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IN VITRO AND *IN VIVO* ANTIINFLAMMATORY ACTIVITY OF THE METHANOLIC EXTRACT OF WHITE OYSTER MUSHROOM *PLEUROTUS FLORIDA* (MONT.) SINGER

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ABSTRACT

In vitro and *in vivo* antiinflammatory activities of methanolic extract of white oyster mushroom *Pleurotus florida* (Mont.) Singer were evaluated. The mushroom extract exhibited significant results for its inhibition of protein denaturation (69.30±4.98% at 1.0mg/ml); inhibition of proteinase activity (27.89±0.14% at 1.0mg/ml) in a dose-dependent manner and also antiinflammatory activity in Carrageenan induced acute inflammatory animal model (50.17% at 200mg/kg b.w). Presence of phytochemicals namely phenols, flavonoids, saponins and tannins may be responsible for such antiinflammatory activity. Results indicate that, white oyster mushroom may be used as a potential antiinflammatory agent.

KEY WORDS: ***Pleurotus florida*, antiinflammatory activity, methanolic extract, phytochemicals, phenols, flavonoids.**

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INTRODUCTION

Mushrooms the macrofungi are used in folk medicine throughout the world since ancient times. They are the nontraditional horticultural crops having a high quality of protein, fibre, carbohydrate, vitamins and minerals, while mushrooms are low in calories and fat including cholesterol[1-3]. In recent years, to unravel the mysteries of mushrooms, especially those used in traditional medicines, mushrooms are being investigated for their many ethnomycological claims of medicinal values. The phytochemical analysis of varieties of mushrooms also showed their medicinal attributes, through the evaluation of various mushroom derived compounds like polysaccharides, triterpenoids, lectins, steroids, proteins and protein bound polysaccharides, which may effect antiviral, antibacterial, antiparasitic, antitumor, antihypertensive, antiobese, antithrombotic, antifibrotic, antiatherosclerosis, hepatoprotective, antidiabetic and antiinflammatory properties[4-7]. The investigation of cultivable mushroom species may yield mycochemicals with novel medicinal components for the development of therapeutic agents in inflammatory and for other ailments[8].

MATERIALS AND METHODS

The fruiting bodies of *Pleurotus florida* [Mont.] Singer were obtained from Mushroom Unit, Department of Biology, The Gandhigram Rural Institute - Deemed University, Gandhigram, Dindigul, Tamilnadu, India. Sample preparation[9], qualitative phytochemical analysis[10], *in vitro* antiinflammatory activity namely inhibition of protein denaturation[11] and inhibition of proteinase activity[12] and *in vivo* antiinflammatory activity namely evaluation of Carrageenan induced edema in hind paw rats were carriedout using standard methods[13].

Animal studies

Animal experiments were carriedout with wistar albino rats as per the guidelines of the Institutional Animal Ethics Committee (Reg. No.: CPCSEA/265).

Statistical analysis

The results were expressed as mean values and standard deviation (SD). Linear regression analysis was used to calculate IC_{50} value. Data were analyzed using One Way Analysis of Variance (ANOVA) followed by Turkey's multiple comparison post hoc tests using SPSS software 16.0 versions. Values of $p < 0.05$ were considered as statistically significant.

RESULTS

Qualitative phytochemical screening

Qualitative phytochemical screening of the methanolic extract of *Pleurotus florida* revealed the presence of flavonoids, polyphenols, saponins and tannins and absence of alkaloids (Table 1).

Table 1
Qualitative phytochemical screening of white oyster mushroom (Pleurotus florida)

S. No.	Constituent	Methanolic extract
1	Alkaloids	-
2	Flavonoids	+
3	Polyphenols	+
4	Saponins	+
5	Tannins	+

Key: "+" denotes present, "-" denotes absent

In vitro antiinflammatory activities

The methanolic extract of *Pleurotus florida* showed significant inhibition of protein denaturation (69.30±4.98 at 1.0 mg/ml) and inhibition of proteinase activities (27.89±0.14 at 1.0 mg/ml) and the concentrations required for 50% of the above inhibition (IC_{50}) were 233.91±9.69 and 349.20±0.77 µg/ml, respectively (Table 2).

Table 2
In vitro antiinflammatory activities of Pleurotus florida, inhibition of protein denaturation and proteinase inhibitory activity.

Sample concentration (mg/ml)	Protein denaturation inhibition (%)	IC_{50} value (µg/ml)	Proteinase inhibition activity (%)	IC_{50} value (µg/ml)
0.2	13.60 ± 2.01		1.17 ± 0.07	
0.4	27.19 ± 4.02		7.37 ± 0.16	
0.6	46.93 ± 2.4	233.91±9.69	15.03± 0.45	349.20 ± 0.77
0.8	57.89 ± 2.63		21.86± 0.39	
1.0	69.30 ± 4.98		27.89± 0.14	

Data represent the mean ± S.E.M (n = 3) (p < 0.05)

In vivo antiinflammatory activity

Carrageenan induced hind paw edema model in rats

Pleurotus florida extract significantly reduced the the Carrageenan induced hind paw edema (50.17%) in rats ($p < 0.001$). The concentration required to inhibit edema in acute inflammation was comparable to the reference drug namely Indomethacin (70.51%) (Table 3).

Table 3
In vivo antiinflammatory activities of Pleurotus florida, Carrageenan induced hind paw edema

Experimental groups	Paw thickness at 0 h (mm)	Paw thickness at 3 h (mm)	Inhibition (%)
Control (Group I)	0.567 ± 0.08	1.967 ± 0.29	-
Pleurotus florida (Group II) (200mg/kg b.w)	0.582 ± 0.12	0.98 ± 0.24	50.17
Indomethacin (Group III) (10mg/kg b.w)	0.65 ± 0.15	0.58 ± 0.13	70.51

Data represent the mean ± S.E.M (n = 5) (p < 0.001)

DISCUSSION

In vitro antiinflammatory studies revealed the inhibition of protein denaturation and proteinase activities. Several investigators have reported that denaturation of protein is one of the causes of inflammation. Production of autoantigens in certain inflammatory diseases may be due to *in vivo* denaturation of proteins. Mechanism of denaturation probably involves alteration in electrostatic, hydrogen, hydrophobic and disulphide bonding[14-17]. Proteinases have been implicated in the development of tissue damage during inflammatory reactions and significant level of protection was provided by proteinase inhibitors[18-20]. Kokila *et al*.[21] studied that *in vitro* antiinflammatory activity of polyberbal products through proteinase inhibition showed higher inhibition activity (84.35% at a dose of 1.0 mg/ml). Bioactive compound such as Pleuran, isolated from fruiting bodies of oyster mushrooms has been reported to possess antiinflammatory activity[22, 23]. Ajith and Janardhanan[24] found that the methanolic extract of Cracked cap mushroom (*Phellinus rimosus* [Berk.] Pilat) inhibits significant antiinflammatory activity in acute and chronic inflammations in mice. Extracts of *Pleurotus florida* and *Pleurotus pulmonarius* gave a lowering response in both acute as well as in chronic inflammation[25, 26]. Jedinak *et al*.[27] in their experiments observed that the antiinflammatory activity of oyster mushroom was mediated through the inhibition of NF-kB and AP_1 signaling. Another potent antiinflammatory agent such as polysaccharide has been extracted from the *Pleurotus pulmonarius* that acted against carrageenan and formalin induced paw edema in rats[28]. Medicinal mushrooms have been recognized to exhibit antiinflammatory processes and confer beneficial effects in a proinflammatory environment[29]. The results suggest the

usefulness of *Pleurotus florida* in the treatment of inflammatory diseases. Earlier Literatures indicated that the mushrooms have diverse phytochemicals such as phenolic compounds, alkaloids, saponins, flavonoids, tannins, sterols, triterpenes and glycosides. These compounds are biologically active and used as strong antioxidant and immunomodulators. In the present study the extract of oyster mushroom recorded, the presence of phenolic compounds, flavonoids, saponins and tannins. The amount of phenolic compounds of the mushroom is directly proportional to its antiinflammatory activity[30-32]. Further the mushroom extract showed better antiinflammatory activities. For chronic diseases such as osteoarthritis and rheumatoid arthritis, lifelong dependency on drugs is necessary. It is believed that commonly used Nonsteroidal antiinflammatory drugs (NSAID) are curative in certain cases, but not in all cases of inflammatory disorders, so also create side effects (most important being the gastrointestinal irritation) and involve economy. Under this backdrop, a search for a novel antiinflammatory drug which is safe and effective is still continuing[33]. At this juncture bioactive compounds found in white oyster mushroom may serve as a promising plant based drug for antiinflammatory disorder.

CONCLUSION

The methanolic extract of *Pleurotus florida* with its significant antiinflammatory activity in rats, suggests its therapeutic potential for the prevention and control of inflammation; moreover, the mushroom species can be used as an easily accessible source of natural antiinflammatory and as a possible food supplement or in pharmaceutical industry. However, an extensive investigations are carried out to elucidate their valuable therapeutic potentials and the chemical characteristics of the antiinflammatory components in the mushroom extracts of *Pleurotus Florida*.

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CONFLICT OF INTEREST STATEMENT: We declare that we have no conflict of interest.

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