

Effects of Onion extract on Ulcerative Colitis in Rats

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ABSTRACT

Background and Aim: The purpose of the present study is to provide a basis for the use of onion as a therapeutic agent for Ulcerative Colitis (UC). **Methods:** The rat's model of UC induced by acetic acid administration intrarectally as previously described and the effect of onion extract was evaluated through the measurement of colonic biometrics, colonic Myeloperoxidase (MPO) activity and serum Lactate Dehydrogenase (LDH) activity in this model. **Results:** In rat treated with onion (300mg/kg, orally) colonic biometrics including weight and length at the 5th day after acetic acid administration was significantly improved. Colonic MPO activity was significantly decreased in onion extract group, while that in UC group significantly increased compared to control. LDH activity in serum was significantly elevated in UC group, but the administration of onion extract improved it. **Conclusion:** Our results suggest that onion used in the present study has potential for the treatment of UC.

Keywords: Ulcerative colitis, Myeloperoxidase activity, Lactate dehydrogenase, Onion, Anti-inflammatory.

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INTRODUCTION

Ulcerative Colitis (UC), or chronic non-specific ulcerative colitis, is a form of chronic colonic mucosal inflammation and ulcerative disease. It is clinically characterized by abdominal pain, diarrhea, or stools containing mixed blood and mucus.^[1] The colonic mucosal damage was considered to be a part of the pathogenesis of UC.^[2,3] The recurrent and refractory UC could induce intestinal stenosis and fibrosis.^[4,5] Therefore, it is very important to study how to improve and repair the structures and functions of colonic mucosa, as well as how to prevent the intestinal fibrosis of UC. Flavonoids are a large group of naturally occurring phenolic constituents, ubiquitously present in edible plants, vegetables and fruits. Epidemiological evidence suggests that consumption of foods and beverages rich in flavonoids correlate with lower risk of various diseases, including certain cancers, cardiovascular diseases and oxidative stress-related diseases.^[6] More than 6000 varieties of flavonoids have been identified, among them quercetin (abundant in onion, apple, broccoli and berries) and catechin (abundant in tea) are the most common and widely consumed flavonoids.^[7] Onion (*Allium cepa* L.), a widely consumed

vegetable in DPR of Korea as well as other countries, is a good source of dietary phytochemical (organosulphur compounds and flavonoid especially quercetin) with proven antioxidant properties and ability to modulate the detoxification systems.^[8,9] Various scientific reports have confirmed its functional properties which include free radical scavenging activities, immune stimulation, cardioprotective effects (by lowering serum cholesterol and blood pressure), anti-cancer, and anti-infectious properties.^[10] Onion contains a considerable number of compounds highly beneficial for human health, and has been reported to have antioxidant, anti-hyperglycemic and anti-hyperlipidemic effects on diabetic rats.^[11-13] However, the effect of onion on colitis in rodents has not yet been reported. Furthermore, the inhibitory effect of onion extract on inflammation in UC rats has not yet been precisely examined. In the present study, anti-inflammatory effect of the onion extract was examined on UC rats by acetic acid administration intrarectally.

MATERIALS AND METHODS

Preparation of Extracts

Onion (*Allium cepa* Linn.) was sourced locally in DPR of Korea and kindly extracted by Traditional Medicine Centre of Pyongyang University of Medical Sciences. Fresh bulbs of onions carefully dressed and frozen at +4°C. About 100 mL of chilled distilled water were added to 100 g of onions and crushed in a homogenizer. The resultant slurry was squeezed and filtered



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through a fine cloth and the filtrates of onion extracts were quickly frozen at -20°C until used.

Animals

Adult Wistar rats (outbred, 8~10 weeks of age, 220~240g) were provided by Laboratory Animal Centre of the Pyongyang University of Medical Sciences and adapted in a lab environment before experiments for a week. Forty-five rats were randomly divided into 3 groups (n=15 per group): Control group, UC model group and Onion extract group. During the experiment, feed and water were available to rats at any time. The temperature was maintained at $20\pm 2^{\circ}\text{C}$ and the humidity was 55%. The study was approved by the Ethics Committee for Animal Experimentation, Faculty of Basic Medicine, Pyongyang University of Medical Sciences.

Induction of Ulcerative Colitis

UC model in rats was induced by instilling 1 mL of 4% glacial acetic acid intrarectally through a polyethylene catheter inserted (8 cm from anal margin) into the colon under light ether anaesthesia.^[14,15] Control rats were treated with an equal volume of Phosphate-Buffered Saline (PBS). The rats were then returned into their cages and allowed to recover. Animals were sacrificed by cervical dislocation on the 5th day after acetic acid administration. Segments of colon from the site of inflammation were taken and cleaned with PBS. They were frozen in liquid nitrogen and stored at -80°C .

Serum LDH Assay

On the 5th day after acetic acid administration, rats were anesthetized and sacrificed by withdrawing blood from the abdominal aorta using vacuum sampling tubes through a laparotomic incision. Serum samples were prepared by centrifuging (1000×g for 10 min) their blood, and serum LDH activity was measured by Hitachi 912 autoanalyzer.

Biometrics in Colon

Colon samples (8 cm from rectum) were collected for biometrics including colon weight (g) and colon length (cm).

Myeloperoxidase Activity

Inflammation was monitored by the estimation of myeloperoxidase activity as previously described.^[16,17] The level of MPO activity was estimated in the colonic segments taken from the rats. Segments of the colon (1 g) were minced finely with scissors and homogenized with a polytron in 10 mL of 50 mmol/L potassium phosphate buffer (pH 6.0) containing 14 mmol/L hexadecyltrimethylammonium bromide. The supernatants were used to estimate the MPO activity. MPO activity was expressed as units/mg tissue. Unit is defined as the conversion of $1\ \mu\text{mol H}_2\text{O}_2/\text{min/g}$ tissue at room temperature.

Administration of Onion Extract

Rats in onion extract group were orally administered with onion extract at a daily dose of 300mg/kg body weight for 5 days from 2 hr later after acetic acid administration.

Statistical Analysis of Data

Results were expressed as the mean and SEM. Data were analyzed by one-way Analysis of Variance (ANOVA) using SPSS 16.0 and the differences between the means assessed using Dunnett's multiple range test. A P value of < 0.01 was taken as the level of statistical significance.

RESULTS

The Changes of Physiological Parameters in Colon

The changes of physiological parameters in colon were presented in Table 1. In non-treated UC group, the weight and length in colon significantly changed compared to control group ($P < 0.01$), while both parameters significantly improved in extract group ($P < 0.01$).

The Changes of Colonic MPO Activity

As shown in Figure 1, colonic MPO activities of UC and extract group were significantly increased compared to that of control group ($P < 0.01$). Administration of onion extract significantly decreased the MPO activity of colon compared to UC group.

The Changes of Compressive Strength

The strength of femur was measured by compressing the bone anterior-to-posterior. Table 1 shows some tendency to dose-dependently inhibition of isoflavone extract on compressive strength.

After 12 weeks, the compressive strength of the distal femoral metaphysis declined by approximately 64% in OVX group compared to sham group. Isoflavone extract inhibited this decrease significantly at doses of 60 and 90mg/kg.

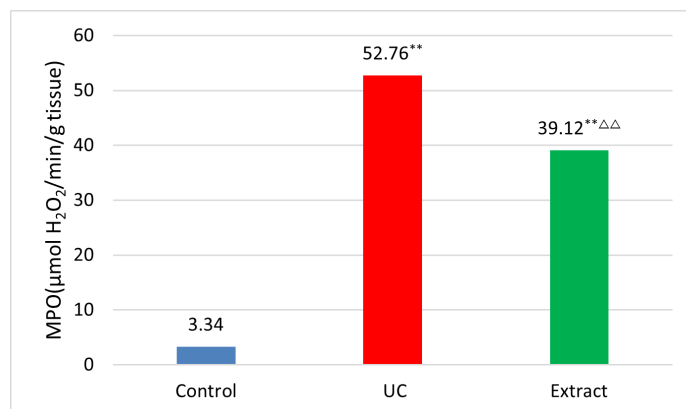


Figure 1: Changes of Colonic MPO activity.

Table 1: Weight and length of colon.

	Colon weight (gm)	Colon length (cm)
Control	1.36±0.02	15.43±0.21
UC	1.81±0.05**	12.78±0.12**
Extract	1.47±0.04** ^{ΔΔ}	14.35±0.11** ^{ΔΔ}

Each value represents the mean ± SEM of 15 rats per group. **P<0.01 as compared with control group. ^{ΔΔ}P<0.01 as compared with UC group.

Table 2: Changes of serum LDH activity.

	Serum LDH (IU/L)
Control	423.12±10.64
UC	2314.85±38.82**
Extract	1219.36±20.42** ^{ΔΔ}

Each value represents the mean ± SEM of 15 rats per group. **P<0.01 as compared with control group. ^{ΔΔ}P>0.01 as compared with UC group.

The Changes of Serum LDH Activity

Serum LDH activities in each group were presented in Table 2. Average of serum LDH activity was 2314.85 IU/L in rats at the 5th day after acetic acid administration (P < 0.01 compared to control group), and the treatment with onion extract significantly reduced activity of this enzyme compared to UC group.

DISCUSSION

Ulcerative colitis also named non-specific UC, mainly presents stomach ache, diarrhea, and mucosal fluid bloody purulent stool. The etiological factors of this disease are complex. If its treatment is unsuitable or lost, it will attack recurrently and be intractable, and leads to intestinal fibrosis even cancer in the later period. Specific treatments are lacked of in the medicine treatment. Now, people prefer to use plants rather than to take chemical drugs for the prevention and treatment of diseases, because plants are the major source of materials which combat various ailments and preserve health. Onion (*Allium cepa* L.) is a good source of activated phytochemicals such as phenolic acids, flavonoids especially quercetin, cepaenes, thiosulfinate, organosulfur compounds and anthocyanin,^[18] with proven antioxidant properties and protective effects against different degenerative pathologies such as cardiovascular and neurological diseases, cancer and other dysfunctions based on oxidative stress.^[19] Onion is rich in sulfur-containing compounds and is used as foodstuff, condiment, flavoring and folk medicine in DPR of Korea. Until now, there are no studies to investigate the effect of onion on UC in rats. In the present study, anti-inflammatory effect of the onion extract was examined on UC rats by acetic acid administration intrarectally. Acetic acid-induced increase in the colon weight and reduction in the colon length are measures of inflammation and edema in the colon. Significant improvement in colon weight and colon length was noticed in extract group compared to UC model group (Table 1). On the other hand, administration of onion extract produced amelioration of increased colonic MPO

activity induced by acetic acid. In general, MPO activity is linked to the condition and severity of inflammation, and so that, this is used to use as the biomarker to evaluate the inflammatory status. Our result showed that onion extract can inhibit the activity of neutrophils in UC. Administration of onion extract showed reduced LDH activity in serum, indicating also suppression of inflammation, which may be due to chemical stimulation by acetic acid in colon of rats. These results suggest that onion extract can suppress the progress of inflammation including formation of ulcer in colon. However, it is still to be examined whether the effect of volatile and non-volatile components in onion is observed in the experiment for improvement of colonic aberrant crypt foci in this model or not. Further studies are necessary to demonstrate the effect of onion extract on several animal model of UC, comparing anti-inflammatory drugs.

CONCLUSION

The present study showed that the anti-inflammatory effect of onion on UC in rats may be beneficial for human health. The results suggest that onion might pave the way for a novel therapeutic agent for the management of UC.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

UC: Ulcerative Colitis; MPO: Myeloperoxidase Activity; LDH: Lactate Dehydrogenase.

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