



Antioxidant and Xanthine Oxidase Inhibitory Potential of Aqueous Extract of *Ferula Asafoetida*

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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

Background: *Ferula asafoetida* is a dried latex that is exuded from rhizome or taproot species. Organosulfides are primarily responsible for flavour and odour of asafoetida. *Ferula asafoetida* is a natural medicine good for asthma and bronchitis. is also used to relieve stomach gas, digestive issues. It is usually added while cooking to harmonise the sweet, sour, salty, spicy taste of the food. Increased activity of xanthine oxidase is involved in the medical condition known as gout, which is characterized by hyperuricemia that leads to deposition of uric acid in the joints resulting in painful inflammation.

Aim: To analyse the anti-oxidant and xanthine oxidase inhibitory potential of aqueous extract of *Ferula asafoetida*.

Materials and Methods: Preparation of the aqueous seed extract of *Ferula asafoetida* done by hot percolation method. Phytochemical screening, *in vitro* antioxidant activity and xanthine oxidase inhibitory potential was done by standard procedures. The data were analyzed statistically by a one - way analysis of variance (ANOVA) followed by Duncan's multiple range test was used to see the statistical significance among the groups. The results with the $p < 0.05$ level were considered to be statistically significant.

Results: The phytochemical screening revealed that the extract is rich in phytoconstituents. DPPH radical scavenging activity established the potent *in vitro* antioxidant activity ($p < 0.05$) of *Ferula asafoetida* extract. The extract was also efficient in inhibiting the activity of xanthine oxidase enzyme ($p < 0.05$) in a concentration dependent manner.

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Discussion: The extract has potent antioxidant and xanthine oxidase inhibitory potential, although the activities are less compared to the standard drug.

Conclusion: The *Ferula asafoetida* extract can be used to treat gout and to combat various other disorders associated with xanthine oxidase activity.

Keywords: *Ferula asafetida*; antioxidant; phytochemical screening; gout; xanthine oxidase; Innovative technology; Novel method.

1. INTRODUCTION

Plants have been a constant source of drugs and recently, much emphasis has been placed on finding novel therapeutic agents from medicinal plants [1]. Today many people prefer to use medicinal plants rather than chemical drugs [2]. Spices are known to possess several medicinal properties. A number of health favorable physiological effects of dietary spices have been experimentally documented in recent decades [2]. The efficacy of these chemopreventive agents against cancer has been related with their antioxidant potential to reduce /or inhibit free radical mediated damage to cellular macromolecules, such as DNA, lipids and protein [3]. The protective action of the antioxidants are related with their potential to decrease oxidative stress and induce phase II detoxifying enzymes such as glutathione S-transferase and quinone reductase [4].

Ferula asafoetida is reported to be effective in lowering blood pressure and blood sugar level, having anti cancer effects, and protects brain health. It is a perennial plant belonging to the *Umbelliferae* family. The flowers are small and dirty yellow coloured produced in large compounds. The syrup prepared by decoction of asafoetida has been widely used because of its prominent activity it possesses and it is used for whooping cough and asthma and various types of respiratory disorders. Previous studies reported the promising activities of *Ferula asafoetida* as having muscle relaxant, memory enhancing, digestive enzyme, antioxidant, antispasmodic, hypotensive, hepatoprotective, antiviral, antifungal, anticancer, anxiolytics, and anthelmintic activities [5]. The volatile oil in the gum resin is eliminated through the lungs, making it suitable for the treatment of asthma. The odor of asafoetida is imparted to the breath, secretions, flatus, and gastric eructations [1]. From old ages, farmers in Malir, Karachi area of Sindh, are applying asafoetida for preventing the plants from root diseases particularly nematode attacks and increasing yield [6]. Chemicals called

coumarins in asafoetida can thin the blood. Ethanolic extract of Asafoetida oleo gum-resin has shown antifungal activity against *Mucor dimorphosporous*, *Penicillium commune* and *Fusarium solani* [7,8].

Xanthine oxidase serves as an important biological source of oxygen-derived free radicals that contribute to the oxidative damage of living tissues. Xanthine oxidase is associated with the formation of uric acid from xanthine and hypoxanthine which in turn is derived from purine catabolism [9-11]. Therefore, defects associated with the purine degradation pathway can result in an increase in the uric acid level which is a risk factor for the development of gout. XO inhibitors which block the terminal step in uric acid biosynthesis, can reduce the plasma uric acid level, and are usually employed for the treatment of gout [12-14]. Our team has extensive knowledge and research experience that has translate into high quality publications [15-30]. Hence the aim of the present study is to assess the xanthine oxidase inhibitory potential of *Ferula asafoetida*.

2. MATERIALS AND METHODS

2.1 Preparation of Aqueous Extract of *Ferula asafetida*

Ferula asafoetida was purchased from a herbal health care center. Crushed and made into powder. 80% of methanolic extract was obtained [31].

2.2 Assessment of Preliminary Phytochemical Screening

2.2.1 Test for phlobatannins

1 ml of the extract was treated with 1ml of 1% of HCL and boiled for 10 minutes. The formation of red colour precipitate indicates the presence of phlobatannin.

2.2.2 Test for carbohydrates

Three to five drops of molisch agent was added with 1 ml of the extract and then 1 ml of concentrated sulphuric acid was added carefully through the side of the tube.

2.2.3 Test for flavonoids

Few drops of 1% liquid ammonia were taken in a test tube and along with it 1ml of extracted indicating presence of flavonoids.

2.2.4 Test for alkaloids

2ml of sample was mixed with 2 ml of HCL. Then 6 drops of HCN was added and further 2 drops of picric reamish pale yellow indicating the presence of alkaloids.

2.2.5 Test for terpenoids

2 ml of sample along with 2ml of chloroform and 3ml of concentrated H₂SO₄ was added. Red - presence of terpenoids.

2.2.6 Test for proteins

1 ml of ninhydrin was dissolved in 1ml of acetone in a small amount.
Purple - presence of protein.

2.2.7 Detection of saponins

Foam test : a fraction of the extract was vigorously shaken with water and observed for Persistent foam.

2.2.8 Test for steroids

1 ml of chloroform was mixed with 1ml of extract and 10 drops of acetic anhydride and five drops of concentrated sulphuric acid were added and mixed.

Dark red and dark pink - presence of steroids.

2.3 Assessment of *in vitro* Antioxidant Activity by DPPH Free Radical Scavenging Activity

Scavenging of 2,2 - diphenyl-1- picrylhydrazyl radical was assessed by the method of DPH solution was added to 1 ml of extract at different concentrations. The mixture was kept at room temperature for 50 minutes and the activity was measured at 517 nm. Ascorbic acid at the same concentration was used as standard.

DPPH scavenging activity (%) =
(control OD - sample OD) / control OD X 100

2.4 *In vitro* Xanthine Inhibitory Activity of Aqueous Extract of *Ferula asafoetida*

In vitro xanthine oxidase inhibitory of the extract was assessed as per the method [32]. In brief the assay mixture consisted of 1ml of fraction, 2.9 ml of phosphate buffer and 0.1ml of xanthine oxidase enzyme solution, which was prepared immediately before use. After pre-incubation at 25° for 15 minutes, the reaction was initiated by the addition of 2ml of the subtract solution. The assay mixture was incubated at 25° for 30 minutes. The reaction was then stopped by the addition of 1ml of 1N hydrochloric acid and the absorbance was measured at 290 nm using a UV spectrophotometer. xoz activity was expressed as the % inhibition of xo in the above assay system calculated as % of inhibition as follows :

Inhibitory activity (%) = (1-as/ac) x100

where as - absorbance in presence of test substance, ac - absorbance of control.

2.5 Statistical Analysis

The data were subjected to statistical analysis using one -way analysis of variance (ANOVA) and Duncan's multiple range test to assess the significance of individual variations between the groups. Decan's test was considered at the level of P < 0.05.

3. RESULTS

3.1 Phytochemical Screening of Aqueous Extract of *Ferula asafoetida*

Amino acids are less in concentration of *Ferula asafoetida*. Proteins are more in concentration of *Ferula asafoetida*. Flavonoids are more in concentration of *Ferula asafoetida*. Alkaloids are more in concentration of *Ferula asafoetida*. Terpenoids are more in concentration of *Ferula asafoetida*. Saponins are more in concentration of *Ferula asafoetida*. Steroids are more in concentration of *Ferula asafoetida*. Carbohydrates are less in concentration of *Ferula asafetida*.

Fig. 1 represents antioxidant potential of aqueous extracts of *Ferula asafoetida* with standard Ascorbic acid- DPPH Assay. X axis

represents concentration in $\mu\text{g/ml}$ and y axis represents the inhibitory potential of the extracts. Blue bar represents standard ascorbic acid and orange bar represents aqueous extracts of *Ferula asafoetida*. Each bar represents Mean \pm SEM of 3 independent observations. Significance at $p < 0.05$

Fig. 2. Represents xanthine oxidase inhibitory potential of aqueous extracts of *Ferula asafoetida* with standard Allopurinol. X axis represents concentration in $\mu\text{g/ml}$ and the y axis represents the inhibitory potential of the extracts. Green bar represents standard drug Allopurinol and red bar represents aqueous extracts of *Ferula asafoetida*. Each bar represents Mean \pm SEM of 3 independent observations; Significance at $p < 0.05$.

4. DISCUSSION

The phytochemical screening showed that the extract is rich in protein, flavonoids, alkaloids, terpenoids, saponins, steroids (Table 1). Free radicals and other reactive oxygen species by-products might be generated by living cells as a result of physiological and biochemical processes. These can cause oxidative damage to the biomolecules like lipids, proteins and DNA, which can lead to many chronic diseases, such as diabetes, cancer, aging, and other degenerative diseases [33]. Medicinal plants contain biologically active compounds known as phytochemicals which constitute a broad spectrum of chemical structures that have disease preventative properties. Thus, preliminary phytochemical screening of plants is an important aspect in determining the chemical constituents in plant materials [34]. The presence of phytochemicals in the asafoetida extract might

have contributed to the wide range of its therapeutic properties.

The extract also possesses significant antioxidant activity as evident from the DPPH radical scavenging activity (Fig. 1), although the activity is less compared to standard vitamin-C. Natural antioxidants present in medicinal plants can help to prevent oxidative damage and reduce the risk of diseases [35]. The continued search among plant secondary metabolites for natural antioxidants has gained importance in recent years because of the increasing awareness of herbal remedies as potential sources of phenolic oxidants [36]. The antioxidant activity of our extract also accounts for its disease preventive activity.

The study also established the *in vitro* xanthine oxidase inhibitory potential of *Ferula asafoetida* extract (Fig. 2). The activity of the extract is compared with the standard drug allopurinol. Allopurinol is an important clinically used inhibitor of xanthine oxidase that is used in the treatment of gout [37]. However, the use of this drug is associated with various side effects such as hepatitis, nephropathy, and allergic reactions [38]. Thus, the search for novel xanthine oxidase inhibitors with a greater therapeutic activity and lesser side effects are desired not only to treat gout but also for preventing other diseases associated with the xanthine oxidase activity [39]. Since our extract is having inhibitory activity towards xanthine oxidase and is natural in origin, it can be used to treat gout if detailed studies were done on the plant. From these investigations, we can say that asafoetida possesses significant antioxidant activity due to presence of various phytoconstituents and it could be a resource of new antioxidant compounds.

Table 1. Phytochemical screening of aqueous extract of *Ferula asafoetida*

S.No	Phytochemical	Presence
1	Amino acid	-
2	Proteins	+
3	Flavonoids	+
4	Alkaloids	+
5	Terpenoids	+
6	Saponins	+
7	Steroids	+
8	Steroids	+
9	Carbohydrates	-

Antioxidant potential of aqueous extract of *Ferula asafoetida*

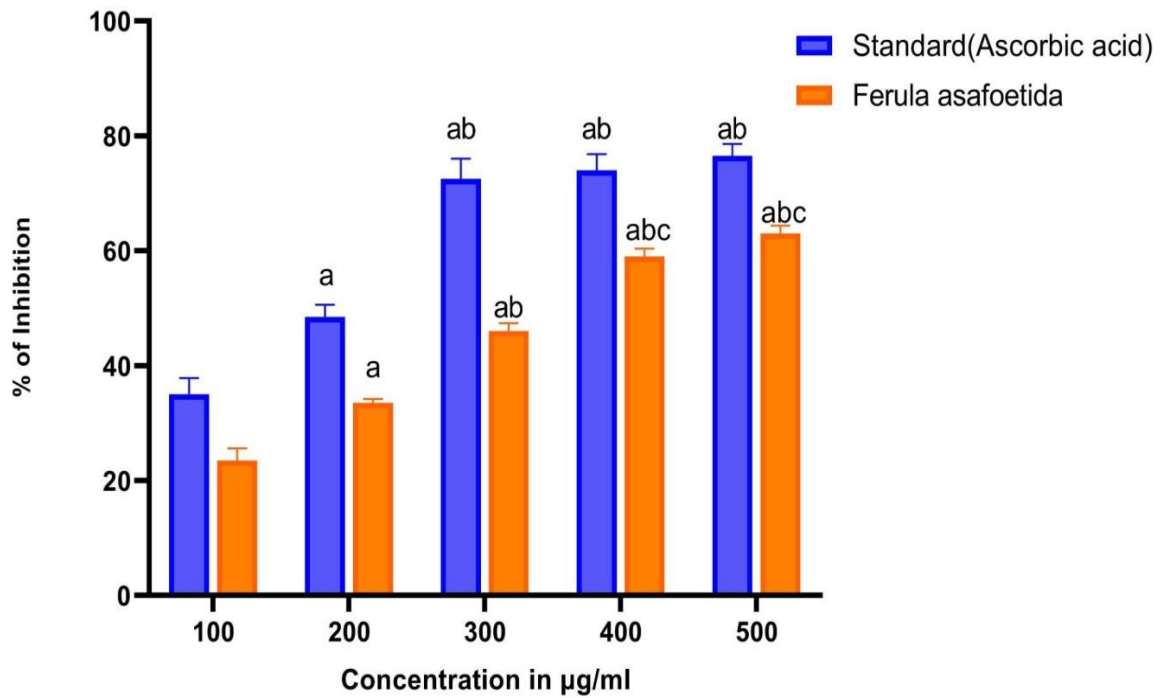


Fig. 1. *In vitro* antioxidant activity of *Ferula asafoetida*

Xanthine oxidase inhibitory potential of aqueous extract of *Ferula asafoetida*

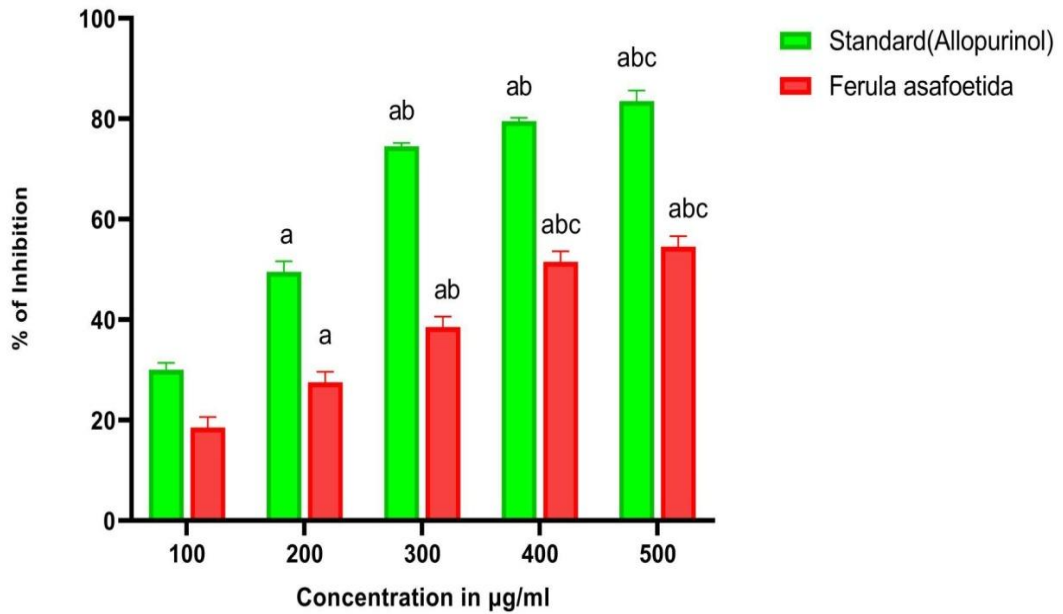


Fig. 2. *In vitro* xanthine oxidase inhibitory activity of *Ferula asafoetida* extract

5. CONCLUSION

The study can be concluded that aqueous extract of *Ferula asafoetida* possessed potent *in vitro* antioxidant and antigout activities. Further studies on the therapeutic role of *F. asafoetida* on *in vitro* cell lines and animal experiments need to be done in order to ascertain the potential of this extract towards the development of new drug.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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