



Evaluation of Anti-Inflammatory Property of Maranta Arundinacea using Protein Denaturation Assay - An *In vitro* Study

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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: *Maranta arundinacea* is a perennial plant which is seen in Mexico, central and South America. It was introduced and cultivated for its starch rich root which is known as arrowroot. It is gluten free and good for digestion. It also boasts metabolic rate and healthy sleep. Arrow root aid in lowering cholesterol which decreases the risk of heart diseases. It is a good substitute for breast milk because it's loaded with magnesium, zinc and iron which promotes the growth and development of infants. Arrow root extract is previously known for its antibacterial and antifungal activity and also it gives relief from skin rashes, acne and skin sores.

Aim: The aim of this study is to evaluate the anti-inflammatory property of *Maranta arundinacea* using protein denaturation assay.

Materials and Methods: *Maranta arundinacea* (Arrowroot) was purchased commercially. Extract was prepared by adding 50 ml of distilled water and boiled at 50 degree Celsius and filtered. The extract was concentrated up to 10ml and the anti-inflammatory property was checked using protein

denaturation assay and the readings were noted using a calorimeter.

$\% \text{ of inhibition} = \frac{\text{Control O.D} - \text{sample O.D}}{\text{Control O.D}} * 100$

Results: It showed good anti-inflammatory activity and thus it can be used as a potent alternative for anti-inflammatory drugs.

Conclusion: Maranta arundinacea extract showed good potential for anti-inflammatory activity. Thus in future more research can be done for formulations of eco-friendly treatment methods.

Keywords: *In vitro* study; Maranta arundinacea; evaluation; protein denaturation assay; anti-inflammatory.

1. INTRODUCTION

Maranta arundinacea is a perennial shrub which is found in Mexico, Central and South America. Maranta arundinacea is commonly known as Arrowroot. Arrowroot was introduced and cultivated for its starch rich root [1]. The benefits of arrowroot is that it is gluten free and is also good for digestion [2]. Arrowroot boosts our metabolic rate and also generates healthy sleep and reduces tension in most of the individuals [3]. Arrowroot is usually processed as powder which in turn is used to add texture and structure in cooking and baking purposes [4]. Arrowroot is often known as the powerhouse of Vitamin B which increases brain function and cell metabolism [5]. Due to the presence of Vitamin B6, arrowroot provides relief from skin rashes, acne and skin sores [6]. Arrowroot aids in weight loss which lowers body cholesterol levels and decreases the rise of heart problems [7]. It is loaded with Magnesium, Zinc and Iron which promotes growth and development and it is also a potent substitute for breast milk for infants [8]. Arrowroot is both antibacterial and antifungal naturally and it is used as topical administration for the treatment of Athlete's foot [9]. It is used as an antidote for poisoned arrows and is also effective for scorpion venom and spider bite [10]. Arrowroot is safe for both internal and external purposes and it does not have any known adverse effects [11].

Inflammation is a protective response against pathogens, irritants or damaged cells which is mediated by immune cells, blood vessels, and molecular mediators [12]. Non-steroidal anti-inflammatory drugs (NSAIDs) are medicines that are used to relieve pain, reduce inflammation, and bring down a high temperature and also used to relieve symptoms of headaches, painful periods, sprains and strains, colds and flu, arthritis, and other causes of long-term pain [13]. Some of the side effects of the above mentioned drugs are stomach ulcers and some allergic reactions like rashes [14]. Instead of these

harmful drugs we can use herbal drugs which are prepared from natural sources like coneflower, Ginseng etc, these can be as potent as commercially available drugs [15,16]. Previously, *Phyllanthus amarus* extract was noted for its anti-inflammatory activity and the results concluded that HE, LRF, and the Lignans present in the plant enhanced its anti-inflammatory property [17]. *Dioscorea bulbifera* L. extract obtained from its bulbils was tested and concluded that it inhibited inflammatory mediators such as histamine, serotonin and prostaglandins.

Arrowroot is used in many disorders like diarrhea and bowel disorders and in the previous studies anti-inflammatory properties was checked for extracts like *P. amaranthus* and *C. nitens*. Our team has extensive knowledge and research experience that has translated into high quality publications [18–42]. The aim of this study is to evaluate the anti-inflammatory property of *Maranta arundinacea* using protein denaturation assay.

2. MATERIALS AND METHODS

2.1 Preparation of Plant Extract

Arrow root extract is purchased commercially from herbal health centre, in Chennai. The extract is diluted with 50 mL of distilled water and boiled for 15 mins at 50 degree celsius. The extract is filtered using whatman filter paper and allowed to stand undisturbed for 20 mins. 10 ml of filtered extract is obtained and used for performing anti-inflammatory assay.

2.1.1 Evaluation of anti-inflammatory activity using albumin denaturation assay

The reaction mixture 0.5ml, which contains 0.45ml of 1% Bovine serum albumin (BSA) was mixed with 500 μ L of aqueous crude extract in different concentrations (500-100 μ g/mL) and the pH of the reaction mixture was adjusted to 6.8 using 1N HCl. The reaction mixture was

incubated at room temperature for 20 min and then heated to 55 °C for 20 min in a water bath. The mixture was cooled to room temperature and the absorbance value was recorded at 660 nm. A BSA mixture with 30% methanol solution was used as a control. Diclofenac sodium in different concentrations was used as a standard. The experiment was performed in triplicate.

Percent inhibition was calculated using the following formula:

$$\% \text{Inhibition} = \frac{\text{Control O.D} - \text{sample O.D}}{\text{Control O.D}} * 100$$

Where,

Control O.D = Optical density of control
 Sample O.D = Optical density of test sample.

3. RESULTS

In order to determine the anti-inflammatory activity of *Maranta arundinacea*, We have taken different concentrations from 10 - 50µL and was compared with the standard diclofenac. The percentage of inhibition increases gradually, as we raise the concentration of the sample. The results depict *Maranta arundinacea* plant extract has anti-inflammatory activity (percentage of inhibition) upto 79% [Table 1], which is somewhat significantly lower than the standard anti-inflammatory agent diclofenac (84%) [Fig.1] and these results were statistically analysed using Chi square test, p value > 0.05(0.088) which is statistically insignificant.

4. DISCUSSION

In the current study, *Maranta arundinacea* (Arrowroot) showed good anti-inflammatory activity against the standard in which its activity increased with increase in concentration [Fig 1]. Previously, *Phyllanthus amarus* extract was noted for its anti-inflammatory activity and the results concluded that Hexane Extract, Lignan-rich Fraction, and the Lignans present in the plant enhanced its anti-inflammatory property. *Dioscorea bulbifera* L. extract obtained from its bulbils was tested and concluded that it inhibited inflammatory mediators such as histamine, serotonin and prostaglandins [43]. The ethanolic extract obtained from leaves of *Chimonanthus nitens* Oliv. show significant anti-inflammatory property by inhibiting IL-1 in the cells [44]. Bioactive extracts of five plant genera which were assumed to have anti-inflammatory property were collected and prepared and tested for anti-inflammatory activity showed good activity [45]. In a study done by Monika Mueller, the extracts were obtained from herbs, spices and fruits and checked for its anti-inflammatory property and was concluded that the compounds such as apigenin, capsaicin and chrysin which is present in these extracts moderately reduced Tumor Necrosing Factor - alpha and Interleukin -6 values which can be used to reduce inflammatory reactions [46]. A study conducted by Cstanislav, did not show any anti-inflammatory property and the plants used were *L. scariola* and *A. absinthium* [47]. Non-steroidal anti-inflammatory drugs (NSAIDs) are medicines that are used to relieve pain, reduce inflammation, and bring down a high temperature and also used to relieve symptoms of headaches

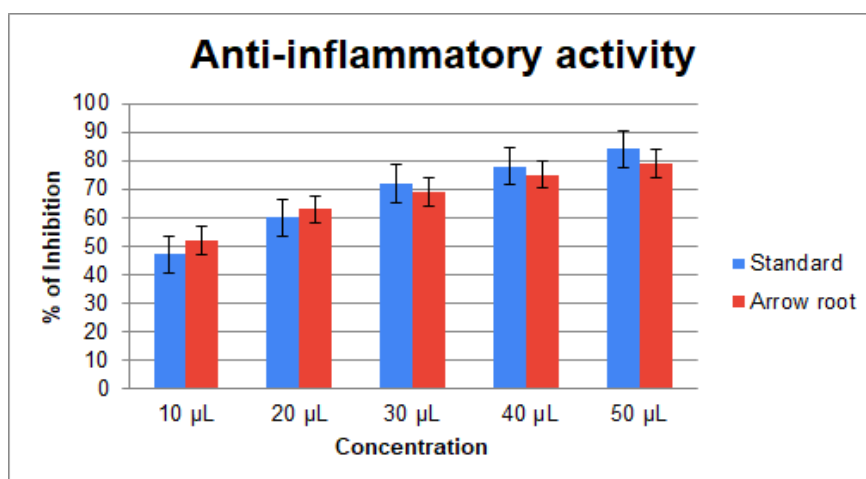


Fig. 1. Graph indicating the increase in the percentage of inhibition for the increase in concentration and its comparison with standard anti-inflammatory drugs

Table 1. Table indicating the percentage of inhibition for various concentrations of arrowroot extract

Concentration (μl)	Wavelength (nm)	Absorbance (Abs)	% of inhibition Extract	% of inhibition Control
10	660	0.02	52	48
20	660	0.03	63	60
30	660	0.04	69	73
40	660	0.02	75	79
50	660	0.03	79	84

because of its severe side effects, herbal drugs can be used as an alternative[48]. Instead of these harmful drugs we can use herbal drugs which are prepared from natural sources like coneflower, Ginseng etc, these can be as potent as commercially available drugs. The limitations of the study is that the extract was bought commercially and the extract was obtained only from the leaves of *Maranta arundinacea*. In future, the ratio of the extract and the nanoparticles can be changed for better results and the extract can also be checked for other properties like anti-bacterial and cytotoxicity.

5. CONCLUSION

The study proves that the plant extract *Maranta arundinacea* has significant anti inflammatory activity compared with control. The arrowroot extract is known to adopt cellular mechanisms to counteract and inhibit inflammation. In the future, arrowroot can be used for inflammatory disorders with minimal side effects.

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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