Screening of selected indigenous plant species for their anti-inflammatory properties

Ikboljon Mukhammedov[1,2*], *Ulugbek* Yusupov[3], *Sokhibjon* Abdusamatov[3],

[1]Kokond University Andijan branch, Department of Microbiology, virology and immunology, 170619, Uzbekistan, Andijan
[2]Andijan State University, Department of Biology, 170100, Uzbekistan
[3]National University of Uzbekistan named after Mirzo Ulugbek, University Street, 4, 100174, Tashkent, Uzbekistan

Abstract. Most plant extracts are used in traditional medicine as antibacterial, antioxidant, anti-inflammatory and antidiabetic. In this study, the anti-inflammatory properties of plant extracts were studied. All local plant extracts showed anti-inflammatory activity. In particular, high anti-inflammatory activity was found in *Dandelion officinalis* 96%, *Nigella L.* 92%, *Common bindweed* 87%, *Convolvulus L.* 86%, *Caesius L.* 86% and Allium cepa sativum 85%. This suggests that plant extracts can help prevent various diseases at the same time.

1 Introduction

Medicinal plants and their extracts are widely used as dietary supplements worldwide to promote and maintain human health [1]. These natural products are usually "whole extracts", which are complex mixtures of not one but several substances contained in a plant. The main advantage of the biological effects of these plant extracts is their use as biological supplements. Currently, thousands of plant extracts are known, hundreds of which are of commercial importance for the pharmaceutical, agrotechnical, food, sanitary, cosmetic and perfumery industries. Plant extracts have antiviral, antimicrobial, antioxidant, anti-inflammatory and other biological effects [2, 3].

Scientific evidence suggests that natural plant products, whether purified or extracted, have anti-inflammatory and antibacterial properties [4, 5]. Bacterial infections in the stomach and intestines also cause inflammation there. Inflammation is responsible for intestinal diseases, acting as a secretory organ and causing diarrhea [6]. Inflammation is associated with a number of chronic human diseases, including cancer, diabetes, cardiovascular disease, and neurodegenerative diseases [7].

Many in vitro experiments have shown the anti-inflammatory activity of plant extracts. Various inflammatory mediators, including tumor necrosis factor (TNF)-α and IL-1β, are involved in the development of inflammatory diseases. Dung et al. concluded that EO from *C. operculatus* shoots has potential

* Corresponding author: muxammedov1989@mail.ru

anti-inflammatory effects due to its inhibition of TNF-α and IL-1β expression and secretion from lipopolysaccharide (LPS)-induced RAW 264.7 cells. It was also shown that eugenol, tea tree oil, and garlic extract can inhibit TNF-α and IL-1β secretion [8, 9].

Given the large number of different groups of chemical compounds present in plant extracts, it is not surprising that they have anti-inflammatory and antimicrobial activity. However, it is important for consumers to use them in a targeted manner to improve and maintain their health. In this regard, the anti-inflammatory properties of 20 different plants used for food and medicinal purposes, common in the Andijan region, were studied.

2 Materials and methods

2.1 Plant material collection and identification

Our research was carried out on the following plant extracts distributed in Andijan region: *Piper nigrum (Piper nigrum), Bunium persicum (Bunium persicum), Coriandrum sativum L (Coriandrum sativum L), Nigella L. (Nigella L.), Bidens tripartita L. (Bidens tripartita L.), Allium cepa sativum (Allium cepa sativum), Quercus velutina (Quercus velutina), Salvadora persica (Salvadora persica), Allium cepa (Allium cepa), Salvia officinalis (Salvia officinalis), Common elderberry (Typha orientalis), Chenopodium vulgaris (Chenopodium vulgaris), Dandelion officinalis (Dandelion officinalis), Peppermint (Mentha piperita), Lycopus virginicus (Lycopus virginicus), Convolvulus L. (Convolvulus L.), Caesius L. (Caesius L.), Cichorium intybus L. (Cichorium intybus L.), Glycine hispida (Glicine hispida)*.

2.2 Drying and Preparation of Plant Biomass

Biomass drying was carried out according to the method of Jane et al. [10]. A 5 g biomass sample was weighed three times in a desiccator and the samples were dried at 105 ºC. The moisture content of the biomass was determined by cooling it to room temperature in a desiccator.

2.3 Extraction of Secondary Metabolites from plant biomass

Isolation of metabolites from plant biomass for the determination of biological activity was carried out according to the method of Hazalin et al. with modifications of Lang et al. [11]. For this, 5 g of biomass was homogenized in a Potter homogenizer, placed in a conical flask, ethanol was poured into it in a ratio of 1/5 as a solvent and placed in an Elpon 357 shaker (Poland) at 180 rpm at room temperature for mixing. Then the mixture was filtered through a paper filter (Whatman paper No. 1) and Na2SO4 was added at an amount of 40 µg/ml to remove the aqueous layer. The mixture was then dried in a Heideolph HB Digitel (Germany) vacuum evaporator and dissolved in 1 ml of water. The resulting extract was used as a stock solution and stored at +4°C.

2.4 Preparation of Red Blood Cell (RBC) Suspension

Preparation of red blood cell suspension [12, 13]. Blood was collected from a healthy human volunteer who had not taken nonsteroidal anti-inflammatory drugs for 2 weeks before the experiment. The blood sample was centrifuged at 3000 rpm for 10 min and washed 3 times with normal saline. The blood volume was measured and made up to 10% v/v with normal saline.

2.5 Heat-Induced Hemolysis

The experiment was performed according to the methods of Sakat et al and Shinde et al with some modifications [12, 14]. The total reaction mixture was 2 ml, containing 1 ml of the test sample and 1 ml of 10% red blood cell suspension. For the control, only saline was added to the test tube. Aspirin was used as a standard drug. The reaction mixture was incubated in a water bath for 30 min at 56 °C. The reaction was stopped by cooling the reaction mixture under running water. The reaction mixture was then centrifuged at 2500 rpm for 5 minutes. The collected supernatant was used to measure the absorbance at 560 nm. The experiment was performed in triplicate. The percentage of hemolysis inhibition was calculated as follows: [Ao-at]\Ao×100%, where Ao is the light absorbance of the control sample, at is the light absorbance of the experimental sample. The percentage of hemolysis inhibition was calculated as follows:

$$Inhibition\ (\%) = \left(\frac{A_0 - A_t}{A_0}\right) \times 100$$

Where:

Ao = Absorbance of control (without extract),

At = Absorbance of test sample.

Each experiment was repeated three times.

3 Results and discussion

20 different plants, which are described in scientific sources for their various medicinal properties and are used in food, were selected for the experiment. Different organs of these plants were taken in an amount of 1 g, extracted in ethyl alcohol, dried, and then dissolved in distilled water at a concentration of 50 mg/ml. Then their antibacterial and anti-inflammatory activities were studied. The first studies were focused on studying the anti-inflammatory properties of plant extracts. In vitro experiments showed that plant extracts have anti-inflammatory activity. Table 1 lists several commonly used plant extracts and their anti-inflammatory activity.

Table 1. Amount and anti-inflammatory activity of plant extracts

№	Plant name	Extracted part	Amount of extracted extract (mg)	Anti-inflammatory activity (%)
1	*Piper nigrum*	seed	46.7±0,14	45±0,19
2	*Bunium persicum*	seed	85.7±0,15	70±0,14
3	*Coriandrum sativum L*	seed	66.7±0,21	47±0,17
4	*Nigella L.*	seed	33.5±0,17	92±0,11
5	*Bidens tripartita L.*	stem	57.1±0,15	30±0,21
6	*Allium cepa sativum*	leaf	33.3±0,16	85±0,19
7	*Quercus velutina*	stem	53.4±0,19	69±0,22
8	*Salvadora persica*	stem	66±0,30	68±0,11
9	*Allium cepa*	leaf	33.4±0,15	56±0,19
10	*Salvia officinalis*	stem	20±0,19	73±0,21
11	*Typha orientalis*	leaf	9.7±0,25	87±0,19
12	*Chenopodium vulgaris*	leaf	24.2±0,18	80±0,19

13	*Dandelion officinalis*	leaf	4.5±0,19	96±0,11
14	*Mentha piperita*	flower	40.2±0,22	-
15	*Lycopus virginicus*	leaf	40.2±0,16	50±0,16
16	*Convolvulus L.*	leaf	47.2±0,21	86±0,19
17	*Caesius L.*	leaf	72.7±0,29	86±0,25
18	*Cichorium intybus L.*	leaf	3.9±0,17	-
19	*Glicine hispida*	seed	80.5±0,27	65±0,12
20	Aspirin			94±0,05

As can be seen from Table 1, *Mentha piperita* and *Cichorium intybus L*. did not show anti-inflammatory activity. However, anti-inflammatory activity was observed in all other plants. In particular, 96% anti-inflammatory activity was observed in *Dandelion officinalis*, 92% in *Nigella L*., 87% in *Common bindweed*, 86% in *Convolvulus L*., 86% in *Caesius L.* and 85% in *Allium cepa* sativum. Similar studies were conducted by Shimoda et al. [15]. The anti-inflammatory activity of 40% ethanolic extract of Zingiber officinale was studied. The results showed high anti-inflammatory activity in acute and chronic inflammation [16]. Saurabh Patel et al. [17]. The anti-inflammatory activity of methanol extract of Murraya koenigii leaves was studied. In this, a dose of 400 mg/kg showed the highest results in albino rats. Also, methanolic extract of Solanum nigrum (375 mg/kg) showed good anti-inflammatory effect and it showed dose-dependent effect [18]. Ethnopharmacologically useful plants are the main source for the development of drugs in traditional medicine.

4 Conclusion

As a result of studying the anti-inflammatory activity of plant extracts, all plant extracts except *Mentha piperita* and *Cichorium intybus L.* reduced heat-induced hemolysis. Anti-inflammatory activities of plant extracts were observed. This allows enriching everyone's home pharmacy in the prevention of various diseases.

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