

Comparative evaluation of the anti-free radical and antibacterial properties of aqueous extracts of *Basella alba*, *Commelina benghalensis* and *Portulaca oleracea*'s mature leaves and their micro-green leaves.

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Abstract

Basella alba, *Commelina benghalensis* and *Portulaca oleracea* are commonly known as weed plants but they contain large amount of antimicrobial and antioxidant properties, because they include essential components including carbs, protein, amino acids, vitamins, minerals, fiber, phytochemicals, and antioxidant molecules, researchers show that green leafy vegetables provide health and medical benefits beyond their fundamental nutritional worth. They have a very high nutritional value and are quite easy to grow. The native and tribal communities' way of life and economy depend heavily on Chhattisgarh's natural greenery. Vegetable greens and herbs known as micro-greens are picked as soon as a plant's first genuine leaves appear. Tiny, delicate greens called micro-greens are used to garnish a range of main courses and to add color, texture, and flavor to salads, because micro-greens have higher concentrations of bio-active ingredients like vitamins, minerals, and antioxidants than mature greens, all of which are good for human health, micro-green intake has increased recently. Therefore, a comprehensive review was conducted to comprehend its advantages and the ongoing research on the subject.

In our research we used our three plant's mature and micro-green leaves for comparative study in major subject like antioxidant properties and anti-bacterial properties. We used DPPH assay for antioxidants testing and *E. coli* and *S. aureus* bacteria for anti-bacterial property testing by performing disc diffusion method. In final result *B. alba* and *P. oleracea* has more antioxidants and antimicrobial quality than *C. benghalensis*.

Key words- Antioxidants, antimicrobial, micro-green, *E. coli*, *S. aureus*, *Basella alba*, *Commelina benghalensis*, *Portulaca oleracea*

Introduction

In India, the leaves of several wild and cultivated plants are consumed as vegetables. They have a very high protective food value and are quite easy to grow. The economy and manner of life of the tribal and local inhabitants in Chhattisgarh are significantly influenced by the state's natural vegetation. Leafy vegetables are essential to the local and tribal population's nutritional needs in rural parts of Chhattisgarh. Leafy vegetables contribute greatly to the population's nutrition throughout the year in addition to supplying a substantial amount of food.

The people of the state of Chhattisgarh practise the scientific benefit of leafy vegetables as a traditional value passed down from generation to generation.

Some green vegetables have the following traditional values:

Portulaca oleracea: with a high concentration of vitamin C and omega fatty acids, *Portulaca oleracea*, also known as gol bhaji, is well known for its anti-inflammatory, muscle-relaxing, and diuretic properties. (Mohamed A. I., Hussein 1994)

Benghalensis Commelina

The perennial herb *Commelina benghalensis*, also known as kena bhaji, is used in traditional medicine to cure a number of conditions, including leprosy, burns, sore throats, ophthalmia, pain, and inflammation. Methanol is also present. (Ghosh P, Dutta 2019)

Basella alba

Eating poi bhaji, or *basella alba*, helps eliminate anaemia and purify the blood, which cleanses the skin and treats acne and facial scars. Additionally, it may help with respiratory conditions. Numerous respiratory conditions can also benefit from poi leaves. Poi's flavonoids have antioxidant properties as well. Additionally, it boosts immunity and may be beneficial to the heart. Adding it to salads strengthens the digestive system. It also helps a lot with constipation because it contains fibre.

Its ability to treat obesity is its biggest advantage. It has high levels of vitamin C and iron, both of which promote a healthy metabolism. Poi can also help decrease blood pressure; drinking its juice first thing in the morning can do this. Additionally, it may help reduce uric acid levels. (Deshmukh and Gaikwad 2014).

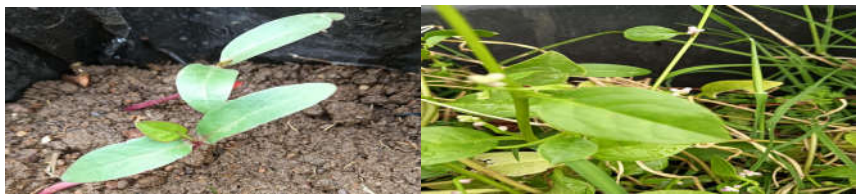


Fig1.1 Microgreens leaf and mature leaf of *Basella alba*



Fig1.2 Microgreens leaf and mature leaf of *Commelina benghalensis*



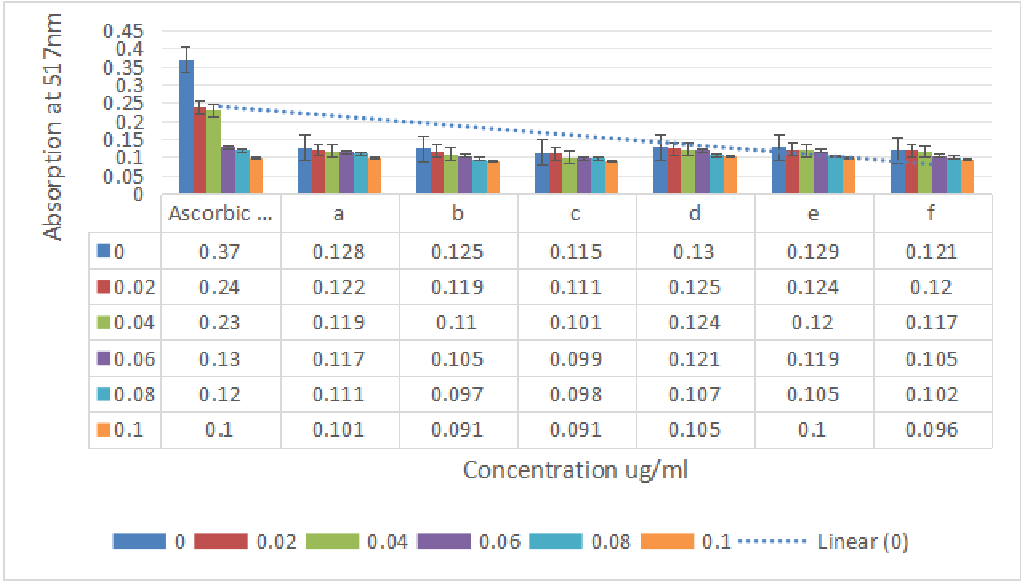
Fig1.3Microgreens leaf and mature leaf of *Portulaca oleracea*

Experimental details ,methods ,materials

Superoxide, peroxides, oxygen, hydroxyl radicals, and reactive oxygen species are among the free radicals that antioxidants protect cells from . DPPH free radical scavenging activity was used in our study to assess the antioxidant activity of our selected leaf samples and micro-greens. When an antioxidant is present, the purple-colored stable free radical molecule DPPH has the potential to be reduced to produce yellow diphenylpicryl hydrazine, which is the basis for DPPH's antioxidant effect. A decrease in the optical density of the DPPH solution indicates an increase in free radical scavenging activity.Ascorbic acid served as the standard, and a DPPH solution served as the control. Microsoft Excel 2010 was utilized for the statistical analysis, and each sample's standard errors were examined using Mean \pm SE.

Table 1.1 Comparative DPPH estimation through UV visible spectroscopy for water extracts of *Basella alba* , *Portulaca oleracea* ,*Commelina benghalensis* leaves and their microgreens from the Mahasamund regions of Chhattisgarh .

S.No	Vol. of Extract (ml)	O.D. (517nm) of standard and leaf extracts with microgreens						
		Ascorbic acid	a	b	c	d	e	f
1.	0.000	0.37	0.128	0.125	0.115	0.130	0.129	0.121
2.	0.020	0.24	0.122	0.119	0.111	0.125	0.124	0.120
3.	0.040	0.23	0.119	0.110	0.101	0.124	0.120	0.117
4.	0.060	0.13	0.117	0.105	0.099	0.121	0.119	0.105
5.	0.080	0.12	0.111	0.097	0.098	0.107	0.105	0.102
6.	0.100	0.10	0.101	0.091	0.091	0.105	0.100	0.096



Graph 1.1: Using the DPPH technique to demonstrate the antioxidant activity of for water extracts of *Basella alba* , *Portulaca oleracea* , *Commelina benghalensis* leaves and their microgreens(where a,b,c are leaves of *B.alba* , *P.oleracea* , *C. benghalensis* and c,d,e are microgreens)

Antioxidants may be the source of bioactive substances like phenol and flavonoids that are present in plants. Plants cannot function as antioxidants without flavonoids and other free hydroxyl groups (Mensor et al., 2001). Using ascorbic acid as a standard, the DPPH technique was used to assess the antioxidant property. To evaluate the antioxidant assay, we combined 1 millilitre of plant material with 3 millilitres of methanol.(Müller et al., 2011)



Fig(a) Fig(b)
Fig1.4(a) Standard /ascorbic acid Showing DPPH assay (b) Showing DPPH assayfor different samples,where a,b,c are leaves of *B.alba* , *P.oleracea* , *C. benghalensis* and c,d,e are microgreens.

Antibacterial activity

Escherichia coli (*E. coli*) and *Staphylococcus aureus*(*S.aureus*), which are pathogenic microorganisms- were employed for comparative antibacterial activity.For the examination of antibacterial properties, we employed the disc diffusion method. In particular, the Disc Diffusion Method ,the bacterial strains that were taken in the incubated petri plate were dispersed using a cotton swab or spreader. The Disc Diffusion Method entails first making a small, spherical disc out of Whatman filter paper number one. Each disc is then dipped into an extract of the leaf samples we have gathered using forceps. The petri plates were split into two equal portions on the outside using a marking pen. One single concentrations of all leaf samples were utilized on one side, and microgreen samples of leaves of same samples were used on another, and a single disc was used in the centre for a comparison analysis with the commercial antibiotic streptomycin.

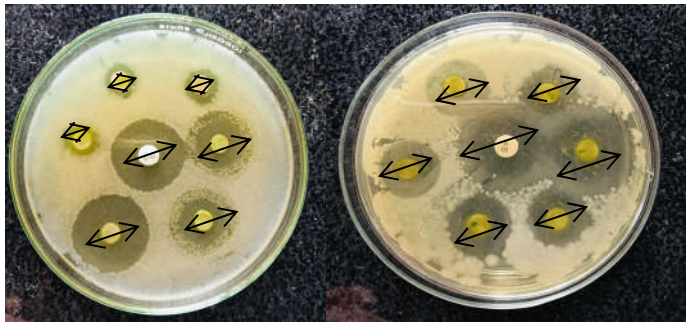


Fig1.5 :Comparative antibacterial activity for *Escherichia coli* (*E. coli*) strain by using disc diffusion method ,here a,b,c are leaves of *Basella alba* , *Portulaca oleracea* ,*Commelina benghalensis* , d,e,f are showing microgreen leaf extract of *B. alba* , *P. oleracea* ,*C. benghalensis* .

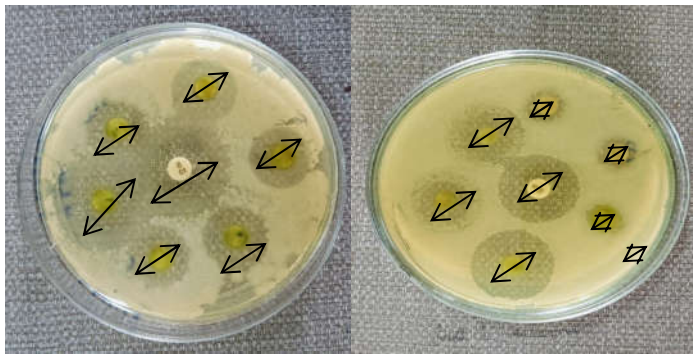


Fig1.6 :Comparative antibacterial activity for *Staphylococcus aureus*(*S.aureus*) strain by using disc diffusion method ,here a,b,c are leaves of *Basella alba* , *Portulaca oleracea* ,*Commelina benghalensis* , d,e,f are showing microgreen leaf extract of *B. alba* , *P. oleracea* ,*C. benghalensis* .

Table 1.2 In following table single concentrations (0.2ul) of extract were used for evaluation and zone of inhibition was measured in mm.

S.No.	Leaf extracts with water solvent	Zone of inhibition of leaf Extract(In mm) at 0.2 µl concentrations	
		<i>Escherichia coli</i> (<i>E. coli</i>)	<i>Staphylococcus aureus</i> (<i>S.aureus</i>)
1.	<i>Basella alba</i> Leaf	6.7	7.3
2.	<i>Basella alba</i> microgreen	8.9	8.1
3.	<i>Portulaca oleracea</i> Leaf	6.8	7.0
4.	<i>Portulaca oleracea</i> microgreen	8.8	8.2
5.	<i>Commelina benghalensis</i> Leaf	3.4	4.5
6.	<i>Commelina benghalensis</i> microgreen	4.5	6.7

Observation and Result

According to our results, *Basella alba* and *Portulaca oleracea*’s leaf and microgreens sample’s antibacterial activity showed the greatest zone of inhibition against *Escherichia coli* (*E. coli*) (6.7mm,8.9 and 6.8 mm ,8.8mm) and *Staphylococcus aureus* (7.3mm,8.1 and 7.0mm , 8.2 mm). Using a straightforward agar well diffusion method, water extract of leaf and micro-greens were investigated at single concentrations 0.2 µl. The highest zone of inhibition was found for the *Basella alba* and *Portulaca oleracea*’s leaf and microgreens samples,It indicates that the leaf sample is more effective at killing microorganisms than the leaf sample from *Commelina benghalensis* . The antioxidant activity of the *Basella alba* and *Portulaca oleracea*’s leaf and microgreens samples were found to be higher than that of the *Commelina benghalensis* leaf sample. This could be due to the

higher concentration of secondary metabolites in the *Basella alba* and *Portulaca oleracea*'s leaf sample, because of stronger antioxidant properties to lessen the generation of free radicals.

Discussion :

We collected leaf samples from Mahasamund district Chhattisgarh. We discovered that the *Basella alba* and *Portulaca oleracea*'s leaf and their microgreens produced the best results, as compared to *Commelina benghalensis*, that allowing for the identification of a large number of secondary metabolites that can be used in medicine to treat a variety of illnesses.

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Discipline

Biotechnology

REFERENCES

1. Banerjee S, Debnath P, Rao PN, Tripathy TB, Adhikari A, Debnath PK. Ayurveda in changing scenario of diabetes management for developing safe and effective treatment choices for the future. *Journal of Complementary and Integrative Medicine*. 2015; 12(2):101-110. Available from: <https://doi.org/10.1515/jcim-2014-0012>.
2. Behravan J., Mosafa F., Soudmand N., Taghiabadi E., Razavi B. M., Karimi G. Protective effects of aqueous and ethanolic extracts of *Portulaca oleracea* L. aerial parts on H₂O₂-induced DNA damage in lymphocytes by comet assay. *Journal of Acupuncture and Meridian Studies*. 2011;4(3):193–197. doi: 10.1016/j.jams.2011.09.008.
3. Deshmukh, S., Gaikwad, D., 2014. A review of the taxonomy, ethnobotany, phytochemistry and pharmacology of *Basella alba* (basellaceae). *J. Appl. Pharma. Sci*.
4. Gallo, Monica et al. "Analysis and Comparison of the Antioxidant Component of *Portulaca Oleracea* Leaves Obtained by Different Solid-Liquid Extraction Techniques." *Antioxidants* (Basel, Switzerland) vol. 6,3 64. 12 Aug. 2017, doi:10.3390/antiox6030064
5. Ghosh P, Dutta A, Biswas M, Biswas S, Hazra L, Nag SK, Sil S, Chatterjee S. Phytomorphological, chemical and pharmacological discussions about *Commelina benghalensis* Linn. (Commelinaceae): A review. *The Pharm Innovation Journal*. 2019; 8(6):12-18.
6. Iranshahy, Milad, et al. "A review of traditional uses, phytochemistry and pharmacology of *Portulaca oleracea* L." *Journal of ethnopharmacology* 205 (2017): 158-172.
7. Karimi G., Aghasizadeh M., Razavi M., Taghiabadi E. Protective effects of aqueous and ethanolic extracts of *Nigella sativa* L. and *Portulaca oleracea* L. on free radical induced hemolysis of RBCs. *DARU, Journal of Pharmaceutical Sciences*. 2011;19(4):295–300.
8. Logisha MSS, Nivetha G, Karpagavalli K, Muthukumar NJ, Mahalakshmi MV, Meenakumari M. A review on antidiabetic herbs of siddha system based on their organoleptic characteristic. *International Journal of Ayurveda and Pharma Research*. 2023; 11(1):87-91. Available from: <https://doi.org/10.47070/ijapr.v11i1.2618>
9. Mohamed A. I., Hussein A. S. Chemical composition of purslane (*Portulaca oleracea*) Plant Foods for Human Nutrition. 1994;45(1):1–9. doi: 10.1007/bf01091224.
10. Müller, L., Fröhlich, K., Böhm, V., 2011. Comparative antioxidant activities of carotenoids measured by ferric reducing antioxidant power (frap), abts bleaching assay (ateac), dpph assay and peroxyl radical scavenging assay. *Food Chemistry*. <https://doi.org/https://doi.org/10.1016/j.foodchem.2011.04.045>.
11. Zhou, Yan-Xi et al. "Portulaca oleracea L.: a review of phytochemistry and pharmacological effects." *BioMed research international* vol. 2015 (2015): 925631. doi:10.1155/2015/925631