Efficacy Study of Mongolian Medicine Danga-5 Tablets on a Mouse Model of Functional Dyspepsia

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Abstract: Functional dyspepsia (FD) is one of the most common functional gastrointestinal disorders. This study evaluates the efficacy of Mongolian Medicine Danga-5 Tablets on a mouse model of functional dyspepsia. First, an FD mouse model was established, and the efficacy of Danga-5 Tablets was assessed after 14 days of continuous intervention, comparing the results with the normal group, model group, and positive control group. Indicators such as general condition, body weight change, gastric emptying rate, and small intestine transit rate were used to observe the effects and efficacy of the medicine on the mouse model of functional dyspepsia. The experimental results showed that Danga-5 Tablets significantly improved the general condition of the model group, as well as increased food intake, water intake, small intestine transit rate, gastric emptying rate, and body weight. Danga-5 Tablets have a regulatory effect on gastrointestinal dysfunction in the mouse model of functional dyspepsia, and its pharmacological mechanism requires further in-depth study.

Keywords: Mongolian Medicine Danga-5 Tablets; Functional Dyspepsia; Efficacy; Gastrointestinal Function Regulation

1. Introduction

Functional dyspepsia (FD) is one of the most common functional gastrointestinal disorders. FD is classified into three subtypes based on pathophysiology and etiology: Postprandial Distress Syndrome (PDS), Epigastric Pain Syndrome (EPS), and a subtype characterized by overlapping features of PDS and EPS. Clinically, FD manifests as dyspepsia, irritable bowel syndrome, functional constipation, etc. According to the international gastrointestinal monitoring study (DIGEST), approximately one-third of over 5,500 respondents had dyspeptic symptoms, including 6.5% with acute dyspepsia and 22.5% with chronic dyspepsia. Only 20% of FD patients experience symptom relief after long-term treatment [1-3]. In Mongolian medicine, FD is not named as such, but it falls under the category of "stomach decline" in Mongolian medical theory, caused by the interrelated cold excess of Badaqan and Khii, which impairs stomach fire and leads to indigestion. Mongolian Medicine Danga-5 Tablets consist of five ingredients: pomegranate, safflower, cardamom, cinnamon, and long pepper. It functions to stimulate appetite, aid digestion, and warm the stomach, and is used for symptoms such as loss of appetite, dyspepsia, cold pain in the epigastrium, fullness and belching, abdominal distension, and diarrhea. According to the literature, pomegranate, cinnamon, safflower, cardamom, and long pepper have spasmolytic, stimulating, and/or sedative effects on the gastrointestinal tract, which may relieve the symptoms of functional dyspepsia [4-6]. Shimeny Ramos M et al. evaluated the resistance of Lactobacillus rhamnosus GG (LGG) to in vitro gastrointestinal digestion in mixed beverages containing beans, peanuts (MBPP), or soy (MBSP), as well as physical and chemical analysis of the microbiological and sensory characteristics of these products, which include guava pulp and beets. Cinnamon bark and acorns from the evergreen oak are natural sources of functional ingredients that are effective for patients with diarrhea, constipation, and irritable bowel syndrome. Cardamom is a traditional Chinese medicine used to treat gastrointestinal diseases. Some reports suggest that cardamom has hepatoprotective activity. This paper presents an experimental study on the efficacy of

Mongolian Medicine Danga-5 Tablets on a mouse model of functional dyspepsia, providing a reference for further development and research of Danga-5 Tablets.

2. Experimental Materials and Methods

2.1 Experimental Materials

SPF-grade KM mice (male), 60 in total, weighing 20-30g, were purchased from the National Animal Center in Beijing. The Mongolian Medicine Danga-5 Tablets used in this study were provided as Chinese-style finished products by Aotech Mongolian Medicine Co., Ltd.

2.2 Model Establishment and Drug Intervention

The mice were randomly divided into six groups: normal group, model group, low-dose, medium-dose, and high-dose Danga-5 Tablet groups, and a positive control group, with 10 mice in each group. Except for the normal group, the other groups were fed and then placed in cold water (4℃) for continuous swimming for 20 minutes, followed by 1 hour at room temperature. Afterward, they were gavaged with a solution of L-arginine (5.7g/kg) combined with iodoacetamide to induce the model, continuing for 5 days. Starting from the 6th day, drug intervention was administered. The low, medium, and high doses of Danga-5 Tablets were 1g/kg, 2g/kg, and 3g/kg, respectively, while the positive control group received 2.9g/kg of Jianweixiaoshi tablets. The normal and model groups were gavaged with an equal amount of physiological saline. The intervention lasted for 14 consecutive days.

2.3 Observation Indicators:

General Condition: The glossiness of the fur, activity level, and changes in the size and consistency of fecal pellets were observed and recorded before and after model establishment.
Body Weight: After one week of adaptive feeding, the body weight of the mice was recorded as the initial weight. During the intervention period, the mice were weighed and recorded at the same time each week. After the intervention, the changes in body weight were analyzed, and a t-test was conducted to compare the differences in body weight among the groups.

2.4 Gastric Emptying Rate and Small Intestine Transit Rate:

After the last gavage in the modeling process, the mice were fasted for 24 hours, then gavaged with 0.5 ml of a carbon powder semi-solid paste (a mixture of carbon powder and peanut powder in a 1:4 ratio). One hour later, the mice were anesthetized, and the stomach was dissected and ligated at the cardia and pylorus. The entire stomach was removed, wiped dry with filter paper, and weighed as the full stomach mass. The stomach was then opened along the lesser curvature, and the contents were washed out with saline and dried with filter paper before weighing again to obtain the empty stomach mass. The difference in mass before and after was used to calculate the gastric emptying rate. Gastric emptying rate = [(full stomach mass - empty stomach mass) / full stomach mass] × 100%.
The entire small intestine from the pylorus to the cecum was removed. The total length and the distance moved by the carbon powder semi-solid paste in the small intestine were measured with a steel ruler. Small intestine transit rate = (carbon powder transit length / total small intestine length) × 100%.

2.5 Statistical Analysis

Statistical analysis was performed using SPSS20.0 software. Measurement data are expressed as $\bar{X}\pm S$. Intergroup comparisons were conducted using one-way ANOVA, with $P<0.05$ considered statistically significant.

3. Results and Conclusion

3.1 Analysis of Experimental Animal Numbers

A total of 60 mice were used in the experiment, with no losses during the process. All mice were included in the results analysis.

3.2 Observation Indicators

3.2.1 General condition

The mice in the normal group exhibited good activity, white and glossy fur, small and hard grayish-black fecal pellets with low moisture content. In contrast, the mice in the model group showed significantly reduced activity, lethargy, often huddling in the corners of the cage, with signs of hunching and piloerection. Their fur gradually lost its luster, becoming dull yellow, and their fecal pellets were large,

soft, and highly moist, with some being unformed. In the drug-administered groups, compared to the model group, these symptoms were alleviated.

3.2.2 Body weight changes

The body weight of mice in both the model group and the drug-administered groups decreased and remained low until the end of the experiment, indicating that the model had a significant and lasting impact on the mice's body weight (Table 1).

Table 1. Effect of Mongolian Medicine Danga-5 Tablets on Body Weight of Mice in the Functional Dyspepsia Model ($\bar{X}$±S)

Group	n	1d(g)	7d(g)	14d(g)
Normal Group	10	26.60±1.69	32.62±2.20	33.12±2.60
Model Group	10	25.54±1.61	28.23±1.60※※	28.23±3.39※※
Danga-5 Low Dose Group	10	25.35±1.51	29.70±1.49△	29.55±2.33△
Danga-5 Medium Dose Group	10	26.45±1.33	29.18±2.31△	32.72±4.50
Danga-5 High Dose Group	10	25.82±1.12	28.68±0.51△△	28.3±6.20△
Positive Control Group	10	26.27±1.20	29.22±0.92	29.98±3.23

Compared with the normal group: ※※P<0.01; Compared with the model group: △P<0.05, △△P<0.01.

3.3 Small Intestine Transit Rate

Compared with the normal group, the small intestine transit rate in the model group mice was significantly reduced (P<0.05). Compared with the model group, the low, medium, and high-dose Danga-5 Tablet groups showed a significant increase in the small intestine transit rate in mice (P<0.05), suggesting that Danga-5 Tablets can promote small intestine motility after intervention (Table 2).

Table 2. Effect of Mongolian Medicine Danga-5 Tablets on Small Intestine Transit Rate of Mice in the Functional Dyspepsia Model (X±S)

Group	n	Small Intestine Transit Rate(%)
Normal Group	10	69.98±11.56
Model Group	10	44.49±10.43※
Danga-5 Low Dose Group	10	73.93±12.31△
Danga-5 Medium Dose Group	10	77.30±12.45△
Danga-5 High Dose Group	10	76.22±10.31△
Positive Control Group	10	75.00±11.25△

Compared with the normal group: ※P<0.05; Compared with the model group: △P<0.05.

3.4 Gastric Emptying Rate

Compared with the normal group, the gastric emptying rate in the model group mice was significantly reduced (P<0.05). Compared with the model group, the low, medium, and high-dose Danga-5 Tablet groups significantly increased the gastric emptying rate in mice (P<0.05), suggesting that Danga-5 Tablets can promote gastric emptying after intervention (Table 3).

Table 3. Effect of Mongolian Medicine Danga-5 Tablets on Gastric Emptying Rate of Mice in the Functional Dyspepsia Model (X±S)

Group	n	Gastric Emptying Rate(%)
Normal Group	10	76.49±2.43
Model Group	10	70.98±5.56※
Danga-5 Low Dose Group	10	76.93±3.32△
Danga-5 Medium Dose Group	10	76.30±1.42△
Danga-5 High Dose Group	10	76.22±1.30△
Positive Control Group	10	74.00±2.25△

Compared with the normal group: ※P<0.05; Compared with the model group: △P<0.05.

4. Discussion

Functional dyspepsia (FD) is one of the most common functional disorders, with a prevalence rate of 20-28%. It affects gastrointestinal function. In the 2012 "Asian

Consensus Report on Functional Dyspepsia," prokinetic drugs were proposed as first-line and second-line treatments for the PDS and EPS subtypes. Although prokinetic drugs have been widely used in conventional Western medicine treatments for FD, there are often cases of treatment failure. In recent years, a study in China showed that nearly one-quarter of FD patients treated with conventional Western medicine experienced ineffective results [7-11]. Therefore, there is an urgent need to explore alternative treatment options for FD patients in clinical practice. Traditional Chinese medicine (TCM) is an irreplaceable new treatment option in the routine management of FD [12,13]. The advantages of TCM in managing FD include lower cost, significant efficacy, and regional advantages.

Mongolian medicine believes that the five viscera and six bowels of the human body, along with the white vessels (nervous system) and red vessels (vascular system), depend on each other and maintain a dynamic balance and integrity [14,15]. When treating FD, Mongolian medicine focuses on overall regulation, aiming to balance the qi, blood, yin, and yang of the organs to achieve therapeutic effects. Moreover, Mongolian medicine uses a flexible and varied approach, adhering to the principle of syndrome differentiation and treatment, and administering drugs according to the time, person, place, and time of day. In treating FD, Mongolian medicine can regulate gastrointestinal function through the coordinated function of multiple organs and regulate metabolism and immune function through multi-target overlay. Many studies on Mongolian medicine have proven that based on the principle of syndrome differentiation and treatment, Mongolian medicine can effectively treat FD and achieve a healthy balance of the body [14,15].

In summary, the holistic syndrome differentiation and treatment philosophy of Mongolian medicine is more conducive to treating FD, providing precise treatment tailored to individual patients based on their specific syndrome type, effectively improving clinical symptoms. It offers a safe, reliable, and clinically applicable diagnostic and treatment plan to improve the long-term prognosis of FD.

This study indicates that Mongolian Medicine Danga-5 Tablets have a regulatory effect on gastrointestinal dysfunction in a mouse model of functional dyspepsia. However, the pharmacological mechanisms require further in-depth research. Therefore, combining the basic theories of Mongolian medicine, more in-depth studies should be conducted to gradually elucidate its mechanisms.

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