber regeneration and vibration perception. Dose is 500-1000 mg three times daily.

GASTROPARESIS

- There is some evidence to support the use of acupuncture for symptomatic gastroparesis.[48]
- Digestive enzymes therapy can be considered in patients with gastroparesis, though high-level evidence is not available to support their use.

SUMMARY

Caring for diabetics is complicated, even without the inclusion of alternative therapies. Pharmacologic management is important but should not be the only treatment option presented to patients. Holistic therapy involves all aspects of a patient's lifestyle as well as their goals to make positive health changes.

RESOURCE LINKS

- [The Anti-Inflammatory Lifestyle](https://www.fammed.wisc.edu/files/webfm-uploads/documents/outreach/im/handout_ai_diet_patient.pdf): https://www.fammed.wisc.edu/files/webfm-uploads/documents/outreach/im/handout_ai_diet_patient.pdf
- [Choosing a Diet](https://www.va.gov/WHOLEHEALTHLIBRARY/tools/choosing-a-diet.asp): <https://www.va.gov/WHOLEHEALTHLIBRARY/tools/choosing-a-diet.asp>
- [Food Safety](https://www.va.gov/WHOLEHEALTHLIBRARY/tools/food-safety.asp): <https://www.va.gov/WHOLEHEALTHLIBRARY/tools/food-safety.asp>
- [Glycemic Index](https://www.va.gov/WHOLEHEALTHLIBRARY/tools/glycemic-index.asp): <https://www.va.gov/WHOLEHEALTHLIBRARY/tools/glycemic-index.asp>
- [Passport to Whole Health](https://www.va.gov/WHOLEHEALTHLIBRARY/docs/Passport_to_WholeHealth_FY2020_508.pdf): https://www.va.gov/WHOLEHEALTHLIBRARY/docs/Passport_to_WholeHealth_FY2020_508.pdf

- [Supplements to Lower Blood Sugar:](https://www.va.gov/WHOLEHEALTHLIBRARY/tools/supplements-to-lower-blood-sugar.asp)
<https://www.va.gov/WHOLEHEALTHLIBRARY/tools/supplements-to-lower-blood-sugar.asp>
- [Surroundings:](https://www.va.gov/WHOLEHEALTHLIBRARY/self-care/surroundings.asp) <https://www.va.gov/WHOLEHEALTHLIBRARY/self-care/surroundings.asp>

AUTHOR(S)

“Type 2 Diabetes Mellitus” was written by [Jacqueline Redmer, MD, MPH](#) and updated by [Vincent Minichello, MD](#) (2014, updated 2020).

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REFERENCES

- 1 Hu FB, Manson JE, Stampfer MJ, et al. Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. *N Engl J Med.* 2001;345(11):790-797.
- 2 Thomas D, Elliott EJ. Low glycaemic index, or low glycaemic load, diets for diabetes mellitus. *Cochrane Database Syst Rev.* 2009;1(1).
- 3 Thomas DE, Elliott EJ. The use of low-glycaemic index diets in diabetes control. *Br J Nutr.* 2010;104(6):797-802.
- 4 Esposito K, Maiorino MI, Ceriello A, Giugliano D. Prevention and control of type 2 diabetes by Mediterranean diet: a systematic review. *Diabetes Res Clin Pract.* 2010;89(2):97-102.
- 5 Barnard ND, Katcher HI, Jenkins DJ, Cohen J, Turner-McGrievy G. Vegetarian and vegan diets in type 2 diabetes management. *Nutr Rev.* 2009;67(5):255-263.
- 6 Huang YS, Zheng Q, Yang H, et al. Efficacy of intermittent or continuous very low-energy diets in overweight and obese individuals with type 2 diabetes mellitus: a systematic review and meta-analyses. *J Diabetes Res.* 2020;2020:4851671.
- 7 Toumpanakis A, Turnbull T, Alba-Barba I. Effectiveness of plant-based diets in promoting well-being in the management of type 2 diabetes: a systematic review. *BMJ Open Diabetes Res Care.* 2018;6(1):e000534.
- 8 Naumann J, Biehler D, Lüty T, Sadaghiani C. Prevention and therapy of type 2 diabetes- what is the potential of daily water intake and its mineral nutrients? *Nutrients.* 2017;9(8).
- 9 Brown TJ, Brainard J, Song F, Wang X, Abdelhamid A, Hooper L. Omega-3, omega-6, and total dietary polyunsaturated fat for prevention and treatment of type 2 diabetes mellitus: systematic review and meta-analysis of randomised controlled trials. *BMJ.* 2019;366:14697.
- 10 Huang FY, Deng T, Meng LX, Ma XL. Dietary ginger as a traditional therapy for blood sugar control in patients with type 2 diabetes mellitus: A systematic review and meta-analysis. *Medicine.* 2019;98(13):e15054.
- 11 Rocha D, Caldas APS, da Silva BP, Hermsdorff HHM, Alfenas RCG. Effects of blueberry and cranberry consumption on type 2 diabetes glycemic control: A systematic review. *Crit Rev Food Sci Nutr.* 2019;59(11):1816-1828.
- 12 Pi-Sunyer X, Blackburn G, Brancati FL, et al. Reduction in weight and cardiovascular disease risk factors in individuals with type 2 diabetes: one-year results of the look AHEAD trial. *Diabetes care.* 2007;30(6):1374-1383.

- 13 Klein S, Sheard NF, Pi-Sunyer X, et al. Weight management through lifestyle modification for the prevention and management of type 2 diabetes: rationale and strategies: a statement of the American Diabetes Association, the North American Association for the Study of Obesity, and the American Society for Clinical Nutrition. *Diabetes care*. 2004;27(8):2067-2073.
- 14 Franz MJ, Bantle JP, Beebe CA, et al. Evidence-based nutrition principles and recommendations for the treatment and prevention of diabetes and related complications. *Diabetes care*. 2003;26 Suppl 1:S51-61.
- 15 Grundy SM. Dietary therapy in diabetes mellitus. Is there a single best diet? *Diabetes care*. 1991;14(9):796-801.
- 16 Parker B, Noakes M, Luscombe N, Clifton P. Effect of a high-protein, high-monounsaturated fat weight loss diet on glycemic control and lipid levels in type 2 diabetes. *Diabetes care*. 2002;25(3):425-430.
- 17 Boden G, Sargrad K, Homko C, Mozzoli M, Stein TP. Effect of a low-carbohydrate diet on appetite, blood glucose levels, and insulin resistance in obese patients with type 2 diabetes. *Ann Intern Med*. 2005;142(6):403-411.
- 18 Gougeon R, Carrington M, Field CJ. The impact of low-carbohydrate diets on glycemic control and weight management in patients with type 2 diabetes. *Can J Diabetes*. 2006;30(3):269-277.
- 19 Lustig RH. *Fat Chance: The Bitter Truth About Sugar*. London: Fourth Estate; 2013.
- 20 Standards of medical care in diabetes--2012. *Diabetes care*. 2012;35 Suppl 1:S11-63.
- 21 Alexander GK, Taylor AG, Innes KE, Kulbok P, Selfe TK. Contextualizing the effects of yoga therapy on diabetes management: a review of the social determinants of physical activity. *Fam Community Health*. 2008;31(3):228-239.
- 22 Innes KE, Vincent HK. The influence of yoga-based programs on risk profiles in adults with type 2 diabetes mellitus: a systematic review. *Evid Based Complement Alternat Med*. 2007;4(4):469-486.
- 23 Cui J, Yan JH, Yan LM, Pan L, Le JJ, Guo YZ. Effects of yoga in adults with type 2 diabetes mellitus: A meta-analysis. *J Diabetes Invest*. 2017;8(2):201-209.
- 24 Innes KE, Selfe TK. Yoga for adults with type 2 diabetes: a systematic review of controlled trials. *J Diabetes Res*. 2016;2016:6979370.
- 25 Thind H, Lantini R, Balletto BL, et al. The effects of yoga among adults with type 2 diabetes: a systematic review and meta-analysis. *Prev Med (Baltim)*. 2017;105:116-126.
- 26 Jayawardena R, Ranasinghe P, Chathuranga T, Atapattu PM, Misra A. The benefits of yoga practice compared to physical exercise in the management of type 2 Diabetes Mellitus: A systematic review and meta-analysis. *Diabetes Metab Syndr*. 2018;12(5):795-805.
- 27 Yu X, Chau JPC, Huo L. The effectiveness of traditional Chinese medicine-based lifestyle interventions on biomedical, psychosocial, and behavioral outcomes in individuals with type 2 diabetes: A systematic review with meta-analysis. *Int J Nurs Stud*. 2018;80:165-180.
- 28 Chao M, Wang C, Dong X, Ding M. The effects of tai chi on type 2 diabetes mellitus: a meta-analysis. *J Diabetes Res*. 2018;2018:9.
- 29 Song G, Chen C, Zhang J, Chang L, Zhu D, Wang X. Association of traditional Chinese exercises with glycemic responses in people with type 2 diabetes: A systematic review and meta-analysis of randomized controlled trials. *J Sport Health Sci*. 2018;7(4):442-452.
- 30 Zhou Z, Zhou R, Li K, et al. Effects of tai chi on physiology, balance and quality of life in patients with type 2 diabetes: A systematic review and meta-analysis. *J Rehabil Med*. 2019;51(6):405-417.

- 31 McGinnis RA, McGrady A, Cox SA, Grower-Dowling KA. Biofeedback-assisted relaxation in type 2 diabetes. *Diabetes care*. 2005;28(9):2145-2149.
- 32 Galper DI, Taylor AG, Cox DJ. Current status of mind-body interventions for vascular complications of diabetes. *Fam Community Health*. 2003;26(1):34-40.
- 33 Dusek JA, Benson H. Mind-body medicine: a model of the comparative clinical impact of the acute stress and relaxation responses. *Minn Med*. 2009;92(5):47-50.
- 34 Rustad JK, Musselman DL, Nemeroff CB. The relationship of depression and diabetes: pathophysiological and treatment implications. *Psychoneuroendocrinology*. 2011;36(9):1276-1286.
- 35 Baillie-Hamilton PF. Chemical toxins: a hypothesis to explain the global obesity epidemic. *J Altern Complement Med*. 2002;8(2):185-192.
- 36 Porta M. Persistent organic pollutants and the burden of diabetes. *Lancet*. 2006;368(9535):558-559.
- 37 Jones OA, Maguire ML, Griffin JL. Environmental pollution and diabetes: a neglected association. *Lancet*. 2008;371(9609):287-288.
- 38 Neel BA, Sargis RM. The paradox of progress: environmental disruption of metabolism and the diabetes epidemic. *Diabetes*. 2011;60(7):1838-1848.
- 39 Hu H. A review of treatment of diabetes by acupuncture during the past forty years. *J Tradit Chin Med*. 1995;15(2):145-154.
- 40 Liang F, Koya D. Acupuncture: is it effective for treatment of insulin resistance? *Diabetes Obes Metab*. 2010;12(7):555-569.
- 41 Chen C, Liu J, Sun M, Liu W, Han J, Wang H. Acupuncture for type 2 diabetes mellitus: A systematic review and meta-analysis of randomized controlled trials. *Complement Ther Clin Pract*. 2019;36:100-112.
- 42 Zhang C, Ma YX, Yan Y. Clinical effects of acupuncture for diabetic peripheral neuropathy. *J Tradit Chin Med*. 2010;30(1):13-14.
- 43 Tong Y, Guo H, Han B. Fifteen-day acupuncture treatment relieves diabetic peripheral neuropathy. *J Acupunct Meridian Stud*. 2010;3(2):95-103.
- 44 Han T, Bai J, Liu W, Hu Y. A systematic review and meta-analysis of alpha-lipoic acid in the treatment of diabetic peripheral neuropathy. *Eur J Endocrinol*. 2012;167(4):465-471.
- 45 Weintraub MI, Wolfe GI, Barohn RA, et al. Static magnetic field therapy for symptomatic diabetic neuropathy: a randomized, double-blind, placebo-controlled trial. *Arch Phys Med Rehabil*. 2003;84(5):736-746.
- 46 Derry S, Lloyd R, Moore RA, McQuay HJ. Topical capsaicin for chronic neuropathic pain in adults. *Cochrane Database Syst Rev*. 2009(4):Cd007393.
- 47 Sima AA, Calvani M, Mehra M, Amato A. Acetyl-L-carnitine improves pain, nerve regeneration, and vibratory perception in patients with chronic diabetic neuropathy: an analysis of two randomized placebo-controlled trials. *Diabetes care*. 2005;28(1):89-94.
- 48 Wang CP, Kao CH, Chen WK, Lo WY, Hsieh CL. A single-blinded, randomized pilot study evaluating effects of electroacupuncture in diabetic patients with symptoms suggestive of gastroparesis. *J Altern Complement Med*. 2008;14(7):833-839.