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# NUTRITIONAL AND PHYTOCHEMICAL STUDIES ON *PLEUROTUS FLORIDA* (MONT.) SINGER AND *CALOCYBE INDICA* P&C

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## ABSTRACT

Nutritional and phytochemical analysis of the oyster mushroom (*Pleurotus florida*) and milky mushroom (*Calocybe indica*) were carriedout. The nutritional analysis results showed the presence of protein, carbohydrate, fibre, ash content and low in fat and calorific value. Extractive yield studies of selected mushrooms using 5 different polar; 5 non polar solvents revealed that higher yield extracts i.e., 19.0±0.05 in *P. florida* and 33.3±0.23 in *C. indica* could be achieved in methanol extracts. Qualitative phytochemical analysis confirmed that both the mushrooms possess the presence of pharmacologically active compounds like phenols, flavonoids, saponins and tannins. Further subjection of both these mushrooms for quantitative analysis showed the presence of total phenol 38.06 ± 10.09 in *P. florida* and 30.72 ± 2.48 in *C. indica* and total flavonoid 1.35 ± 0.34 in *P. florida* and 0.80 ± 0.04 in *C. indica*. Thus, the study suggests that both mushroom varieties are nutrient rich; possess significant presence of aforesaid phytochemical compounds that can be explored for their medicinal properties.

**Key words:** *Pleurotus florida*, *Calocybe indica*, Nutritients, Phytochemicals, Medicinal properties.

## INTRODUCTION

Mushrooms have been widely used as food and food ingredients in many food products for a long time. Mushroom extracts and compounds have been found with special central effects that could be of pharmacological interest. From a nutritional point of view, mushrooms contain high protein and low fat. Recently, mushrooms have received much attention as sources of biological active substances i.e., secondary metabolites. In addition, phytochemicals of

mushrooms were reported to function as antibacterial, antiviral, anticaner, antidiabetic, antiobese, antihypercholesterolemic, antioxidant, antiulcer, antiinflammatory, neuroprotective and hepatoprotective agent [1].

## MATERIALS AND METHODS

The fruiting bodies of *Pleurotus florida* (Mont.) Singer and *Calocybe indica* P&C were obtained from Mushroom Unit, Department of Biology, The Gandhigram Rural Institute (DU), Gandhigram, Dindigul, Tamilnadu, India. Sample preparation [2], nutritional analysis [3, 4] and phytochemical analysis [5] the extract was evaluated by followed the method reported previously.

## RESULTS AND DISCUSSION

### Nutritive values of *Pleurotus florida* and *Calocybe indica*

Nutritional parameters such as moisture, protein, carbohydrate, fat, fibre, ash and calorific value were measured and the results were tabulated (Table 1).

**Table 1. Nutritional composition of *Pleurotus florida* and *Calocybe indica***

| Nurtients (%) | *Pleurotus florida* | *Calocybe indica* |
|---|---|---|
| Moisture* | 91.9±0.79 | 88.6±1.05 |
| Protein** | 36.3±1.50 | 25.7±1.55 |
| Carbohydrate** | 39.9±0.31 | 48.3±0.29 |
| Crude fat** | 1.2±0.01 | 3.8±0.11 |
| Crude fibre** | 10.4±0.28 | 14.7±0.23 |
| Ash** | 8.1±0.11 | 9.3±0.28 |
| Calorific value (k.cal $g^{-1}$) | 304.5±0.28 | 320.3±0.28 |

*Values expressed as mean ± standard deviation of three determinations (n=3)*

**denotes value on wet weight basis; **denotes values on dry weight basis.*

*Pleurotus florida* and *Calocybe indica* mushrooms are nutritionally valuable. Except moisture and protein content, other nutritional parameters such as carbohydrate, fat, fibre and calorific value were found to be more in *C. indica* than *P. florida*. The moisture contents in mushroom fruiting bodies of *Pleurotus florida* and *Calocybe indica* were found to be 91.9±0.79% and 88.6±1.0%, respectively. The protein content was 36.3±1.50$g^{-1}$ in *P. florida* and 25.7±1.55$g^{-1}$ in *C. indica*. The carbohydrates and fibre contents of *P. florida* were 39.9±0.31 $g^{-1}$ and 10.4±0.28$g^{-1}$, respectively and in *C. indica* 48.3±0.29$g^{-1}$ and 14.7±0.23$g^{-1}$, respectively. The total fat content was 1.2±0.01$g^{-1}$in *P. florida* and 3.8±0.11$g^{-1}$ in *C. indica*. The total ash

content of *P. florida* and *C. indica* were found to be 8.1±0.11 and 9.3±0.28g,$^{-1}$ respectively. The calorific values were found 304.5±0.28 k.cal g$^{-1}$ in *P. florida* and 320.3±0.28 in *C. indica*. These results were supported by many researchers [6-9].

Oyenuga [10] reported that mushrooms are the rich source of protein than most commonly consumed vegetables, whilst their protein content is lower than that found in eggs, meat and fish; however it is adequate to be used as a substitute in the diet of the general public. Lindequest *et al*. [11] stated that the nutritional and chemical compositions of mushroom are responsible for their medicinal values.

**Phytochemical analysis**

*Determination of extractive value*

The percentage of extracts obtained from *Pleurotus florida* and *Calocybe indica* using polar (ethanol, methanol, ethyl acetate, acetone and water) and non-polar solvents (petroleum ether, di-ethyl ether, chloroform, hexane, benzene) were determined and recorded (Table 2). Colors of both the mushroom extracts were observed as dark brown, yellow and luteous; the textures of the all samples are gummy in nature. Among the different solvent system used, methanol was proved to be a better solvent by showing higher percentage of extraction in *P. florida* (19.0±0.05%) and *C. indica* (33.3±0.23%), respectively. Hence, the methanolic extracts of both *P. florida* and *C. indica* were selected for further analysis.

**Table 2. Mushroom extract yield values**

| Solvent | ST | *Pleurotus florida* | | | *Calocybe indica* | | |
|---|---|---|---|---|---|---|---|
| | | CoE | Texture | % Yield | CoE | Texture | % Yield |
| Methanol | P | DB | Gummy | 19.0±0.05 | DB | Gummy | 33.3±0.23 |
| Aqueous | P | DB | Gummy | 17.4±0.28 | DB | Gummy | 29.5±0.23 |
| Ethanol | P | DB | Gummy | 4.8±0.05 | DB | Gummy | 15.5±0.51 |
| Acetone | P | DB | Gummy | 6.2±0.11 | DB | Gummy | 3.8±0.11 |
| Ethyl acetate | P | DB | Gummy | 4.4±0.25 | DB | Gummy | 5.3±0.23 |
| Di-ethyl ether | NP | Y | Gummy | 1.2±0.11 | Y | Gummy | 5.1±0.05 |
| Benzene | NP | Y | Gummy | 1.9±0.11 | Y | Gummy | 4.1±0.15 |
| Chloroform | NP | Y | Gummy | 2.6±0.11 | Y | Gummy | 3.2±0.11 |
| Petroleum ether | NP | L | Gummy | 1.2±0.17 | Y | Gummy | 3.8±0.11 |
| Hexane | NP | Y | Gummy | 1.0±0.05 | Y | Gummy | 3.5±0.11 |

*Values expressed as mean±SD of three determinations (n=3)*

*ST - Solvent type; P - Polar; NP - Non-polar. CoE - Color of extractive; DB – Dark brown; L - Luteous; Y - Yellow.*

Extraction methods used in pharmaceuticals involve the separation of medicinally active

portions of plant tissues from the inactive/inert components by using selective solvents. During extraction, solvents diffuse into the solid plant material and solubilize compounds with similar polarity. The products so obtained from plants are relatively complex mixtures of metabolites, in liquid or semisolid state or in dry powder form, and are intended for oral or external use [12].

***Qualitative analysis***

The phytochemicals in methanolic extracts of *Pleurotus florida* and *Calocybe indica* were qualitatively analyzed and the results were presented in Table 3.

**Table 3. Qualitative analysis of extracts of *Pleurotus florida* and *Calocybe indica***

| Component | Name of the test | *Pleurotus florida* | *Calocybe indica* |
|---|---|---|---|
| Alkaloids | Wagner's test | - | - |
| | Dragendroff's test | - | - |
| Flavonoids | Lead acetate test | +++ | +++ |
| | Ferric chloride test | +++ | +++ |
| Saponins | Frothing test | +++ | +++ |
| | Foam test | +++ | +++ |
| Phenols and Tannins | Lead acetate test | +++ | +++ |
| | Ferric chloride test | +++ | +++ |
| Steroids and Sterols | Salkowshi's test | + | + |
| | Liebermann's test | + | + |
| Glycosides | Keller-Killani test | - | - |
| | Liebermans test | - | - |
| Anthraquinones | Anthraquinones test | + | + |
| Terpenes | Terpenes test | ++ | ++ |
| Triterpenes | Liebermann-Burchard's test | ++ | ++ |
| Phlobatannins | Phlobatannins test | + | + |

*Key: "+++" denotes present in very high concentration; "++" denotes present in high concentration; "+" denotes present in small concentration; "-" denotes absent.*

Among the various phytochemicals, maximum values of phenols, flavonoids, tannins and saponins were observed. However, other compounds like triterpenes, terpenes, anthraquinones, phlobatannins, sterols and steroids were also detected, while the compound alkaloids and glycosides are absent in the extract.

***Quantitative analysis***

Based on the qualitative analysis, total phenol and flavonoids were quantified and the results were recorded (Table 4). *Pleurotus florida* mushrooms were found to possess more total phenols and flavonoids. The total phenol and flavonoids were found to be 38.06 ± 10.09 mg GAE/g extract and 1.35 ± 0.34 mg RE/g extract, respectively in *Pleurotus florida* and 30.72 ± 2.48 mg GAE/g extract and 0.80 ± 0.04 mg RE/g extract, respectively in *Calocybe indica*.

**Table 4. Quantitative analysis of phytochemicals**

| Phytochemicals | *Pleurotus florida* (%) | *Calocybe indica* (%) |
|---|---|---|
| Total Phenols (mg GAE/g extract) | 38.06 ± 10.09 | 30.72 ± 2.48 |
| Total Flavonoids (mg RE/g extract) | 1.35 ± 0.34 | 0.80 ± 0.04 |

*Values are means of three independent analyses of the extract ± standard deviation*

*GAE – Gallic acid equivalent; RE- Rutin equivalent.*

Phenolic compounds are known as powerful chain breaking antioxidants, may contribute directly to antioxidative action. These compounds are very important constituents of mushrooms and their radical scavenging ability is due to their hydroxyl groups. The phenolic compounds present in almost all plant foods and have ability to scavenge radicals such as hydroxyl, superoxide and peroxyl, which are known to be important in cellular prooxidant states. Flavonoids help to provide protection against the oxidation at the cellular level as antioxidants by interfering in enzyme activity, chelating of redox active metals and by scavenging free radicals and also several reports were supported to this study [13-15]. Alvarez-Parrilla *et al*. [16] reported that methanolic extracts of wild edible mushrooms have a direct correlation between phenols and antioxidants. Suseem and Saral [17] demonstrated that methanol extract of *Pleurotus eous* had the highest total phenolic content compared to ethyl acetate, petroleum ether and aqueous extracts.

Presence of nutritional components and phytochemicals inferred in this study indicate the importance of *Pleurotus florida* and *Calocybe indica* in the pharmaceutical industry.

## CONCLUSION

Oyster and milky mushrooms were analyzed for nutritional and phytochemical constituents seemed to have the potential to act as a source of useful drugs and also to improve the health status of the consumers due to the presence of various compounds that are vital for good

health. Further research should be focused to isolate the active compounds from *Pleurotus florida* and *Calocybe indica* mushrooms to commercialize their production and marketing. Further studies on these mushrooms in pharmacological aspects are in progress.

**Conflict of interest statement:** We declare that we have no conflict of interest.

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