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Assessment of Total Phenolic Content, *In-Vitro* Antioxidant, Anti-Inflammatory and A-Amylase Inhibitory Activity of Aerial Parts of *Alhagimaurorum*

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Abstract: *Alhagimaurorum* is a folklore medicinal plant and a member of family Leguminaceae, the present study investigates *in-vitro* antioxidant activity, *in-vitro* anti-inflammatory activity, α- amylase inhibitory activity and total phenolic content from the aerial parts of *Alhagi maurorum*. Ethanolic extract 50% v/v of the aerial part of *Alhagi maurorum*(AMEE) was obtained by hot percolation method at 60^0C. AMEE was subjected for liquid-liquid partitioning to obtain various fractions such as ethyl acetate (AMEA), chloroform (AMCF), methanol (AMMF) and aqueous (AMAF) fractions. The ethanolic extract AMEE and its fraction AMEA were subjected for total phenolic content, preliminary phytochemical screening, *TLC-vitro* antioxidant activity, *in-vitro* anti-inflammatory activity and α-amylase inhibitory activity. Folin-Ciocalteu reagent was used to estimate total phenolic content. DPPH was used to determine *in-vitro* antioxidant activity. Acarbose was used to determine α-amylase inhibition and anti-inflammatory activity of aerial part was investigated by protein denaturation method. Phytochemical analysis of extract and its fraction showed presence of major classes of phytochemicals such as alkaloids, carbohydrates, tannins, flavonoids, steroids. Aerial parts of *Alhagi maurorum* were found to contain 4.049 mg/g and 4.053 mg/g of Gallic acid equivalent of total phenolic in ethanolic extract and its ethyl acetate fraction respectively. But exhibited moderate antioxidant activity. Determination of the type of α-amylase inhibition by these plant extract and its fraction could provide by successful use of plant chemicals as drug targets. The results showed that the *in-vitro* antioxidant activity, anti-inflammatory activity and α-amylase inhibitory activity of plant extract and its fraction was 50± 76.8 significant. It was concluded that a vast number of pharmacological and medicinal properties of Alhagi species make these plants a desirable source for development of new drugs.

Keywords: Antioxidant, Anti-inflammatory, α-amylase inhibitory, DPPH, Total phenolic content, AMEE, AMEA.

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1. INTRODUCTION

Medicinal plants have been known for millennia and are considered as a rich source of pharmaceutical agents for the prevention and treatment of diseases and ailments. According to WHO, more than 80% of the population within developing countries uses herbal and other traditional medicines to treat their common ailments. Natural products have interesting and useful biological activities and they also perform various functions. Researchers are increasingly turning their attention towards natural products in order to develop better drugs against cancer, as well as viral and microbial infections. There are more than 35000 plant species which are used in different human cultures around the world for medicinal purpose. According to both recent and previous investigations, phenols, polyphenols and flavonoids are natural antioxidant products of plants and they are present in different concentrations mostly in medicinal plants[2].*Alhagimaurorum* is a perennial plant. It grows from a massive rhizome system which may extend to about six feet into the ground. It is used as diaphoretic, diuretic, expectorant and in treatment of ulcers. The plant is normally used in folk medicine as a remedy for rheumatic pains, bilharziasis, and various types of gastrointestinal discomfort and in diseases of the urinary tract and liver[-5] Oil from the leaves of the plant is used for the treatment of rheumatism, while the flowers of the plant are used for the treatment of piles. It is also used as laxative. Conventional cough syrups have sedatives, anti-allergic nerve-soothing drugs which cause drowsiness. They are not recommended for people with cardiac problems, but a herbal cough syrup using *Alhagi maurorum* has been reported to overcome the above mentioned shortcomings of conventional cough syrups. There has been a remarkable interest in this plant as evidenced by its use in traditional and folkloric systems of medicine[3].This family is rich in edible medicinal plants as raw materials in the pharmaceutical industries. The antiulcerogenic effect for the plant has also been reported. Chemical investigation of *Alhagi* species revealed the presence of fatty acids, sterols, flavonoids, coumarins, alkaloids and vitamins [4].*A. Maurorum* Medik, is known as *Alhagipseudalhagi* (Bieb.) Desv, *Alhagicamelorum* Fisch.ex DC found in Gujarat, Uttar Pradesh, Rajasthan and Punjab[5].Traditionally the plant is used as laxative, antibilious, diuretic, diaphoretic and expectorant. The leaves of the plant are used for fever, headache and rheumatism. lowers of the plant are used as blood coagulant and piles[6].The plant is also used in the treatment of Quinone reductase inducing activity[7].Phytochemical studies on this plant have showed the presence of Kampferol, chrysoeriol, isohamnetin, chrysoeriol-7-oxyloside, kaempferol-3-galacto rhamnoside , isohamnetin 3-o-ß-D-apio-furanosyl (1-2) ß-D-galactopyranoside, alhagitin, alhagidin[8], Rutin, ferulic acid, isorhamnetin, 5- hydroxymaltol[9], ß-phenethylamine, N-methylß-phenethylamine, N-methyl-tyramine, hordenine, 3:4 -dihydroxy-ß-phenethyltrimethylammonium hydroxide,3-methoxy-4-hydroxy-ß-phenethyltrimethyl ammoniumhydroxide, N-methyl mescaline, solsolidine[10] and proanthocyanidins[10]Lupeol, a bioactive triterpenoid, has been isolated from the root barks of the plant. Previous reports of this plant showed that its extracts were used for anti-inflammatory, antidiarrheal, antinociceptive, antioxidant, antiproliferative, hepatoprotective activity and antiarthritic activity. The plant is used as laxative, diuretic and expectorant in Rajasthan. Leaves are smoked in the treatment of asthma in Mount Abu, Rajasthan, administered orally in fever and applied for the treatment of haemorrhoids by indigenous people of Saurashtra region of Gujarat. In Mewat, Gurgaon district, Haryana leaves are given to cure chest pain and headache and in Rajasthan leaves are given for cure of rheumatism. Oil from leaves is used in rheumatism and flowers are used for piles. Crushed flowers along with sugar are taken orally to cure bleeding piles in the Shekhawati region of Rajasthan. The flowers are used to cure haemorrhoids in Rajasthan. Water extract of roots is used to enlarge the ureter and to remove kidney stones. In China, the plant is used for the treatment of rheumatism and cancer while the secretion of aerial part of plant, called "*alhagi* sugar", is used as a kind of Uygur ethno medicine to treat neurogenic headache. In Turkmen Sahara region of North of Iran, concentrated decoction of flowers, leaves and roots are used to treat haemorrhoids, cardiac pains and dysuria.[10] People of Karat and Khuzdar regions of Baluchistan, Pakistan use powder of flowers ground in sugar for improvement of eyesight, powder of dry flowers in stomach ache and water extract of roots for liver complaints[11].Pharmacological studies [12] have demonstrated that Alhagi maurorum known to possess antiulcer genic, anti-inflammatory, anti-microbial, hepato protective, anti arthritic, antioxidant and antitumor activities. An Antioxidant is a molecule capable of inhibiting the oxidation of other molecules. These biological activities could be attributed to the presence ofsecondary plant metabolites present in Alhagimaurorum such as carotenoids, vitamins, minerals, amino acids, sterols, glycosides, alkaloids, flavonoids and phenolic etc. Harmful stimuli including pathogens, irritants or damaged cells initiate response of vascular tissue as inflammation. Inflammation is a protective attempt by the organism to remove injurious stimuli as well as initiate the healing process for the tissue. However, if inflammation is not treated it leads to onset of diseases like vasomotor rhinorrhoea, rheumatoid arthritis and atherosclerosis. Present study was conducted to identify the major classes of phytochemicals present in the aerial parts of Alhagi maurorum, to estimate total phenolic content and radical scavenging activity and to evaluate anti-inflammatory activity of *Alhagi maurorum* against denaturation of protein in search of potent anti-inflammatory agent from natural source and determination of the of α-amylase inhibition by these plant.

2. MATERIALS AND METHODS

2.1 Plant Material

The aerial parts of plant *Alhagimaurorum* were collected during the month of May 2017 from the local surroundings (banks of river Ganga) in Allahabad, Uttar Pradesh. Further taxonomic identification was conducted by Dr. G.P. Sinha, Scientist, Botanical Survey of India, CRC, Allahabad (U.P.) with accession No. (BSA-95441) and the specimen was deposited in the herbarium of BSI for future reference.

2.2 Drugs, Chemicals And Instruments

Acarbose and Diclofenac sodium were purchased from Sir Sunderlal Hospital, BHU Varanasi. 1,1Diphenyl-2-picrylhydrazyl (DPPH), Gallic acid, Folin-Ciocalteu reagent, Butylated hydroxyl toluene (BHT) was obtained from School of Basic Science, SHUATS, Allahabad. All the other chemicals used were of AR grade and were purchased from Merck specialities, Mumbai, India. The instruments used were UV-VIS spectrophotometer (Systronics).

2.3 Preparation Of Extract And Its Fractions

The aerial parts of the plant were dried under shade andpowdered. Pulverized plant material (500 gm) wasxtracted out using Soxhlet extractor at 60 °C using 50% v/v ethanol.The percentage yield was found to be 52% w/w. The ethanolic residue obtained after extraction was mixed with distilled water and by means ofsuccessive liquid–liquid partitioning with chloroform, ethylacetate and methanol. The fractions obtained were subjected to concentrated on rotavapour (Buchi, USA) ata temperature of < 40 °C and then dried in lyophilizer (Labconco,USA) under reduced pressure . The crude extract and fractions were used for preliminary phytochemical screening, TLC and *in-vitro* studies.

2.4 Phytochemical Screening

The dried crude extract and its fractions were analysed for the presence of various classes of active chemical constituents such as tannins, saponins, glycosides, flavonoids, alkaloids, terpenes and steroids **(Atta et *al.*, 2004)[13].**

2.5 Thin Layer Chromatography

Thin layer chromatography (TLC) was performed on AMEE and the entire fractions of plant by using Silica Gel as the stationary phase **(Gocan 2002)**. The plates were observed under UV chamber at 365 nm for the presence of spots using Ethyl acetate: methanol (9:1v/v) as mobile phase. Four fractions of AMEE including AMC, APEA, APM and APA were screened for the presence of phytochemical constituents like **Alkaloids**, **Flavonoids** etc and analysed by TLC. In AMEE, four spots and in APEA, seven spots of phytochemical constituents were observed at 354 nm hence selected for anti-inflammatory activity

2.6 Determination Of Total Phenolic Content

The total phenolic content for ethanolic extract and its fractions were determined by using Folin-Ciocalteu reagent. Estimation of total phenolic content, in-vitro antioxidant and antiinflammatory activity of flowers of Moringa oleifera,[10]**.** Gallic acid was used as a reference standard. An aliquot of 0.5 mL of the plant extract (100 µg/mL) was mixed with 2 mL of the Folin-Ciocalteu reagent (diluted 1:10 with de-ionized water) and 4 mL of (7.5% w/v) sodium carbonate solution. The reaction mixture was incubated at room temperature for 30 min. The absorbance of the resulting blue colour solution was measured at 765 nm using double beam UV-VIS spectrophotometer. The total phenolic contents were assessed by using a standard curve of Gallic acid. The content of total phenolic compounds expressed as mg/g Gallic acid equivalent (GAE) of dry extract and fraction.

2.7 Determination Of Antioxidant Activity By DPPH-Scavenging Assay

The free radical scavenging activity of the extract and fraction of aerial parts of *Alhagimaurorum* and of standard solution (BHT) were investigated using 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging method[12]**.**The assay mixture contained 2 mL of 1.0 mmol/L DPPH radical solution and 1 mL of ascorbic acid standard solution or extract or fractions solution of different concentrations (10-500 µg/mL). The solution was mixed and incubated in dark at 37 °C for 20 min. The decrease in absorbance of each solution was measured at 517 nm using UV/Vis spectrophotometer. The percentage of radical scavenging (%) was calculated by the following formula:

$$\%\ \boldsymbol{Freeradicalscavengingactivity} = \frac{\boldsymbol{A_s - A_t}}{\boldsymbol{A_s}}\boldsymbol{X100}$$

Where, A_s=Absorbance of standard solution at 517 nm; A_t= Absorbance of sample.
The (IC_{50}) was estimated from the curve plotted between percent inhibitions against the respective concentration.

2.8 Evaluation Of In- Vitro Anti-Inflammatory Activity

Anti-inflammatory activity of the aerial parts of AMEE and its fraction were determined by protein denaturation method[10]**.**Diclofenacsodium was used as a standard drug. 2 mL of different concentrations of AMEE, its fraction (100-500 µg/mL) or standard solution (100 and 200 µg/mL) and 2.8 mL of phosphate buffered saline (pH 6.4) was mixed with 2 mL of egg albumin (from fresh hen's egg) and incubated at (27±1) °C for 15 min. Denaturation was induced by keeping the reaction mixture at 70°C in a water bath for 10 min. After cooling, the absorbance was measured at 660 nm (n=3). The percentage inhibition of protein denaturation was calculated using :

$$\%\ \boldsymbol{Freeradicalscavengingactivity} = \frac{\boldsymbol{A_t - A_s}}{\boldsymbol{A_s}}\boldsymbol{X100}$$

Where, A_t=absorbance of test sample; As=absorbance of standard solution.

2.9 A-Amylase Inhibitory Activity

The enzyme solution (0.5 unit/ml) was prepared by mixing 0.001g of α-amylase in 100ml of 20 mM sodium phosphate buffer (pH 6.9) containing 6.7 mM sodium chloride. The extract or fractions were dissolved in DMSO to give suitable concentrations for the assay. The colour reagent was a solution containing 96mM 3,5-dinitrosalicylic acid (20ml), 5.31 M sodium potassium tartrate in 2M sodium hydroxide (8ml) and deionised water (12ml). One ml of each of the extracts or fractions and 1ml of the enzyme solution were mixed in a test tube and incubated for 30min. To 1ml of this mixture was added 1ml of starch solution and the tube was further incubated for 3 min. Then, 1ml of the colour reagent was added and the stopper tube was placed into an 85 ^{0}C water bath. After 15 min, the reaction mixture was removed from

the water bath and cooled thereafter, diluted with 9 m distilled water and the absorbance value determined at 540 nm using UV/Vis spectrophotometer. Negative control experiment was conducted in an identical manner, replacing extracts or fractions with 1ml DMSO. Acarbose solution would be used as positive control. The inhibition % of α-amylase will be assesses by the following formula-

$$\alpha\text{- amylase \%} = 100\times (A_C - A_S) / A_C$$

Where, A_C = Absorbance of control at 540 nm; A_S = Absorbance of sample.

The α-amylase % will be plotted against sample concentration and a logarithmic regression curve will be obtained in order to calculate the IC_{50} value which is the concentration of sample (mg/ml) necessary to decrease the absorbance of α-amylase solution by 50%. **(Dastjer diet *al.*, 2015).**

3. STATISTICAL ANALYSIS

The results are expressed as mean±SD, n= 3, Student's t- test was used to analyse level of statistical significance between groups, $p < 0.05$ was considered statistically significant.

4. RESULTS

4.1 Phytochemical Screening

Preliminary phytochemical analysis of the extract and its fraction showed the presence of major classes of phytochemicals such as tannins, alkaloids, flavonoids, carbohydrates etc (Table 1)

Table 1. Preliminary phytochemical analysis of aerial parts of plant extract and fraction

Phytochemical Test	Name of the test	Ethanol Extract	Ethyl acetate fraction
Alkaloids	Mayer's test	+	+
Carbohydrates	Fehling's test	+	+
	Mayer's test	+	+
Tannins	Acetic acid test	-	-
	Lead acetate test	+	+
Saponins	Froth test	-	-
Total phenols	Ferric chloride test	+	-
Flavonoids	Sodium hydroxide test	+	+
Steroids	Salkowski test	+	+
Coumarins	Sodium hydroxide test	+	+
Fat & Oil	Filter paper test	-	-

4.2 Thin Layer Chromatography (TLC)

Thin layer chromatography of the 50% ethanolic extract of aerial parts of plant on silica plate using ethyl acetate: methanol (9:1) as mobile phase shows four spots at R_f0.38 (purple), 0.91 (faint purple), 0.96 (purple), 0.98 (pink) and its ethyl acetate fraction shows seven spots at R_f0.43(red), 0.67(yellow), 0.78(brown), 0.82(pink). 0.87(pink), 0.93(purple), 0.97(red) are visualized by projecting ultraviolet light onto the sheet at 365 nm. The ethanoic extract and its ethyl acetate fraction showed maximum number of phytochemicals and spots. Hence, AMEE and AMEA were selected for further activity.

4.3 Total Phenolic Content

The total phenolic content expressed in terms of GAE and yield (%) of aerial parts of plant ethanolic extract and its ethyl acetate fraction was found to be (4.049±0.03) mg of GA/g, 0.404% (w/w) and (4.053±0.05) mg of GA/g, 0.405% (w/w) respectively. The total phenolic contents were calculated using the following linear equation based on the calibration curve of Gallic acid; $Y= 0.015X+0.072$, $R^2=0.995$ Where, Y is absorbance and X is amount of Gallic acid in µg.

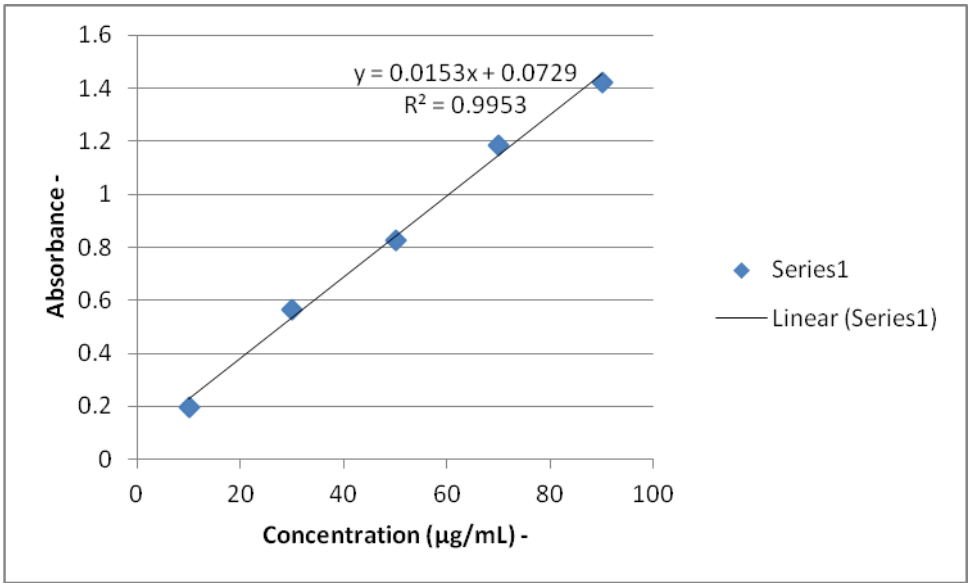

Fig 1: Standard graph of Gallic acid.

4.4 DPPH Free Radical Scavenging Activity

The scavenging effect of different concentration of aerial parts of *Alhagimaurorum*plant extract and its ethyl acetate fraction on the DPPH free radical was compared with standard anti-oxidant, BHT. The results were expressed as inhibition (%) shown in (Table 2& Figure 2).

Table 2. Percentage inhibition of DPPH free radical of aerial parts of *Alhagimaurorum* plant extract/ ethyl acetate fraction/ BHT at 517 nm.

Concentration	Percentage inhibition of DPPH		
(µg/mL)	BHT	Ethanol extract	Ethyl acetate fraction
10	40.55±0.81	4.89±1.02	8.01±0.50
30	41.55±0.40	7.33±0.41	10.99±0.41
50	44.19±0.41	9.50±0.51	13.03±0.93
70	49.89±0.61	10.59±0.61	15.81±0.71
90	50.91±0.20	15.27±0.20	17.44±0.81
IC_{50} value	80	-	-

Values are mean±SD, n= 3.

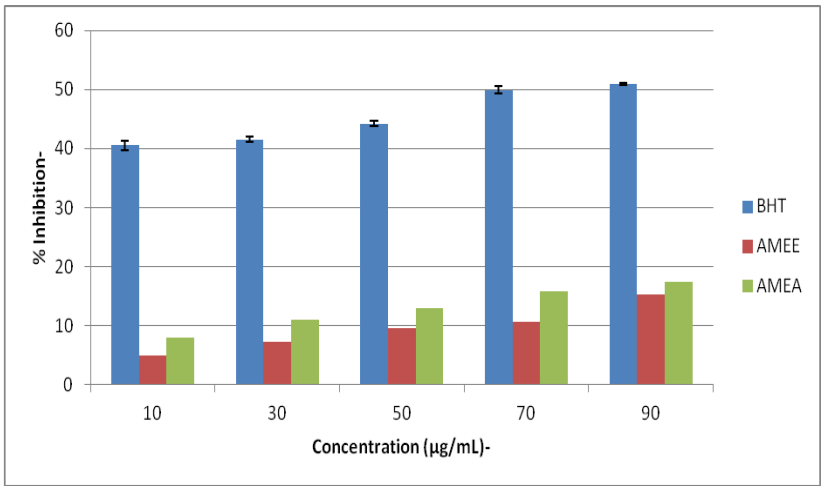

Fig 2: DPPH scavenging activity of BHT, plant extract and its fraction.

4.5 In-Vitro Anti-Inflammatory Activity

The inhibitory effect of different concentrations of aerial parts of *Alhagimaurorum*ethanolic extract and its ethyl acetate fraction on protein denaturation are shown in (Table 3& Figure 3). Aerial parts of *Alhagimaurorum*ethanolic extract and its ethyl acetate fraction (100-200µg/mL) showed significant inhibition of denaturation of egg albumin in a dose dependent manner. The *in-vitro* anti-inflammatory activity of the extract and its fraction was comparable to the diclofenac sodium, a reference drug. A significant difference in the inhibition of thermally induced protein denaturation was observed in case of extract and its fraction when compared with standard drug at concentration of 100 µg/mL. Though at concentration of 200 µg/mL, inhibition activity of extract and its fraction and diclofenac sodium were comparable.

Table 3. *In-vitro* anti-inflammatory effect of aerial parts of *Alhagi maurorum* ethanolic extract and its ethyl acetate fraction.

Treatment	Concentration (µg/ML)	Inhibition of protein denaturation (%)
Ethanolic extract	100	61.42±0.06
	200	62.03±0.48
Ethyl acetate fraction	100	62.13±1.40
	200	72.49±0.57
Diclofenac sodium	100	81.75±1.09

Values are mean±SD, n=3.

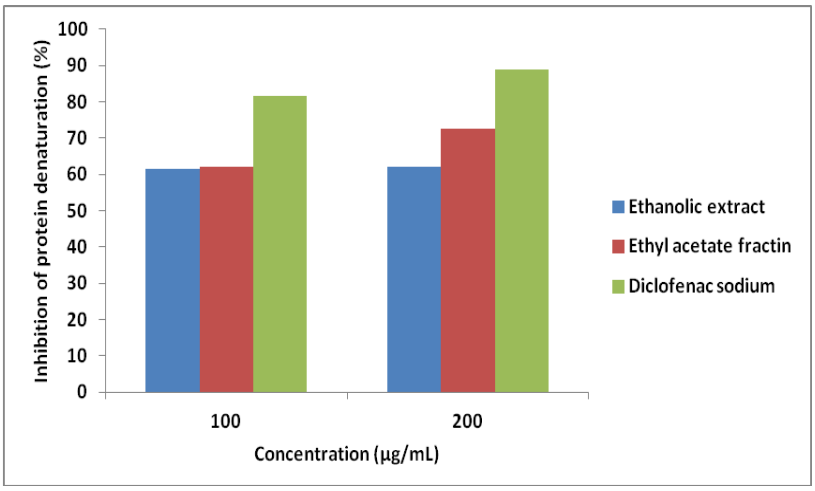

Figure 3: Inhibition of protein denaturation of standard diclofenac sodium, plant extract and its fraction.

4.6 A-Amylase Inhibitory Activity

The inhibitory activity of the ethanolic extract and its ethyl acetate fraction obtained from *Alhagi maurorum* were investigated on the α-amylase enzyme and IC_{50}values were calculated. The percentage inhibition and IC_{50} value displayed by each extract and its fraction is shown in (Table 4& Figure 4).

Table 4.Percentage inhibition of α-amylase inhibitory effect of aerial parts of *Alhagi maurorum* ethanolic extract/ ethyl acetate fraction/ Acarbose at 540 nm.

Concentration	Percentage of inhibition		
(µg/mL)	Acarbose	Ethanol extract	Ethyl acetate fraction
10	23.65±4.92	19.14±0.67	49.67±0.64
15	24.73±1.86	20.36±1.5	52.04±0.18
20	41.93±3.22	39.24±1.62	54.18±1.93
25	53.76±1.86	52.58±0.3	54.64±0.39
30	66.66±1.85	58.49±2.07	72.47±6.58
IC_{50} value	24.5	23.5	11

Values are mean±SD, n=3.

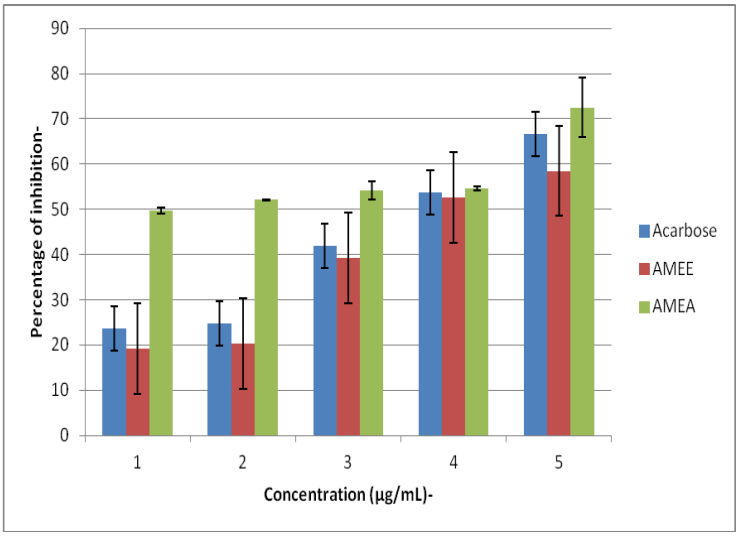

Fig 4: α-Amylase inhibitory activity of Acarbose, plant extract and its fraction.

5. DISCUSSION

Medicinal plants since ancient time are lauded for their diverse pharmacological actions which could be attributed to the presence of secondary plant metabolites such as alkaloids, flavonoids, steroids etc. Some of these plants are important source of natural antioxidants that have been shown to reduce the risk and progression of certain acute and chronic diseases such as cancer, heart diseases and stroke by scavenging free radicals which are implicated in the pathogenesis of many diseases [13]. The result of preliminary phytochemical screening confirmed the presence of various classes of secondary metabolites in *Alhagi maurorum* aerial parts ethanolic extract and its ethyl acetate fraction. The present study indicated that aerial parts of *Alhagi maurorum* are rich in polyphenols (4.049 mg/g of GAE of dry extract and 4.053 mg/g of GAE of its ethyl acetate fraction). DPPH free radical scavenging activity is an easy and widely used method for testing *in-vitro* antioxidant activity of natural compounds or plant extracts. The antioxidants found in aromatic, medicinal and other plants that act as protective shield in our body against diseases such as arterial, cardiac diseases arthritis, cataracts and also premature ageing along with several chronic diseases. The main characteristics of an antioxidant are its ability to trap free radicals. Free radicals contribute to more than one hundred disorders in humans including nervous system injury, gastritis, cancer and AIDS.DPPH radical scavenging activity of *Alhagimaurorum*aerial part extract and its fraction was compared with standard BHT in this study. Although standard antioxidant had higher scavenging activity at all tested concentrations than the extract and its fraction, the extract and its fraction still showed good free radical scavenging activity. The free radical scavenging property of *Alhagimaurorum*maybe one of the mechanisms by which this plant is effective as a traditional medicine. The consumption of the *Alhagimaurorum*aerial part can be beneficial in preventing oxidative stress related degenerative diseases. Inflammation is a normal protective response to tissue injury and it involves a complex array of enzyme activation, mediator release, fluid extravasations, cell migration, tissue breakdown and repair. It is a complex process, which is frequently associated with pain and involves occurrences such as: the increase in vascular permeability, increase of protein denaturation and membrane alterations. Harmful stimuli including pathogens, irritants or damaged cells initiate response of vascular tissue as inflammation. Inflammation is a protective attempt by the organism to remove injurious stimuli as well as initiate the healing process for the tissue. However, if inflammation is not treated it leads to onset of diseases like vasomotor rhinorrhoea, rheumatoid arthritis and atherosclerosis. Hence, a simple and viable protein denaturation bioassay method was selected to evaluate its potential as anti-inflammatory drug. It is well known fact that denaturation of tissue proteins leads to inflammatory and arthritic diseases. Natural products that can prevent protein denaturation therefore, would be worthwhile for development of anti-inflammatory drug therapy. *Alhagimaurorum*aerial part ethanolic extract and its ethyl acetate fraction and reference drug diclofenac sodium exhibited dose dependent percentage inhibition of heat induced protein denaturation in fresh egg albumin. Percent inhibition of protein denaturation with respect to control is a measure of protein stabilization. Although *Alhagimaurorum*aerial part extract and its ethyl acetate fraction showed a moderate free radical scavenging activity, its effect on inhibition of protein denaturation was found to be comparable with the standard drug diclofenac sodium. Thus it can be concluded that anti-inflammatory activity of *Alhagimaurorum*aerial part could be due to their high phenolic content. Diabetes mellitus is a chronic metabolic disorder identified by hyperglycemia due to insulin insufficiency and/or insulin resistance contributing to excess blood glucose. It affected approximately 171 million people all around the world in the year 2000 and the number is projected to increase to around 366 million by 2030. Management of the blood glucose level is an essential approach in the control of diabetes complications. Inhibitors of carbohydrates hydrolysing enzymes (α-amylase and α-glycosidase) have been helpful as oral hypoglycaemic medicines for the control of hyperglycemia exclusively in patients with type-II diabetes. The outcomes of this study show that the administration of *Alhagimaurorum*species may possibly control the postprandial blood glucose ranges and confirm the use of these herbs suggested as a treatment of diabetes in traditional medicine. Extract and its fraction displayed a good inhibitory activity on α-amylase. Generally, us *in-vitro* studies indicated that *Alhagimaurorum*can function as organic α-amylase inhibitors and might possess beneficial antidiabetic property in the type-II diabetes mellitus.

6. CONCLUSION

The present study revealed that the a of *Alhagimaurorum*ethanolic extract (AMEE) and its ethyl acetate fraction (AMEA) possess a wide range of pharmacological effects, the most important of which include Anti-inflammatory, Antioxidant and α-Amylase inhibitory activities. These species have been traditionally used for stomach complaints, to relieve pain and to control diabetes complications. A vast number of pharmacological and medicinal properties of Alhagi species make these plants a desirable source for development of new drugs.

7. AUTHOR CONTRIBUTION STATEMENT

ReenaS.Lawrence[1] and Shradhanjali Singh[2].conceived of the presented idea. both developed the theory and performed the computations. Divya Patel and Shradhanjali Singh[21]verified the analytical methods. Reenalawrence. to investigate and supervised the findings of this work. Amrita raj discussed the results and contributed to the final manuscript All authors carried out the experiment and discussed the results and contributed to the final manuscript.

8. CONFLICT OF INTEREST

Conflict of interest declared none.

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