PREVENTIVE EFFECT OF FRESH YAM EXTRACT ON GASTRIC ULCERS IN MICE

Qiuxia Wu[1,*], Qingsheng Sun[2]
[1]Department of Gastroenterology, Henan Hospital of Traditional Chinese Medicine (The Second Affiliated Hospital of Henan University of traditional Chinese Medicine), Zhengzhou 450002, PR China - [2]Zhengzhou Hospital of Traditional Chinese Medicine, Zhengzhou 450007, PR China

ABSTRACT

Objective: *The purpose of this article is to study the preventive effect of fresh yam extract on gastric ulcers in mice. By analysing and observing the morphological structure of the gastric mucosa, calculating the ulcer index of gastric ulcers in the mice and observing the expression of malondialdehyde nitric oxide protein in the serum superoxide apparatus, the prevention and treatment of gastric ulcers was explored.*

Methods: *The methods included an experimental comparison by randomly dividing 100 experimental mice into a blank control group, a model group, a Teprenone group, a high-dose fresh yam extract group and a low-dose fresh yam extract group. There were a total of five groups, and each group was comprised of 20 mice. In the control and model groups, normal saline was used for intragastric administration, and the remaining three groups were given intragastric administration for 45 days. Afterwards, indomethacin (2.5 mg/mL) was intragastrically administered to the mice in all groups except the blank control group to establish a gastric ulcer model. All mice were sacrificed after the data collection was completed. Stomach tissues were removed and stained for pathological sections to observe changes in the mucosal tissue morphology. Subsequently, the ulcer index was measured, and data such as ulcer inhibition rate and serum protein expression were calculated.*

Results: *The analysis indicated that the ulcer inhibition rate of the high-dose fresh yam extract group was 1.63±0.32 mm^2, the low-dose fresh yam extract group was 3.74±1.36 mm^2, the Teprenone group was 1.27±0.38 mm^2 and the model group was 5.73±1.83 mm^2.*

Conclusion: *Fresh yam extract can alleviate gastric ulcers caused by indomethacin, as exhibited by the high-dose fresh yam extract group, the low-dose fresh yam extract group and the Teprenone group. When comparing these groups with the model group, gastric tissue inflammation, cell infiltration and gland damage were less severe. A high dose of fresh yam extract can reduce the expression of MDA and NO in serum and increase the expressions of SOD and GSH-Px ($P<0.05$).*

Keywords: *Yam extract, gastric ulcer, oxidative stress, preventive effect.*

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Introduction

Gastric ulcer disease is a common digestive system disease. Globally, about 10% of people will have this disease in their lifetime. The pathogenesis of a gastric ulcer is relatively complicated, mainly due to imbalances of the internal viral attack factor and defence factor within gastric tissue. In addition, the state of the gastric mucosa, gastric acid and pepsin affects the severity of the disease. Therefore, it is critical to clarify its pathogenesis and search for appropriate drug treatments. Yam, a common food ingredient, is also used in Chinese medicine. It contains rich nutrients and active ingredients, which are helpful to human health and make yam favourable for the treatment of many diseases[(1)]. Fresh yam extract has a positive effect on the prevention of gastric ulcers. Yam polysaccharides and yam pigments have good antioxidant and stomach-protecting effects. Yam polysaccharides exhibit immunomodulatory activity, which can inhibit the occurrence of ulcers. The aetiology is

diverse and complex and the pathological mechanism is variable, so the prevention and treatment of some other drugs are still under study[2, 3]. According to the existing research, the extract of fresh yam has a positive protective effect on the gastric mucosa as well as a positive effect on the inhibition of gastric ulcers. Clinical Chinese herbal medicine, including the medicinal use of yams, is still being developed[4].

The mechanism of drugs also needs to be further studied as it is necessary to reasonably match the interaction of various drug components during their use[5]. In many domestic studies, scholars believe that the pathogenesis of gastric ulcers has not been fully examined. Among the predisposing factors for acute gastric ulcers, a high inflammation state is generally one of the important factors that cause acute gastric ulcers and influence their severity[6]. The treatment of gastric ulcers is linked to the treatment of gastric mucosa. At present, many complications accompany drug treatments, such as drug resistance and a high recurrence rate[7]. Combinations of antibiotics are increasing in frequency, which makes treatment regimens complicated. Therefore, clinically, drugs that lack a repair mechanism for the mucosal barrier and the necessary conditions to maintain the formation of drug-resistant strains are still necessary[8, 9]. This article begins with the definitions and morphologies of gastric ulcers and fresh yam extracts and explores the effects of fresh yam extracts on the treatment and prevention of gastric ulcers in mice based on different treatment regimens. By establishing a model of a gastric ulcer, a comparative study was conducted using different doses of the drug Teprenone and fresh yam extract to accurately understand the disease progression, explore the preventive effects of yam extract and propose an optimized treatment plan.

Comparative studies are popular in medical research for innovating methods to solve problems, and they provide a good theoretical basis for the treatment of gastric ulcers and diseases caused by them. This study allows the specific experimental results to be analysed by comparing changes and determining the balance of the body's response and the efficacy of the drug by organically combining the two. By providing a valuable technical experience for future animal experiments, similarities and differences in research directions are established through comparative advantage analysis, and advanced methods are learned at the same time. Suggestions for the improvement of future medical technology are made, including an in-depth understanding of animal pathological conditions and strengthening animal medicine. The specialization and accuracy of this aspect provide a theoretical basis for the field of animal medicine.

Core concepts

Gastric ulcers

Gastric ulcer, as the name suggests, refers to a kind of ulcer that occurs in the stomach corner, antrum, cardia and hiatal hernia. It is a common gastrointestinal disease as well as a type of peptic ulcer[10]. Many patients are affected by their irregular diets, which affects the normal operation of the oesophagus, stomach and duodenum. There are several cases of gastric ulcers that have occurred near the stomach-jejunum anastomosis or in the diverticulum containing the gastric mucosa, which made diagnosis difficult[11, 12]. Gastric ulcers are considered to be peptic ulcers because the disease is caused by internal digestion of the mucosa by gastric acid and pepsin, resulting in damage to the gastric mucosa, which in turn leads to ulcers. Furthermore, numerous factors can cause gastric ulcers, not only gastric acid and pepsin[13]. It is worth noting that there are many similarities in the pathogenesis and clinical symptoms of gastric ulcers and duodenal ulcers, so after diagnosis, the two are often treated together. A duodenal ulcer is also considered to be a gastric ulcer[14]. The key to treatment is to determine the location of the disease. Among the causes of gastric ulcers, stress is one of the most critical, as it is a vital factor in the recovery and treatment of gastric ulcers[15, 16]. The healing and recurrence of ulcers are significantly influenced by stress.

With the development of modern medicine, the treatment of gastric ulcers is constantly improving, but there are still many difficulties to be overcome, including the study of stress triggers; otherwise, relapse and poor curing effects will likely occur[17]. Therefore, in modern treatments, effective interventions such as anti-stress treatments or the alleviation of stress factors are implemented to achieve satisfactory results for patients and doctors.

Yam extract

Yam extract is the extraction of trace elements and biologically active ingredients from fresh yams for the treatment and physiotherapy of diseases. The nutritional content of yams is rich in a variety of polysaccharides, saponins, pigments, phospholipids, mucus quality, starch, protein, amino acids and other

biologically active ingredients[18]. Yams belong to the dried tubers of the yam family and are a perennial herb of the yam family. They are widely grown in my country. Yams are considered to be a nourishing and healthy food that can strengthen the spleen and lungs, solidify the kidneys and improve the essence. Additional benefits include oxidation, anti-ageing properties, lowering of blood sugar and blood fat, protection of liver cells, immune regulation, anti-tumour properties, protection of gastric mucosa and resistance to mutation[19]. Therefore, yams are not only enjoyed as a food source but are also used in Chinese medicine for the treatment of many diseases. In the treatment of gastric ulcers, the yam decoction has a high viscosity and protects the gastric mucosa, which is rich in polysaccharide proteins and electrolytes. In addition, it has been found that allantoin is a critical active ingredient in yams; allantoin can repair epithelial tissue and promote wound healing in the treatment of ulcers[20, 21]. Huai yam polysaccharides can successfully prevent gastric ulcers in rats and ensure that the gastric mucosa is in a protective state.

This is because Huai yam polysaccharides have a fibrocyte growth factor that inhibits gastric ulcers, which can offset the alkalinity of gastric mucosa in rats with gastric ulcers, thereby protecting gastric tissue. Fresh yam extract can also reduce serum gastrin levels, matching different reagents according to the specific situation[22]. In terms of improving the quantity and quality of the mucosal layer in the stomach, fresh yam extract can have an anti-ulcer effect by increasing the level of serum epidermal growth factor.

Treatment options for gastric ulcers

Suppressed gastric acid therapy

In the initial research of gastric ulcers, gastric acid was neutralized mainly by drug treatment, thereby reducing damage to the gastric mucosa. When drugs are used for the treatment of gastric ulcers, alkaline chemical reagents tend to be selected. Commonly used drugs include sodium bicarbonate and magnesium hydroxide because these drugs can directly neutralize gastric acid, inhibit the activation of pepsinogen and then alleviate the ulcer damage to the gastric mucosa[23, 24].

However, in clinical treatment and subsequent rehabilitation investigations, it was found that treatment will produce many side effects leading to alkalosis, hypercalcemia and constipation[25]. In the 1970s, the first generation of H2 receptor inhibitors was successfully developed, and H2RA-cimetidine began to be used clinically, with good results. Patients required a dosage level of 800–1000 mg/d, and the specific effect was not ideal. Subsequently, medical drug experts developed a new generation of H2RA-series drugs, including nizatidine and ranitidine. The use of these drugs has resulted in reduced dosage levels, toxicity and side effects on the human body. They have become the first choice for the treatment of gastric ulcers. Their inhibitory effect on gastric acid is generally caused by blocking the parietal cell microendocrine membrane.

The proton pump is used, and the medicinal use can last for 24 hours. There are many types of drugs produced from it, including omeprazole and esomeprazole. With the advancement of technology, the effects of gastric acid inhibition are improving. However, to protect the gastric mucosa, gastric ulcer treatments cannot rely solely on inhibiting the secretion of gastric acid at night but must adjust the balance of all influencing factors, not only to promote the healing of ulcers but also to ensure normal digestion of the stomach features.

Eradication of helicobacter pylori

In the medical field, it is necessary to eradicate ulcers, regardless of the cause of an ulcer. When selecting treatments, the eradication of Helicobacter pylori is imperative. Two antibiotics have demonstrated positive results in the eradication of Helicobacter pylori, namely bismuth preparations and PPI, which are effective, simple and economical. Bismuth uses a standard dose of colloidal bismuth, and PPI can use omeprazole lansoprazole or rabeprazole for drug eradication. Antibiotics generally use clarithromycin tetracycline or furazolidone. Helicobacter pylori will develop drug resistance, and it is most resistant to commonly used drugs, such as clarithromycin and metronidazole. Therefore, during the treatment process, patients may have poor results and relapse of ulcers.

In addition, ethyl acetate has a strong antioxidant capacity in terms of its ability to reduce scavenging DPPH free radicals and Zhe free radicals. In the eradication of Helicobacter pylori, the methanol extract of Caulis odoratum has significant antioxidant activity and a positive curative effect on the inhibition of lipid peroxides and DP free radical scavenging rates in viable cells. Studies have shown that DPPH free radical scavenging has a certain antioxidant activity, and as the concentration increases, the antioxidant performance increases.

The yellow bean in the medicine is not only the main component for the eradication of Helicobacter pylori but also has positive antioxidant effects in vivo, which may be one of its anti-ageing mechanisms.

Protection of gastric mucosa

The gastric mucosa is a critical component of the gastric tissue. The protective agent on the surface of the gastric mucosa can promote the repair of the gastric mucosa and protect the gastric tissue. Bismuth, aluminium magnesium carbonate and sucralfate are commonly used in treatments aimed at protecting gastric mucosa. Not only can these treatments reduce the spread of bacteria, but they also reduce the predisposing factors for gastric ulcers. After the treatment enters the body, a protective film is formed on the ulcer surface. This protective film promotes the secretion of gastric mucus and the synthesis of PGE2 in the gastric mucosa, which can produce a weak anti-pepsin effect. It can also increase the blood supply to the gastric mucosa and promote the production of phospholipids and the secretion of gastric mucus and sodium bicarbonate. Subsequently, the bioactive factors produced combine with the proteins of the necrotic tissue on the surface of the ulcer to form a thin film layer, thereby protecting the gastric mucosa, promoting the repair of epithelial cells and inhibiting gastric acid secretion. However, excessive use of the drug is toxic and will produce negative side effects, including abdominal pain, diarrhoea and uterine contractions. Endogenous PCG2 is synthesized by arachidonic acid or linoleic acid in the gastric mucosa and catalysed by cyclooxygenase, which can protect the gastric mucosa, inhibit excessive secretion of gastric acid and promote the secretion of mucus HC03 from the gastrointestinal mucosa.

Thus, the alkali sex microenvironment is enhanced to prevent gastric acid and other attack factors from damaging the gastric mucosa. Aluminium magnesium carbonate can protect the gastric mucosa, stimulate the secretion of prostaglandins and adsorb and bind pepsin to inhibit its activity. It can also bind bile acids to adsorb and dissolve lecithin to prevent damage to the gastric mucosa while releasing epidermal growth factors, neutralizing gastric acid and protecting the gastric mucosa.

Methods

Experimental materials

The experimental animals were provided by the Animal Experiment Center of the Affiliated Hospital of Medical University, where the author is located. There were 100 KM mice selected, 50 of which were females and 50 of which were males. The body weights of the mice were 20–30 g, and their vital signs were normal. Before the experiment, all the experimental mice were kept in a special feeding room, in which the room temperature was maintained at 22–24 degrees, the relative humidity was maintained at 50–60% and the light time was kept above 10 hours a day.

Standard animal feed and drinking water were used to ensure an adequate supply. The 3R Principle used for animal studies was strictly followed throughout the process, in line with the laboratory regulations. The main experimental reagents and instruments included fresh yam purchased in the formal market, indomethacin (Sigma, USA), Teprenone capsule, serum MDA (batch number: 20181019), SOD (batch number: 20180511), NO (batch number: 20181019), GSH-Px (batch number: 20180511) and mouse activity detection kit. All other biochemical reagents were provided by Sinopharm Group. In addition, an ultraviolet-visible spectrophotometer was used.

The analysis data was collected through experiments, and SPSS17.0 statistical software was used to perform correlation analysis using Pearson. One-way analysis of the variance was used for comparison between multiple groups, and $P<0.05$ was considered statistically significant.

Groups	Dose (g/kg)	Ulcer Index (mm^2)	Ulcer Inhibition Rate (%)
Control	--	0	100
Model	--	5.73±1.83	0
Low dose of fresh yam extract	2.5	3.74±1.36	34.7
High dose of fresh yam extract	7.5	1. 63±0. 32	71.5
Teprenone	0.02	1. 27±0. 38	77.8

Table 1: Comparison of gastric ulcer index and ulcer inhibition rate in each group ($\bar{x}\pm s$), n=20).

Experimental methods

First, the fresh yam extract was prepared by selecting yams with uniform textures, the same lengths and no spoilage. The yams were cleaned, peeled and cut into small pieces of similar size, and a juicer was used to process the yam pieces into a uniform fresh yam homogenate. To distinguish the experimental variables, three times the volume of double-distilled water was added to the yam homogenate of the experimental low-dose group, and one-third of the volume of double-distilled

water was added to the yam homogenate of the experimental high-dose group. These mixtures were stored at room temperature in a sterile environment.

Subsequently, all mice were randomly divided into five experimental groups, with 20 mice (10 males and 10 females) in each group. These groups were the blank control group, model group, Teprenone group, fresh yam extract high-dose group, fresh yam extract low-dose group. Indomethacin was used by the gastrointestinal method along with chemical ignition to establish a mouse model of an acute gastric ulcer. In the blank control group and the model group, a normal saline injection was given; in the schwechat group, a matching concentration of 2.0mg/ml schwechap solution was given for gavage; in the high and low-dose yam extract groups, the gavage concentrations of fresh yam extract were 0.75 g/mL and 0.25 g/mL, respectively, and the total gavage volume was approximately 10 mL/kg body weight. Gavage was continued for 45 days, and each mouse was treated once a day. After the experimental period, the three groups that received medicine and the model group were given a one-time gavage to establish a model of a gastric ulcer, and all mice were sacrificed after 12 hours. Blood was taken to detect serum SOD, GSH-Px activity and NO and MDA protein expressions.

Finally, all mice were dissected, the stomach tissues were removed, the saline was carefully washed and the water was blotted with filter paper to fix the stomach tissues on the experimental table for observation and recording. The Guth standard was used to calculate the ulcer index. The ulcer index of each mouse is the score of the total lesions that were present in the whole stomach of the mouse, from which the ulcer index and inhibition rate are derived. After that, the gastric mucosa tissue was stained and analysed, and the pathological section of the gastric ulcer was stained with hematoxylin-eosin (HE). The morphological structure was observed using an electron microscope. Finally, the serum SOD, GSH-Px activity and NO and MDA protein expressions of the mice were detected.

Results

Experimental results

In the blank control group, the entire surface of the gastric mucosa was pale pink and smooth, and there was no bleeding; in the model group, coffee-like substances appeared on the surface of the gastric tissue. After washing, more densely distributed bleeding points were found as well as cord- and dot-like dark brown ulcers (5.73±1.83 mm^2). This shows that the established gastric ulcer group fully achieved the recognition function. In the Teprenone group, the analysis showed that the lesion ulcer index was only 1.27±0.38 mm^2. After pre-administration of fresh yam extract, the gastric ulcer area in the mice was significantly reduced ($P<0.05$). A concentration of fresh yam extract was effective in the inhibition of gastric ulcers, as shown in Figure 1.

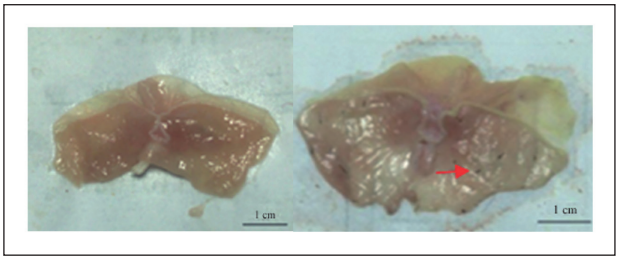

Figure 1: Inner wall of gastric mucosa in control group and inner wall of gastric mucosa in ulcer model group.

In the model group, the internal cells and glands of the gastric mucosa tissues were severely damaged, so the Teprenone group was considered to be effective in preventing gastric ulcers. Compared with the control group, the mucosal effect of the gastric tissue was not significantly different, but in the low-dose fresh yam extract group, the degree of gastric ulcer damage was more severe. When analysing the protein expression of mice in the statistical model group, it was found that the activities of SOD and GSH-Px in the serum decreased, the contents of MDA and NO, as well as the ulcer index, increased. However, the serum MDA and NO levels in the fresh yam extract groups decreased, and the activities of SOD and GSH-Px increased ($P<0.05$). The high-dose yam extract group improved the activity of serum SOD. At a dose of 0.25 g/mL, the serum SOD activity of the two yam extract groups slightly increased. In general, high-concentration administration of yam resulted in the inhibition of ulcer rates and could achieve the same effect as the drug Shi Weishu. The preventive effect of low-concentration yam was not satisfactory and requires additional research.

Groups	Dose (g/kg)	SOD (U/mL)
Control	--	33.74±1.97
Model	--	7.63±2.12
Teprenone	0.02	31.57±1.87
High dose of fresh yam extract	7.5	21.67±2.22
Low dose of fresh yam extract	2.5	14.72±2.32

Table 2: Effect of fresh yam extract on serum SOD activity value ($\bar{x}\pm s$), n=20).

Data analysis

As shown in Figure 2, the effects of several serum proteins on fresh yam extracts were analysed. In the blank control group, the content of GSH-Px was 3.4 μmol/L, MDA was 13.46 μmol/L and SOD was 33.74 μmol/L. In the model group, the content of GSH-Px was 13.97 μmol/L, MDA was 36.87 μmol/L and SOD was 7.63 μmol/L. In the Schwechat group, the content of GSH-Px was 3.23 μmol/L, MDA was 24.87 μmol/L and SOD was 31.57 μmol/L. In the high-dose yam extract group, the content of GSH-Px was 5.08 μmol/L, MDA was 29.89 μmol/L and SOD was 21.67 μmol/L. In the low-dose yam extract group, the content of GSH-Px was 8.61 μmol/L, MDA was 33.23 μmol/L and SOD was 14.72 μmol/L. In general, fresh yam extract can suppress excessively high serum proteins, repair the gastric tissue mucosa and have a positive effect on the treatment of ulcers.

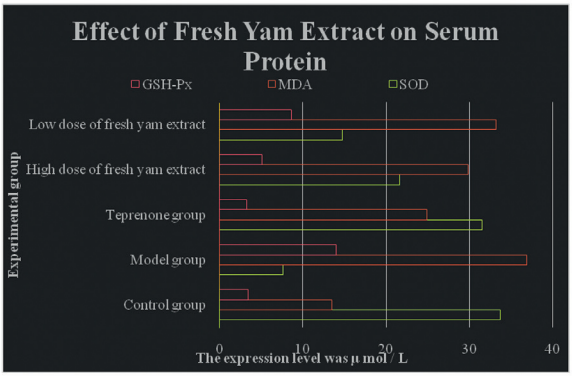

Figure 2: Effect of fresh yam extract on serum protein.

Changes in the body weights of the rats in the five experimental groups are shown in Figure 3, from which the treatment and recovery of gastric ulcers can be observed. On the 5th day, rats in the blank control, model, Teprenone, high-dose fresh yam extract and low-dose fresh yam extract groups weighed 25 g, 24 g, 24 g, 26 g and 22 g, respectively. On the 15th day, the weights of the rats in the blank control, model, Teprenone, high-dose fresh yam extract and low-dose fresh yam extract groups were 28 g, 29 g, 26 g, 27 g and 25 g, respectively.

On the 25th day, the rats in the blank control, model, Teprenone, high-dose fresh yam extract and low-dose fresh yam extract groups weighed 30 g, 20 g, 28 g, 28 g and 27 g, respectively. On the 35th day, the rats in the blank control, model, Teprenone, high-dose fresh yam extract and low-dose fresh yam extract groups weighed 30 g, 20 g, 28 g, 28 g and 27 g, respectively. On the 45th day, the weights of the rats in the blank control, model, Teprenone, high-dose fresh yam extract and low-dose fresh yam extract low-dose groups were 25 g, 15 g, 28 g, 32 g and 31 g, respectively. Based on changes in body weight, gastric ulcers can be treated and prevented promptly to ensure a normal quality of life.

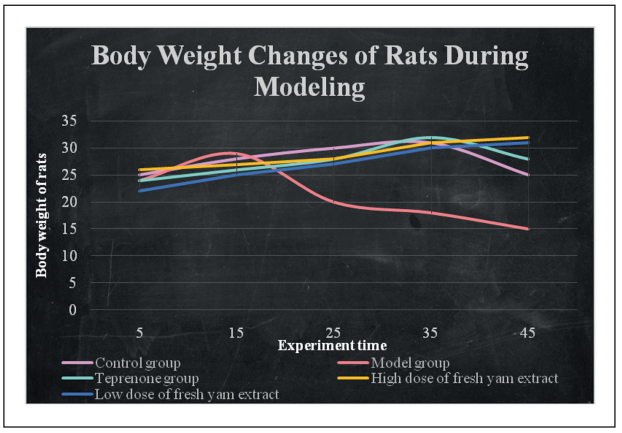

Figure 3: Changes in rat body weight during modelling.

As shown in Figure 4, compared with the blank control group, the gastric juice volume of the model group was significantly reduced ($P<0.01$).

The gastric juice volume of the blank control group was 4 ml, while the model group was damaged due to the establishment of a gastric ulcer model. The gastric juice volume of the model group was only 2.5 ml. The gastric fluid volume of the three pharmaceutical groups remained at a normal level. The volumes of gastric juice in the Teprenone group, the high-dose fresh yam extract group and the low-dose fresh yam extract group were 3.7 ml, 3.5 ml and 3.7 ml, respectively. This demonstrates that gastric ulcers affect the balance within the stomach tissue.

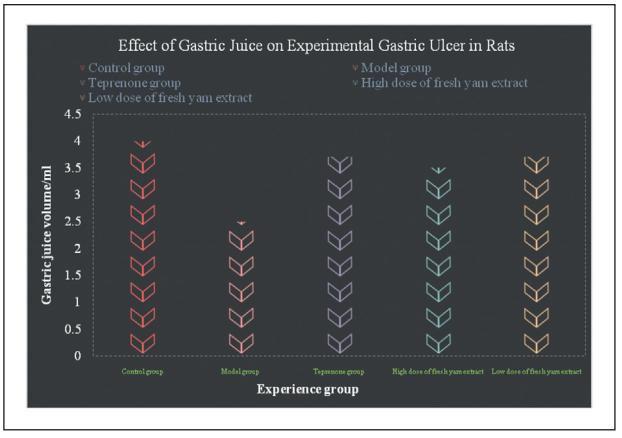

Figure 4: Effect of gastric juice changes in gastric ulcer rats.

As shown in Figure 5, the use of yam extract in the treatment and prevention of ulcers in mice is inseparable from the influence of the distinct ingredients of yam extract. Among the yam

extract factors that influence gastric ulcers, yam polysaccharides had the largest effect on ulcers, accounting for 32%, followed by yam pigments, accounting for 26%. The availability of other drugs results in unsatisfactory results. In addition, plasma proteins accounted for 6% and trace elements accounted for 6%, which assisted in the presentation of drug effects from the side. Antibiotics and bioactive factors accounted for 18% and 12%, respectively, which constituted the overall effect.

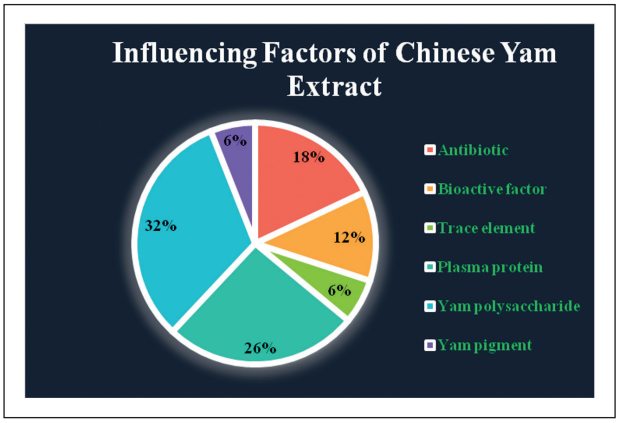

Figure 5: Influencing factors of yam extract.

Discussion

Salivary gland cancerous tumours are common in CPathological diagnosis is a crucial diagnostic method in modern medicine, and, in combination with test results, it is a key step in the scientific analysis process and provides valuable insights for the subsequent treatment of a disease. By establishing a test comparison group and a model group, the model could be comprehensively constructed. Teprenone, a widely used anti-gastric ulcer drug, was established as a single group to observe the degree of gastric tissue destruction compared to the model group as well as from the side.

The degree of gastric ulcer prevention is remarkable. Compared to the Tepronone treatment group, the stomach tissues of mice that received a high-concentration of yam extract were less damaged, and there was not a significant difference between the morphological structures of the gastric tissues of the mice in the two groups. From this, it can be concluded that the high-concentration administration of yam for gastric ulcer disease in mice exhibited an effective preventive effect similar to that of Schwesu. However, the preventive effect of low-concentration yam was not significant by comparison and further research is needed. Medical research in recent years has shown that oxidative stress injuries and inflammatory responses are important inducing factors for acute gastric ulcers. Indomethacin, which is usually administered to patients, is the main cause of oxidative stress damage. Although indomethacin can relieve pain in the short term, it damages the gastric mucosa and the body's defence system.

Severe ulcers may even be aggravated by destroying redox-sensitive transcription factors and the body's inflammatory response. Therefore, it is necessary to explore a natural food with protective effects on gastric ulcers. The yam is both a medicine and food that can satisfy daily diets and provide positive health effects.

References

1) Vasincu, A. Effects of Aqueous Extract of Vernonia Kotschyana Sch. Bip. Ex Walp Roots on Experimental Gastric Ulcer in Mice. Farmacia 2019; 67(5): 836-843.
2) He, H., Li, X., Yu, H., Zhu, S., He, Y., et al. Gastroprotective Effect of Araloside A on Ethanol- and Aspirin-Induced Gastric Ulcer in Mice: Involvement of H + /K + -Atpase and Mitochondrial-Mediated Signaling Pathway. J Nat Med 2019; 73(2): 339-352.
3) Athaydes, B. R., Alves, G. M., Leone, E. M. D. A. A., Dutra Gomes, J. V., Rodrigues, R. P., et al. Avocado Seeds (Persea Americana Mill.) Prevents Indomethacin-Induced Gastric Ulcer in Mice. Food Res Int 2019; 119(5): 751-760.
4) Wei, D., Guo, S., Su, S., Qian, D., Duan, J. Protective Effect of Okra Seed Oil on Acute Gastric Ulcer in Mice. Journal of China Pharmaceutical University 2017; 48(3): 334-342.
5) Shang, X., Chen, H., Qu, Y., Fan, J. The Bi-Functional Roles of Ca-y Zeolite in the Treatment of Ethanol–Hcl Induced Gastric Ulcer Using AMice Model. RSC Advances 2016; 6(5): 3458-3461.
6) Zhou, Z., Li, J. J. Acute Toxicity of Total Polymethoxy Flavones from Bauhinia Championii in Mice and Its Effects on Gastric Ulcer. Chinese Traditional and Herbal Drugs 2018; 49(12): 2942-2945.
7) Ribeiro, A. R. S., do Nascimento Valena, J. D., Jeferson, D. S. S., Boeing, T., Da Silva, L. M., et al. The Effects of Baicalein on Gastric Mucosal Ulcerations in Mice: Protective Pathways and Anti-Secretory Mechanisms. Chem Biol Interact 2016; 260(1): 33-41.
8) Md, A., In-Shik, K., Dongchoon, A., Hyun-Jin, T., Hyeon-Hwa, N., et al. Anti-Inflammatory and Gastroprotective Roles of Rabdosia Inflexa through Downregulation of Pro-Inflammatory Cytokines and Mapk/Nf-ϰb Signaling Pathways. Int J Mol Sci 2018; 19(2): 584.

9) Lim, J. M., Song, C. H., Park, S. J., Park, D. C., Cho, H. R., et al. Protective Effects of ATriple-Fermented Barley Extract (Fbe) against Hcl/Etoh-Induced Gastric Mucosa Damage in Mice. Food Sci Nutr 2018; 6(8): 2036-2046.
10) Jaccob, A. A. Effect of Pharmacological Doses of Garlic and Omega 3 on Gastric Lesions Induced by Ethanol in Mice. Asian J Pharm Clin Res 2016; 9(5): 153-157.
11) Mao, X., Lu, J., Huang, H., Gao, X., Zheng, H., et al. Four Types of Winged Yam (Dioscorea Alata l.) Resistant Starches and Their Effects on Ethanol-Induced Gastric Injury in Vivo. Food Hydrocoll 2018; 85(11): 21-29.
12) Baek, K. S., Yi, Y. S., Son, Y. J., Yoo, S., Sung, N. Y., et al. Invitro and Invivo Anti-Inflammatory Activities of Korean Red Ginseng-Derived Components. J Ginseng Res 2016; 40(4): 437-444.
12) Ma, W. K., Li, H., Dong, C. L., He, X., Yuan, C. S. Palmatine from Mahonia Bealei Attenuates Gut Tumorigenesis in Apcmin/+ Mice Via Inhibition of Inflammatory Cytokines. Mol Med Rep 2016; 14(1); 491-498.
13) Nesello, L. A. N., Campos, A., da Rosa, R. L., Andrade, S. F., Filho, V. C. Screening of Wild Fruit Trees with Gastroprotective Activity in Different Experimental Models. Arq. Gastroenterol 2017; 54(2): 135-138.
14) Satoh, H., Urushidani, T. Soluble Dietary Fiber Can Protect the Gastrointestinal Mucosa against Nonsteroidal Anti-Inflammatory Drugs in Mice. Dig Dis Sci 2016; 61(7): 1903-1914.
15) Chen, H., Nie, Q., Xie, M., Yao, H., Zhang, K., et al. Protective Effects of β-Glucan Isolated from Highland Barley on Ethanol-Induced Gastric Damage in Rats and Its Benefits to Mice Gut Conditions. Food Res Int 2019; 122(8): 157-166.
16) Chen, L. W., Chang, L. C., Hua, C. C., Hsieh, B. J., Chen, S. W., et al. Analyzing the Influence of Gastric Intestinal Metaplasia on Gastric Ulcer Healing in Helicobacter Pylori–Infected Patients without Atrophic Gastritis. BMC Gastroenterol 2017; 17(1): 1.
17) Mabeku, L. B. K., Nana, B. N., Bille, B. E., Tchuenguem, R. T., Nguepi, E. Anti-Helicobacter Pylori and Antiulcerogenic Activity of Aframomum Puinosum Seeds on Indomethacin-Induced Gastric Ulcer in Rats. Pharm Biol 2017; 55(1): 929.
18) Mojkowska, A., Gazdzinski, S., Fraczek, M., Wyleo, M. Gastric Ulcer Hemorrhage - APotential Life-Threatening Complication of Intragastric Balloon Treatment of Obesity. Obes Facts 2017; 10(2): 153-159.
19) Xing, X., Cui, Y., Wang, J., Wang, J., Chen, M. Endoscopic Hemostasis for A Massively Bleeding Large Gastric Ulcer with Deep Base. Am J Gastroenterol 2017; 112(2): 210-210.
20) Shang, X., Chen, H., Qu, Y., Fan, J. The Bi-Functional Roles of Ca-y Zeolite in the Treatment of Ethanol–Hcl Induced Gastric Ulcer Using AMice Model. RSC Advances 2016; 6(5): 3458-3461.
21) Tsukayama, I., Toda, K., Takeda, Y., Mega, T., Suzuki-Yamamoto, T. Preventive Effect of Dioscorea Japonica on Squamous Cell Carcinoma of Mouse Skin Involving Down-Regulation of Prostaglandin E2 Synthetic Pathway. J Clin Biochem Nutr 2018; 62(2): 139-147.
22) Pinzón-Rico, Y. A., Raz, L. Commercialization of Andean Wild Yam Species (Dioscorea l.) for Medicinal Use in Bogotá, d.c. Colombia. Econ Bot 2017; 71(1): 45-57.
23) Panda, D., Biswas, M., Padhan, B., Lenka, S. K. Traditional Processing Associated Changes in Chemical Parameters of Wild Yam (Dioscorea) Tubers from Koraput, Odisha, India. Indian J Tradit Knowl 2020; 19(2): 268-276.
24) Yiting, Z., Hodgson, N. W., Trivedi, M. S., Abdolmaleky, H. M., Margot, F., et al. Decreased Brain Levels of Vitamin B12 in Aging, Autism and Schizophrenia. PLoS One 2016; 11(1): e0146797.
25) Adeniran, A. A., Sonibare, M. A. In Vitro Antioxidant Activity, Brine Shrimp Lethality and Assessment of Bioactive Constituents of Three Wild Dioscorea Species. J Food Meas Charact 2017; 11(2): 685-695.

Corresponding Author:
Qiuxia Wu
No.6 Dongfeng Road, Zhengzhou City, Henan Province, China
Email: h83hki@163.com
(China)