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# Effect of crude-herb moxibustion on blood lipids in rats with dyslipidemia

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## KEYWORDS

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Blood lipid

**Abstract** *Objective:* To evaluate the lipid-regulating effect of crude-herb moxibustion on rats with dyslipidemia.

*Methods:* Fifty-four Sprague–Dawley rats were randomly divided into six groups with nine rats each. Control group rats were fed a normal diet, and bilateral acu-point Fenglong (equivalent to ST40 in humans) on the hind legs were covered with a placebo (general mucilage) for 2 hours each day. Model group rats were fed a high-lipid diet for 2 weeks. Therapy group rats were fed a high-lipid diet for 2 weeks and then administered crude-herb moxibustion at ST40 for 2 hours each day for the next 2 weeks. Prevention group rats were administered crude-herb moxibustion 2 hours a day for 2 weeks and then fed a high-lipid diet for the subsequent 2 weeks. Prevention/Therapy group rats were each administered crude-herb moxibustion at ST40 for 2 hours each day for 2 weeks, followed by a high-lipid diet for the next 2 weeks, and then crude-herb moxibustion again at ST40 for another 2 weeks. Simvastatin group rats were fed a high-lipid diet for 2 weeks and then treated with simvastatin for the next 2 weeks. Blood lipids, hepatosomatic indices (HSIs) and epididymal fat pad weights of all rats were examined. *Results:* Compared with the Model group, levels of total cholesterol (TC), glycerinate, low-density lipoprotein cholesterol (LDL-C) and very low-density lipoprotein cholesterol (VLDL-C) in plasma collected from the Therapy group, the Prevention/Therapy group, and the Simvastatin group were decreased. Moreover, compared with the Model group, HSIs in Therapy group rats were also decreased following administration of crude-herb moxibustion, but TC, TG, HDL-C, LDL-C, and VLDL-C levels in the Prevention group were higher than those in the Model group.

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**Conclusion:** The results reveal that blood lipids and HSIs appear to be modulated by the effect of crude-herb moxibustion and suggest therapeutic strategies for the treatment of dyslipidemia.

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## Introduction

Dyslipidemia is a metabolic disorder characterized by elevated levels of serum lipoproteins<sup>1</sup>. Dyslipidemia is one of the most important risk factors for coronary heart disease (CHD) and has been identified as the leading cause of death worldwide, causing global social and economic burden<sup>2,3</sup>. CHD is associated with obesity, type 2 diabetes mellitus, hypertension, stroke, and especially atherosclerosis<sup>4,5</sup>. The overall pooled prevalence of dyslipidemia in Chinese adults was estimated to be 41.9%, with a higher rate in men than in women<sup>6</sup>.

Common drugs for dyslipidemia include niacin, folic acid derivatives, bile acid-binding resins, and 3-hydroxy-3-methyl-glutaryl-coenzyme A (HMG-CoA) reductase inhibitors, which are commonly known as statins. As one of the most widely used statin, simvastatin is highly selective for liver functions, inhibits synthesis of endogenous cholesterol, thus decreasing blood lipids. Simvastatin is a typical lipid lowering drug<sup>7</sup>. In numerous placebo-controlled clinical trials, statins have been shown to have well-defined safety profiles, but their side effects include liver damage and a small risk of muscle problems, such as myalgia, mild myositis, creatine kinase (CK) elevations, and rhabdomyolysis<sup>8</sup>. Previous clinical research indicates that mild myositis appears most often in controlled trials at an estimated rate of 5%–10%<sup>9</sup>.

In traditional Chinese medicine (TCM), description of symptoms of the condition similar to dyslipidemia is found in the ancient text, *Yellow Emperor's Inner Classic*. In TCM, dyslipidemia is caused by a syndrome known as phlegm obstruction<sup>10</sup>. The acupoint Fenglong (ST40) is typically used to treat phlegm obstruction<sup>11</sup>. Accumulating evidence shows that acupuncture applied to ST40 has preventive and therapeutic effect on dyslipidemia, cardiovascular diseases, obesity, type 2 diabetes, hypertension, and stroke<sup>12</sup>. Electro-acupuncture (EA) or moxibustion applied to ST40 decreases plasma total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C), and increases high-density lipoprotein cholesterol (HDL-C) levels in dyslipidemic rats<sup>13</sup>. Acupuncture at ST40 also promotes hepatic gene expression and thus accelerates reversal of cholesterol transport and alleviates fat accumulation inside hepatocytes<sup>14</sup>. Additionally, acupuncture at ST40 in the rat model of hyperlipidemia lowers serum malondialdehyde (MDA) and endothelin-1 (ET-1) levels and improves superoxide dismutase (SOD) activity and nitric oxide (NO) and calcitonin gene-related peptide (CGRP) contents, and mitigates lipid peroxidation, clears free radicals<sup>15,16</sup>. Studies in the mice model of hyperlipidemia showed that acupuncture at ST40 regulates and ameliorates the metabolic balance of free radicals, and protects vascular

endothelia<sup>17,18</sup>. At the gene level, research has shown that EA at ST40 in rats may have therapeutic effect on dyslipidemia that are mediated by increasing the expressions of the ABCA1, PPAR $\alpha$ , LXR- $\alpha$ , and RXR- $\alpha$  mRNA, thus promoting the reversal of cholesterol transport<sup>19</sup>.

Traditional Chinese herbal medicines influence multiple mechanisms in the human body. With regard to dyslipidemia, the herb hawthorn fruit (*Crataegus pinnatifida* Bge. var. major N. E. Br.) has been found to significantly decrease serum triglyceride (TG), TC, and LDL-C, and to reduce scores of pathologic changes due to hyperlipidemia while increasing HDL-C level<sup>20,21</sup>.

Another TCM modality is crude-herb moxibustion, one of moxibustion therapies. Crude-herb moxibustion is application applied to the acupoint or the affected part with the herb of a constant irritant to skin till it presents red color, wistful or intravenous induction. Crude-herb moxibustion involves the synergistic effects of Chinese herbs and local acupoints.

Clinical research has found that crude-herb moxibustion is efficacious in the treatment of dyslipidemia. Crude-herb moxibustion applied to dyslipidemic rats can regulate general and liver fat metabolism, reduce fat deposits in the liver, inhibit fatty degeneration of liver cells, and restore normal liver cell function<sup>22</sup>. However, this report did find that crude-herb moxibustion exacerbates dyslipidemia<sup>28</sup>. Thus, more evidence is needed to validate the effects of crude-herb moxibustion on dyslipidemia.

This study investigated the therapeutic and preventive effects of the application of crude-herb moxibustion to acupoint ST40 in rats with dyslipidemia.

## Materials and methods

### Experimental animals

Fifty-four Sprague–Dawley rats (7 weeks old, 180 g–220 g) were acquired from Vital River Laboratories (Beijing, China) and housed in stainless steel cages in a controlled environment at 24°C $\pm$ 1°C and 70% relative humidity and maintained on a 12 hours light–dark cycle for at least 6 days prior to the experiments. The protocol was approved by Animal Care and Use Review Committee of Beijing University of Chinese Medicine and was in accord with the ethics guidelines of Beijing University of Chinese Medicine.

### Preparations prior to crude-herb moxibustion

At the age of 8 weeks and after 1 week of acclimatizing to laboratory conditions, the rats were randomly assigned to either a control or a high-lipid diet ( $n = 9$  rats/group). Body

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