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Effect and mechanism of modified Dachengqi Decoction on gastrointestinal motility in dyspepsia mice

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Abstract. Objective: To study the effect of Modified Dachengqi decoction and Dachengqi decoction on gastrointestinal motility in dyspepsia mice. Method: Mice were randomly divided into 5 groups: control group (normal saline), model group (normal saline), Dachengqi decoction group (0.054 g kg -1), Modified Dachengqi decoction group (0.084g kg -1) and Motilium group (0.17 ml kg -1).Result:Compared with the normal group, the myenteric tension of small intestine increased significantly, and the small intestine propulsion rate decreased significantly ($P < 0.05$).Compared with the model group, the myenteric tension of small intestine in Dachengqi decoction group decreased significantly ($P < 0.05$), the myenteric tension of small intestine muscle in Modified Dachengqi decoction group decreased significantly, and the small intestinal propulsion rate increased significantly ($P < 0.01$). And in these two groups, the serum MDA levels decreased significantly, and the serum SOD activity increased significantly ($P < 0.01$).Conclusion: Modified Dachengqi decoction can improve gastrointestinal stagnation in dyspepsia mice, and its mechanism may be related to the regulation of oxidative stress in dyspepsia mice.

1. Introduction

With the rapid development of the society, the variety and structure of people's diet have changed a lot. Food, such as high fat, high protein, and so on, is a big part of our daily diet. In addition, some people are crazy at spicy food and etc, and that can cause a problem, which is the growing proportion of the dyspepsia. The main symptoms are abdominal distention, lump, abdominal pain, constipation, diet reduction, hiccup and too much stomach acid, Smelly mouth, etc.

2. Materials and Methods

2.1. Animals

Kunming mice of SPF grade, 4 weeks old, male, weight 18~22 g, were provided by the experimental animal center of Henan University of Chinese Medicine, laboratory certificate no: SYXK (Yu Li 2018-0005).

2.2. Drugs and Reagents

Dachengqi Decoction (the main drugs are Chinese rhubarb, Magnolia officinalis, Fructus aurantii Immaturus, Glauber's salt), Modified Dachengqi decoction (the main drugs are rhubarb, Magnolia officinalis, Fructus Aurantii, Glauberite, Hawthorn, medicated leaven, Malt, white atractylodes rhizome), High calorie and high protein feed (Made by Soy milk powder, full fat sweet milk powder,

dried fish floss, flour according to 2: 1: 1: 1 plus some water) provided by Henan University of Chinese Medicine. Domperidone Suspension (Belgian Janssen Pharmaceutical Ltd, Malondialdehyde (MDA) test box (Nanjing Jian Cheng Technology Co., Ltd. batch number: 20180131), SOD test box (Nanjing Jian Cheng Technology Co., Ltd. batch number: 20180205).

2.3. Experimental Equipment
DHG Series Heating and Drying Oven, DG20-002, BL-420 system, URIT-660Enzyme analyzer (Chengdu Yi Ke instrument and Equipment Co., Ltd).

2.4. Model Preparation
Apart from the control group, the other four groups were given high calorie and high protein feed; they were all free to drink water. If the four groups of mice in the model had weight gain, reduced food intake and the starch granules appeared in the feces, that is, the model was successful[1].

2.5. Grouping and Intervention Methods
The five groups were control group, model group, Dachengqi decoction group, Modified Dachengqi decoction group and Motilium group. From the 3rd day of model making, the control group and the dyspepsia group were given intragastric administration by normal saline, the dachengqi decoction group was given 0.054g kg^{-1} dachengqi decoction, and the Modified Dachengqi decoction group was given 0. 084 g kg^{-1} Modified Dachengqi decoction, and the motilium group was given 0.17ml kg^{-1} motilium suspension. Twice a day, the five groups of mice were fasting but could drink water.

2.6. Observations

2.6.1. Small intestine propulsion rate
One hour before dissection, mice were perfused with 10% of Actidose, opened abdominal cavity, Using the pylorus as a starting point, measure the following data: (1)The moving distance of the Actidose in the intestinal canal(D);(2)Total length of intestinal tract which is the distance between the pylorus and the rectum(L).Gastrointestinal propulsion rate(%)= D / L×100%[2].

2.6.2. Intestinal muscle tension
Find the duodenum with pylorus as a sign, taking 2 ~ 3 cm of the intestinal segment below the duodenum, each end of which was tied to a wire, one end was fixed on the specimen hook, the other end was attached to the tension sensor, and immersed in 37 ℃ Tyrode. After stabilization, the contraction curve was recorded by the BL-420 biological function experimental system [3].

2.6.3. Gastric emptying rate
Stomach full weight (M1), Net stomach weight (M2), Calculate gastric residue rate [100X (M1-M2)/M1%] [4].

2.6.4. Gastric acid pH
The pH value of gastric juice was measured by pH test paper after gastric separation from mice.

2.6.5. Measurement of MDA content and SOD activity in Serum
The content of MDA and the activity of SOD in mouse serum were measured according to the instructions of MDA kit and SOD kit.

2.7. Statistical Method
Data are presented as the mean ± SD. Differences were evaluated using Statistical Package for Social Science 19.0 (SPSS11.0, Chicago, IL, USA). Statistical analysis was performed using One-way ANOVA followed by least-significant difference (LSD). $p < 0.05$ was considered to be statistically significant[5].

3. Results

3.1. Comparison of Small Intestinal Muscle Tension in Mice of Each Group(Table 1)

Compared with the control group, the tension of small intestine in the model group was significantly higher than that in the control group ($P < 0.05$). Compared with the model group, the tension of small intestine in Modified Dachengqi decoction group was significantly lower ($P < 0.01$).

Table 1. Comparison of small intestinal muscle tension in mice of each group($\bar{x}$±s)

group	n	small intestinal muscle tension/mg
control	5	0.55±0.16#
model	5	1.32±0.89*
DCQ	5	0.56±0.19#
MDCQ	5	0.50±0.23##
motilium	5	0.44±0.03##

Note: compared with the control group, * means $P < 0.05$,** means $P < 0.01$. Compared with the model group, # means P<0. 05 and ## signified $P < 0. 01$.

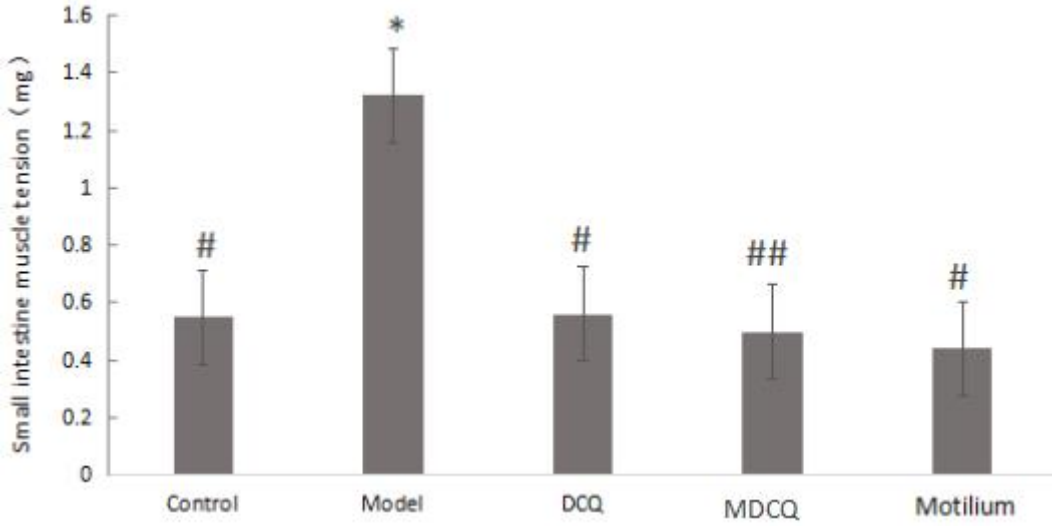

Figure 1. Comparison of small intestinal muscle tension in mice of each group

3.2. Comparison of Small Intestinal Propulsive Rate in Mice of Each Group(Table 2)

Compared with the control group, the tension of small intestine in the model group was significantly higher than that in the control group ($P < 0.05$). Compared with the model group, the tension of small intestine in the Modified Dachengqi decoction group was significantly lower ($P < 0.01$).

Table 2. Comparison of small intestinal propulsive rate in mice of each group($\bar{x}$±s)

group	n	small intestinal propulsive rate/%
control	5	86.15±17.99#
model	5	62.65±11.22*
DCQ	5	77.2±16.63
MDCQ	5	91.92±13.79##
motilium	5	95.58±8.76##

Note: compared with the control group, * means $P < 0.05$,** means $P < 0.01$. Compared with the model group, #means P<0. 05 and ## signified $P < 0. 01$.

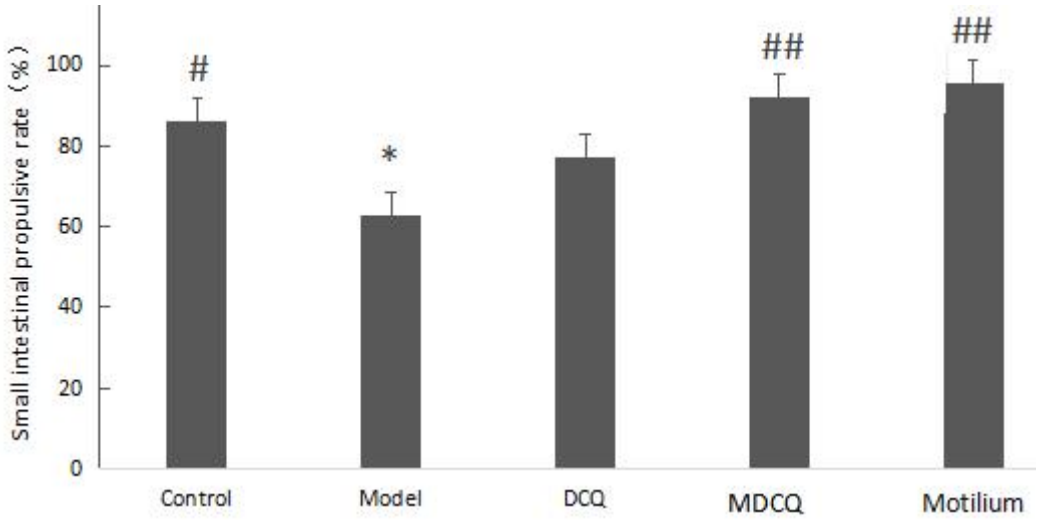

Figure 2. Comparison of small intestinal propulsive rate in mice of each group

3.3. Comparison of Gastric Emptying Rate in Mice of Each Group(Table 3)
Compared with the dyspepsia group, the gastric emptying rate in the motilium group was significantly higher than that in the control group ($P < 0.05$).

Table 3. Comparison of gastric emptying rate in mice of each group($\bar{x}\pm s$)

group	n	gastric emptying rate
control	5	45.83±8.33
model	5	37.50±25.00
DCQ	5	50.00±0.00
MDCQ	5	48.83±8.33
motilium	5	62.08±20.97#

Note: compared with the control group, * means $P < 0.05$,** means $P < 0.01$. Compared with the model group, #means $P<0.05$ and ## signified $P < 0.01$.

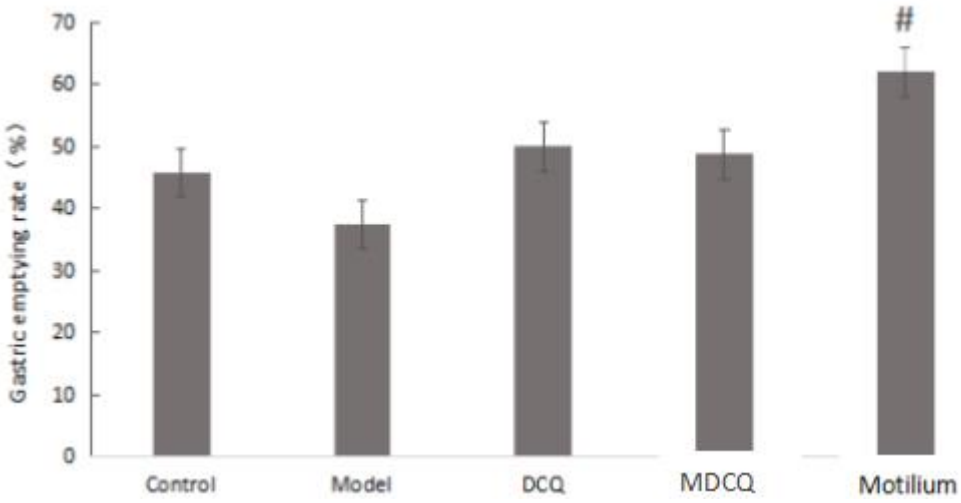

Figure 3. Comparison of gastric emptying rate in mice of each group

3.4. Comparison of MDA Content and SOD Activity in Mice of Each Group(Table 4)
Compared with the control group, the content of MDA in the dyspepsia group was significantly

increased (P < 0.01), and the serum SOD activity in the dyspepsia group was significantly decreased (P < 0.01). Compared with the dyspepsia group, the content of MDA and the activity of SOD in Modified Dachengqi decoction group decreased significantly (P < 0.01).

Table 4. Comparison of MDA content and SOD activity in mice of each group($\bar{x}$±s)

group	n	MDA(nmol/ml)	SOD(U/ml)
control	3	6.83±0.35##	51.43±4.27##
model	3	10.04±0.17**	12.07±9.29**
DCQ	3	7.52±0.47##	49.25±7.97##
MDCQ	3	8.55±0.10**##	53.02±3.91##
motilium	3	7.09±0.94##	56.48±9.75##

Note: compared with the control group, * means P < 0.05,** means P < 0.01. Compared with the model group, #means P<0. 05 and ## signified P < 0. 01.

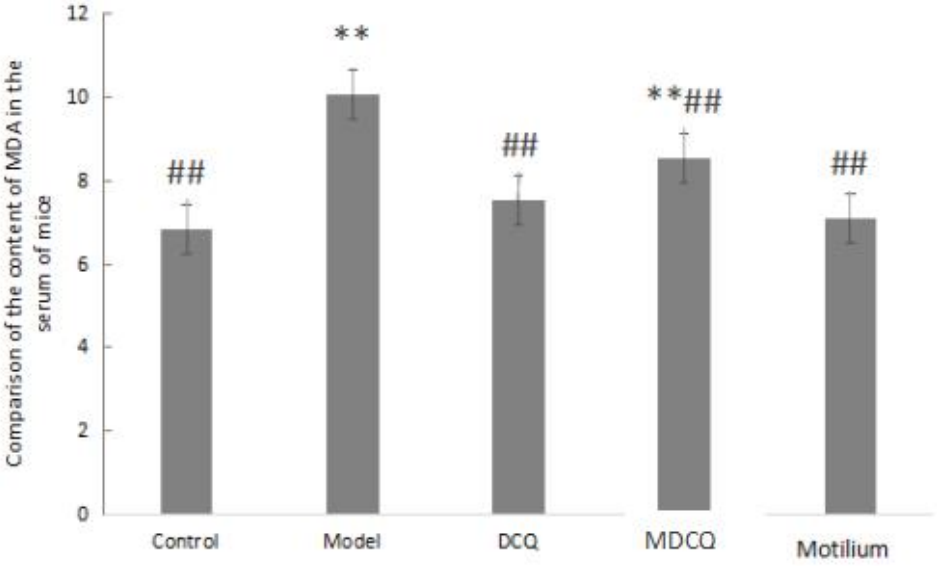

Figure 4. Comparison of the content of MDA in the serum of mice

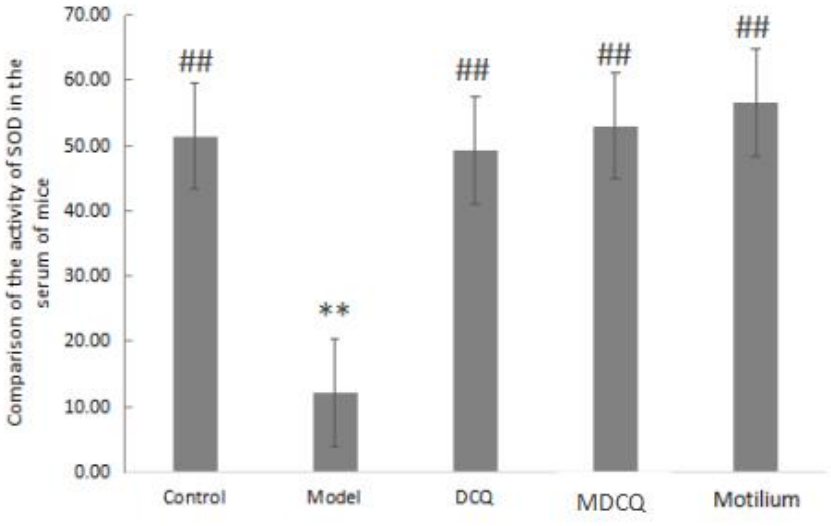

Figure 5. Comparison of the activity of SOD in the serum of mice

4. Discussion

In this experiment, we used self-made high protein and high calorie feeds to simulate people's daily diet, so as to build a mouse model of dyspepsia. In the process of model preparation, we found the weight and the chest circumference of the mice were increased, the amount of eating and defecation were decreased, and we also found that the mice dung was dry and covered with white starch granules. Modified Dachengqi Decoction can significantly improve intestinal muscle tension, intestinal propulsion rate and gastric emptying in dyspepsia.

The activity of SOD indirectly reflects the ability of the organism to scavenge oxygen free radicals. Through data analysis, we found that Compared with the dyspepsia group, the MDA content in the serum of Dachengqi Decoction group and Modified Dachengqi Decoction group decreased significantly, and the activity of SOD in serum increased significantly. Therefore, we deduce that Dachengqi Decoction and Modified Dachengqi decoction may reduce the cell damage by reducing the content of MDA in the dyspepsia mice and increasing the activity of SOD, its mechanism may be related to the regulation of oxidative stress in dyspepsia mice.

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