Review Article

Bioactivities of *Osbeckia octandra* DC. Extracts

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Abstract

Osbeckia octandra DC. is a small shrub that belongs to the *Melastomataceae* family. This plant species has been used in Sri Lankan Ayurvedic medicine to treat diabetes, hemorrhoids, hepatitis, ascites, jaundice, other liver disorders, and hyperlipidemia. This work aims to present a comprehensive, systematic review of *O. octandra*. The electronic databases, including the Web of Science, Scopus, ScienceDirect, PubMed, and Semantic Scholar, were employed to identify the related published studies of *O. octandra* up to December 2023. Both *in vitro* and *in vivo* studies show that *O. octandra* has antihepatotoxic activity, immunomodulatory activity, antioxidant activity, cholinesterase inhibitory activity, protease inhibitory activity, and hepatoprotective activity. On the other hand, the phytochemistry of *O. octandra* is unknown. Furthermore, none of the active compounds have been identified for their reported pharmacological activities. Hence, further *in vitro, in vivo*, and clinical studies should be conducted on extracts, and active compounds should be identified from these extracts. Only limited scientific evidence is available for the ethnopharmacological uses of *O. octandra*. Therefore, this work provides the basis for carrying out further pharmacological activity research and phytochemistry analyses of this plant species.

Keywords: Ayurveda, hepatitis, *Melastomataceae*, *Osbeckia octandra,* Sri Lanka

Introduction

Osbeckia octandra DC. is a small shrub that belongs to the *Melastomataceae* family. *O. octandra* is native to Sri Lanka, and it has been introduced into Mauritius. Moreover, the synonyms of this plant species are *Alosemis zeylanica* Raf., *Asterostoma octandra* Blume, *Melastoma octandrum* L., *Osbeckia polycephala* Naudin, and *Osbeckia simsii* DC.[6] (Kew Royal Botanic Gardens, 2024). *O. octandra* has been used in Sri Lankan Ayurvedic medicine to treat diabetes, hemorrhoids, hepatitis, ascites, jaundice, other liver disorders, and hyperlipidemia[3] (Institute of Ayurveda and Alternative Medicine, 2024;[5] Jayaweera, 1980).

The aim of this work is to present a comprehensive, systematic review of the bioactivities of *O. octandra* from previously published relevant studies.

Materials and Methods

The electronic databases, including the Web of Science, Scopus, ScienceDirect, PubMed, and Semantic Scholar, were employed to identify the related published studies of *O. octandra* up to December 2023. "*O. octandra*" was used as the search term to carry out the literature search.

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Website: https://journals.lww.com/mtsp

DOI: 10.4103/mtsp.mtsp_5_24

Reported Pharmacological Activities of Osbeckia *octandra*

Reported pharmacological activities of *O. octandra,* including the level of evidence, part used, extract, bioassay or model used, dose or concentration, and reference, are listed in Table 1. *In vivo* and *in vitro* scientific evidence is available for reported pharmacological investigations. Most of the scientific evidence available is at the *in vitro* level, and more studies have been conducted for hepatoprotective activity (Jayathilaka *et al*., 1989;[4] Thabrew *et al*., 1995,[12] 1991;[11] Thabrew *et al*., 1994,[13] 1987;[15] Thabrew and Jayatilaka, 1999).[14] The outcomes from the previously mentioned studies provide scientific evidence for ethnopharmacological uses. For example, as mentioned in the introduction, *O. octandra* is used to treat liver-related

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How to cite this article: Vivekanandarajah S, Shanmugalingam V, Rajamanoharan P. Bioactivities of *Osbeckia octandra* DC. Extracts. Matrix Sci Pharma 2024;8:7-9.

Received: 07-03-2024, **Revised:** 12-03-2024,
Accepted: 04-04-2024, **Published:** 30-05-2024

Table 1: Reported pharmacological activities of various parts of *Osbeckia octandra*

Bioactivity	Level of evidence	Part used	Extract	Assay/model	Reference
Antiangiogenic	*In vivo*	Leaf	Aqueous	Thioacetamide-induced experimental liver cirrhosis	Bogahawaththa *et al*. (2021)[1]
Anticancer	*In vitro*	Leaf	Dichloromethane and methanol	Oral cancer cell	Kim *et al*. (2022)[7]
Anticancer	*In vitro*	Leaf	Aqueous	Oral cancer cell	Prasadani *et al*. (2021)[9]
Antidiabetic	*In vitro*	Leaf	Aqueous	Bovine serum albumin	Perera *et al*. (2013)[8]
Antidiabetic	*In vivo*	Leaf	Aqueous	Normal	Fernando *et al*. (1990)[2]
Antifibrotic	*In vivo*	Leaf	Aqueous	Thioacetamide-induced experimental liver cirrhosis	Bogahawaththa *et al*. (2021)[1]
Antioxidant	*In vitro*	Whole plant	Ethanol	2,2-diphenyl-1-picrylhydrazyl	Samaradivakara *et al*. (2016)[10]
Antioxidant	*In vitro*	Whole plant	Ethanol	Ferric reducing antioxidant power	Samaradivakara *et al*. (2016)[10]
Antioxidant	*In vitro*	Whole plant	Ethanol	Oxygen radical absorbance capacity	Samaradivakara *et al*. (2016) [10]
Antioxidant	*In vitro*	Leaf	Aqueous	2,2'-azinobis (3-ethylbenzothiazoline-6-sulphonic acid)	Perera *et al*. (2013)[8]
Antioxidant	*In vitro*	Leaf	Aqueous	2,2-diphenyl-1-picrylhydrazyl	Perera *et al*. (2013)[8]
Cholinesterase inhibitory	*In vitro*	Whole plant	Ethanol	Acetylcholinesterase	Samaradivakara *et al*. (2016)[10]
Cholinesterase inhibitory	*In vitro*	Whole plant	Ethanol	Butyrylcholinesterase	Samaradivakara *et al*. (2016) [10]
Hepatoprotective	*In vitro*	Whole plant	Aqueous	Luminol-induced chemiluminescence of human polymorphonuclear leukocyte	Thabrew *et al*. (1991)[11]
Hepatoprotective	*In vivo*	Leaf	Aqueous	Carbon tetrachloride-induced liver damaged	Jayathilaka *et al*. (1989)[4]
Hepatoprotective	*In vivo*	Leaf	Aqueous	Carbon tetrachloride-induced liver damaged	Thabrew *et al*. (1987)[15]
Hepatoprotective	*In vivo*	Leaf	Aqueous	Carbon tetrachloride-mediated liver damaged	Thabrew and Jayatilaka (1999)[14]
Hepatoprotective	*In vitro*	Mature leaf	Aqueous	Injury induced by D-galactosamine rat hepatocyte	Thabrew *et al*. (1995)[12]
Hepatoprotective	*In vitro*	Mature leaf	Aqueous	Injury induced by tert-Butyl hydroperoxide rat hepatocyte	Thabrew *et al*. (1995)[12]
Hepatoprotective	*In vivo*	Leaf	Not stated	Paracetamol-induced liver injured	Thabrew *et al*., 1994)[13]
Hepatoprotective	*In vitro*	Leaf	Not stated	Rat hepatocyte	Thabrew *et al*. (1994)[13]
Immunomodulatory	*In vitro*	Whole plant	Aqueous	Luminol-induced chemiluminescence of human polymorphonuclear leukocyte	Thabrew *et al*. (1991)[11]
Protease inhibitory	*In vitro*	Whole plant	Ethanol	Elastase	Samaradivakara *et al*. (2016)[10]
Protease inhibitory	*In vitro*	Whole plant	Ethanol	α-chymotrypsin	Samaradivakara *et al*. (2016) [10]

disorders, and research carried out by Thabrew *et al*. (1994),[13] Thabrew *et al*. (1995),[12] Jayathilaka *et al*. (1989),[4] and Thabrew *et al*. (1987)[15] also showed that this plant species contains hepatoprotective and antihepatotoxic activities. Furthermore, ethanol extract exhibited more bioactivities, and the whole plant of *O. octandra* possesses more bioactivities. However, none of the active compounds have been identified for the reported bioactive investigations. Only the best studies based on the highest level of scientific evidence with the lowest doses, concentrations, and durations are discussed below.

In vivo scientific evidence available

Antiangiogenic activity

The antiangiogenic activity of aqueous leaf extract was studied in thioacetamide-induced experimental liver cirrhosis animals. The extract (500 mg/kg) orally administered for 15 weeks showed antiangiogenic activity. The therapies substantially lowered disease-related modifications such as the weight of the liver and liver enzymes (Bogahawaththa *et al*., 2021).[1]

Antidiabetic activity

Leaf aqueous at a dose of 10 mL/kg was orally administered to rats for 3 h and decreased the elevated blood glucose levels. Tolbutamide was used as a positive control in this research (Fernando *et al*., 1990).[2]

Hepatoprotective activity

Paracetamol-induced liver-injured mice were utilized to study the hepatoprotective activity of leaf extract. A dose of 330 mg/kg of the extract was orally administered. At 24 h following paracetamol administration, oral treatment of the

extract led to significant defense against damage to the liver, overall hepatic glutathione, histology of the liver, and plasma levels of aspartate aminotransferase (Thabrew *et al*., 1994).[13]

In vitro scientific evidence available

Anticancer activity

Leaf aqueous extract showed anticancer activity in oral cancer cells. Cell viability was lowered by extract concentrations that were dosed over time. At 6, 12, and 24 h of incubation, the statistically greatest response occurred at 30 µg/mL of concentration, and a substantial reduction in the movement of cells was noticed. In addition, cell damage to DNA expanded drastically with the concentration gradient, with the biggest effect noticed at 30 µg/mL following 48 h of incubation (Prasadani *et al*., 2021).[9]

Antioxidant activity

An ethanol extract was prepared using the whole plant. The antioxidant activity of the whole plant extract was studied in a 2,2-diphenyl-1-picrylhydrazyl assay. The antioxidant activity was observed at an IC_{50} value of 5.2 µg/mL (Samaradivakara *et al*., 2016).[10]

Cholinesterase inhibitory activity

An investigation was carried out by Samaradivakara *et al*.,[10] 2016, to analyze the cholinesterase inhibitory activity of the whole plant ethanol extract. A concentration of 72 µg/mL (IC_{50}) exhibited cholinesterase inhibitory activity in the acetylcholinesterase inhibition assay.

Immunomodulatory activity

Luminol-induced chemiluminescence of human polymorphonuclear leukocytes (alternative pathway) assay was used to study the immunomodulatory activity of the aqueous whole plant extract. The IC_{50} value of 850 µg/mL had immunomodulatory activity in this research (Thabrew *et al*., 1991).[11]

Protease inhibitory activity

Samaradivakara *et al*. 2016[10] studied the protease inhibitory activity in the elastase activity assay. The whole plant ethanol extract at an IC50 value of 16 µg/mL possessed protease inhibitory activity.

Conclusion

O. octandra has been used to treat various ailments in traditional medicinal systems such as Ayurveda in Sri Lanka. However, only limited studies have been carried out to provide scientific evidence for these ethnopharmacological uses. Previous scientific investigations show that this plant species possesses antihepatotoxic, immunomodulatory, antioxidant, cholinesterase inhibitory, protease inhibitory, hepatoprotective, and antihepatotoxic activities. Thus, this work recommends performing further *in vitro, in vivo*, and clinical investigations of various extracts from various parts of *O. octandra*. Furthermore, pharmacologically active compounds should be identified for utilization in further studies. The phytochemistry of *O. octandra* is unknown. Hence, phytochemical profiles of various parts of this plant species should be found. This work provides the basis for further pharmacological activities for this plant species.

Acknowledgments

The authors are grateful to their family members for their support in delivering this work.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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