



Evaluation of Anti-Inflammatory and Antioxidant Properties of *Cayratia trifolia*

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: *Cayratia trifolia* is a plant belonging to the family Vitaceae and genus Cayratia. Anti-inflammatory activity is the property of a substance or treatment that reduces inflammation or swelling. Antioxidants are defined as substances that delay or inhibit oxidative damage to a target molecule and its principal function is its ability to trap free radicals. The alcoholic leaf extract of *Cayratia trifolia* has anti-inflammatory as well as antioxidant properties against inflammations and swelling and DPPH free radicals respectively and can be evaluated using both in vitro and in vivo assays. The principal aim of the study is to employ in-vitro assays to evaluate the anti-inflammatory and antioxidant properties of *Cayratia trifolia*.

Materials and Methods: Plant extract of *Cayratia trifolia* was purchased and tested for anti-inflammatory and antioxidant properties. In case of evaluating the antioxidant activity, the methanolic extract of the plant was utilised. The examination of the anti-inflammatory properties of *Cayratia trifolia* involves acetyl salicylic acid as a positive control and aspirin and aspirin was employed as a standard anti-inflammatory drug.

Results: The anti-inflammatory activity of *Cayratia trifolia* extract was examined and it was observed that the plant extract showed an increased percentage of inhibition of trypsin with

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increasing concentration. Similarly, the antioxidant activity was compared to Vitamin C and the percentage of inhibition of DPPH free radicals increased with the increase in concentration of the extract.

Conclusion: Within the limits of the study, the plant extract of *Cayratia trifolia* was observed to possess both antioxidant and anti-inflammatory properties.

Keywords: *Cayratia trifolia*; antioxidant; anti-inflammatory; ecofriendly; innovative technique , novel method.

1. INTRODUCTION

Cayratia trifolia is a plant belonging to the family Vitaceae and genus Cayratia. It is a perennial climber having trifoliate leaves with 2-3 cm long petioles and ovate to oblong-ovate leaflets. It is commonly known as fox-grape or bush-grape [1]. It consists of black-coloured berries and its leaves contain several flavonoids, such as cyanidin and delphinidin. Hydrocyanic acid is present in the stem, leaves and roots of the plant [2]. Leaves contain stilbenes, piceid, resveratrol, viniferin, ampelopsin [3]. This plant has medicinal uses, where the root, ground with black pepper, is applied to boils and is also used as an astringent medicine. The bark extract shows antiviral, antibacterial, antiprotozoal, hypoglycemic, anticancer and diuretic activity. Upon preliminary phytochemical screening, the whole plant of *Cayratia trifolia* was observed to contain steroids, terpenoids, flavonoids & tannins, and yellow waxy oil [4].

Inflammation is the body's first response to infection or injury and is critical for both innate and adaptive immunity. Anti-inflammatory activity is the property of a substance or treatment that reduces inflammation or swelling [5]. The main action of anti-inflammatory activity is the inhibition of protein synthesis and pro-cyclooxygenase enzymes which are responsible for the conversion of Arachidonic acid to prostaglandins. There are two principal types of anti-inflammatory drugs, namely, steroidal anti-inflammatory drugs, which reduce inflammation by binding to cortisol receptors and nonsteroidal anti-inflammatory drugs, which decrease damage by inhibition of cyclooxygenase enzymes [6]. Non-steroidal anti-inflammatory drugs generally include aspirin, ibuprofen and naproxen. The different plants or herbs that help reduce inflammation include curcumin [7], black tea, capsaicin, rosemary, Uncaria tomentosa [8], etc. Antioxidants are defined as substances that delay or inhibit oxidative damage to a target molecule [9]. The principal function of antioxidants is its ability to trap free radicals.

Free radicals are oxygen-containing molecules that can cause large chain chemical reactions in the body since their reaction with other molecules. These reactions are called oxidation [10]. The presence of free radicals can result in central nervous system related diseases like Alzheimer's, and can also cause rheumatoid arthritis, cancer, diabetes, cataract, and genetic degenerative diseases like Huntington's disease. Few powerful antioxidants include alpha-tocopherol which is an active form of vitamin E in humans, and vitamin C [11].

The alcoholic leaf extract of *Cayratia trifolia* has anti-inflammatory as well as antioxidant properties against inflammations and swelling and DPPH free radicals respectively and can be evaluated using both in vitro and in vivo assays. Our team has extensive knowledge and research experience that has translate into high quality publications [12-31]. The principal aim of the study is to employ in-vitro assays to evaluate the anti-inflammatory and antioxidant properties of *Cayratia trifolia*.

2. MATERIALS AND METHODS

Plant extract of *Cayratia trifolia* was purchased and tested for anti-inflammatory and antioxidant properties.

2.1 *In vitro* Anti-inflammatory Activity

2.1.1 Protease inhibition assay

Inhibition of trypsin was evaluated by the method of Oyedepo and Femurewas (1965) and Sakat et al. (2010). 100 µL of bovine serum albumin was added to 100 µl of plant extracts (0.1 to 0.5mg/ml) with an increase in concentrations (100-500µg/ml). This was incubated at room temperature for 5 minutes. Reaction was inhibited by the addition of 250 µl of trypsin followed by centrifugation. The supernatant was collected, and absorbance was observed at 210 nm. Acetyl salicylic acid was used as a positive control. The experiment was carried out in

triplicates and percent inhibition of protease inhibition was calculated. In this study, Aspirin was used as a standard anti-inflammatory drug.

Calculation: % Inhibition= $100 - ((A_1 - A_2)/A_0) * 100$

2.2 In vitro Antioxidant Activity

2.2.1 DPPH radical assay

The DPPH free radical scavenging assay was performed by Liyana Pathirana and Shahidi method [Kikuzaki and Nakatan, 1993]. 200 µL of 0.1 mM DPPH prepared in methanol was added to 100 µL of the plant extract with an increase in concentration (100-500µg/ml). The resulting mixture was incubated at room temperature in the dark for 15 minutes. Absorbance was observed at 517 nm. BHT was taken as a positive control. The experiment was carried out in triplicates and percentage inhibition of the DPPH radical scavenging activity was calculated.

Calculation: % Inhibition= $((A_0 - A_1)/A_0) * 100$,

Where A_0 is the absorbance of the control and A_1 is the absorbance of the sample.

2.3 Statistical Analysis

The data were analyzed statistically using one way analysis of variance (ONE-WAY ANOVA). Duncan Multiple range test was used to analyze the statistical significance between groups. The

levels of significance were considered at the levels of $p < 0.05$.

3. RESULTS

The results obtained from the study were plotted in the form of graphs. Fig. 1 refers to the graph plotted to compare the anti-inflammatory activity between aspirin and *C.trifolia* using the protein denaturation inhibition assay. The antioxidant activity between *C.trifolia* and vitamin C is represented by Fig. 2.

4. DISCUSSION

The anti-inflammatory activity of *Cayratia trifolia* extract was examined and it was observed that the plant extract showed an increased percentage of inhibition of trypsin with increasing concentration. Similarly, the antioxidant activity was compared to Vitamin C and the percentage of inhibition of DPPH free radicals increased with the increase in concentration of the extract.

The anti-inflammatory property of aspirin was comparatively higher than that of *C. trifolia* due to the increased inhibition of proteins. According to previous studies, it was proved that aspirin was generally used to reduce inflammation, and also possessed analgesic properties [32]. Aspirin blocks the production of prostaglandins, which is considered as an important mediator of inflammation [33].

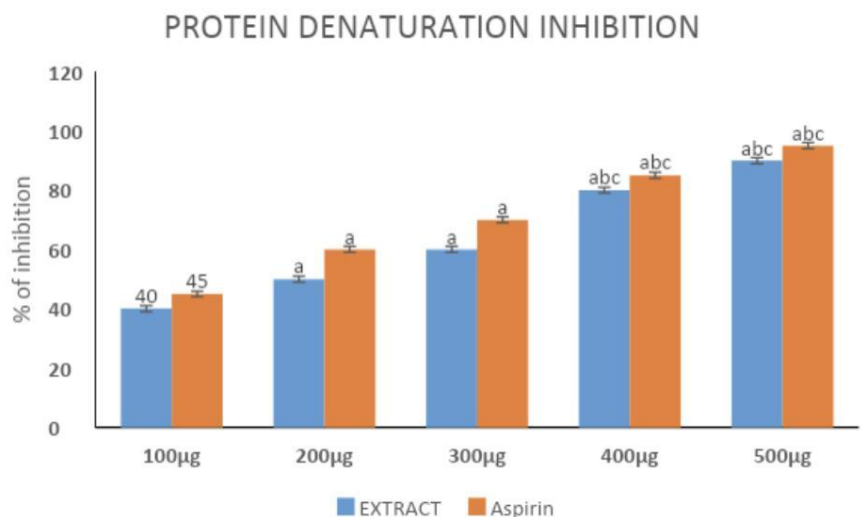


Fig. 1. The graph depicts the anti-inflammatory activity of *Cayratia trifolia*
Each bar represents the mean \pm SD of 6 observations. Significance at the levels of $p < 0.05$. a-compared with 100 µg; b-compared with 200 µg; c-compared with 300 µg

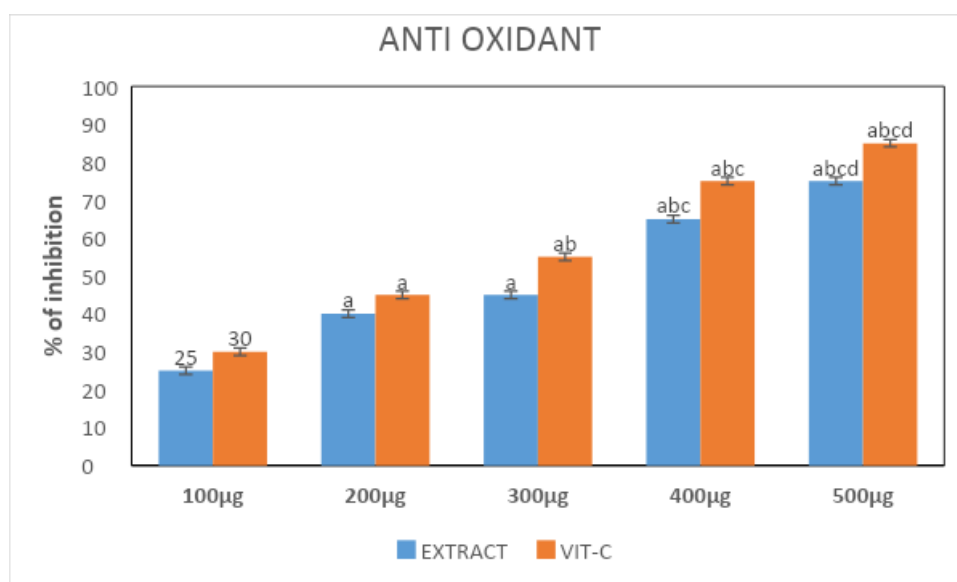


Fig. 2. The bar chart represents the antioxidant activity of *Cayratia trifolia* extract. Each bar represents the mean \pm SD of 6 observations. Significance at the levels of $p < 0.05$. a-compared with 100 μ g; b-compared with 200 μ g; c-compared with 300 μ g

The plant extract of *Cayratia trifolia* exhibited anti-inflammatory properties, but showed slightly less activity than aspirin, which is also known as acetyl salicylic acid. Previous research has indicated that the methanolic leaf extract of *Cayratia trifolia* was observed to have anti-ulcer properties [34]. Hence, *C. trifolia* exhibited anti-inflammatory properties by inhibiting the synthesis of trypsin.

Vitamin C is known to possess a potent antioxidant property by trapping free radicals and by destroying them. Vitamin C, otherwise known as ascorbic acid, acts as an antioxidant and a pro-oxidant in-vitro and also provides protection against oxidative stress-induced cellular damage, by scavenging free radical species. The plant extract of *Cayratia trifolia* has antioxidant activity against DPPH free radicals and scavenges them through the DPPH free radical scavenging assay. Preceding works of various authors proved that the ethanolic extract of *Cayratia trifolia* contains natural sources of antioxidants and possessed good free radical scavenging activity.

The limitations of this study was that it was carried out only as an in-vitro study. In-vivo studies can also be carried out for obtaining better results in the future.

The future scope of this study based on *Cayratia trifolia* is that it can be used as a natural remedy for treatment of inflammations and ulcers or swellings. The possession of antioxidant property

by the plant extract can also be used for treating multiple diseases like diabetes.

5. CONCLUSION

Within the limits of the study, the plant extract of *Cayratia trifolia* was observed to possess both antioxidant and anti-inflammatory properties. Though its activity was not as effective as the standard drug used for comparison, it can be used as a biological alternative for treating inflammations, cancer or heart diseases.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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