

**ANTIOXIDANT ACTIVITY OF *PLEUROTUS* SPECIES  
AND ANTIDIABETIC ACTIVITY OF  
*PLEUROTUS CITRINOPILEATUS* (SINGER)**

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## ABSTRACT

The genus *Pleurotus* comprises some of the most popular edible mushrooms due to their favourable organoleptic and medicinal properties, vigorous growth and undemanding cultivation conditions. *Pleurotus* species contain a variety of secondary metabolites including various phenolic compounds which have been said to act as excellent antioxidants and possess antidiabetic activity. The antioxidant activity of mycelial extract of nine *Pleurotus* species and antidiabetic activity for *Pleurotus citrinopileatus* was investigated.

The total phenolic content in mycelial extract of nine *Pleurotus* species was assayed by Folin-Ciocalteu's method while antioxidant activity was determined by two different assays namely scavenging effect on 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical and ferric reducing antioxidant power (FRAP) assay. Mycelial extract of *P. flabellatus* exhibited the highest total phenolic content with  $233.53 \pm 3.60$  mg of GAEs/g of extract. Mycelial extract of *P. sajor caju* exhibited highest FRAP value with  $28.20 \pm 0.19$   $\mu$ mol of  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  equivalents/g of extract respectively. Mycelial extract of *P. cystidiosus* showed the most potent DPPH radical scavenging activity of 0.599 mg/ml at which 50% of DPPH radical were scavenged.

The antidiabetic property of *P. citrinopileatus* was investigated by analysis of fasting blood glucose level, fasting body weight, fasting insulin and catalase level throughout the 45 days of treatment, with a long term view towards the possible use of this mushroom in the treatment of diabetes. The results showed that fasting blood sugar level of STZ induced diabetic rats fed on *Pleurotus citrinopileatus* dropped by day 30 and returned back to normal when compared to normal rats. Diabetic rats treated with mycelial extract of *P. citrinopileatus* showed an increase in body weight after 30 days of treatment compared to diabetic rats treated with water.

By the end of 45 days, no significant difference was observed in fasting insulin level between normal group and diabetic group of rats treated with high dose of mycelial extract. Fasting catalase level marks no significant difference between normal rats and diabetic rats treated with mycelial extract of *P. citrinopileatus*. Histological section of the kidney of STZ induced diabetes rats treated with 1000 mg/kg of mycelial extract showed a very mild congestion of glomeruli and interstitium stroma of cortex. Hence, the consumption of selected *Pleurotus* species grown in tropical conditions may have health promoting benefits as it is taken in appropriate dose as food supplement in daily life.

## ABSTRAK

Genus *Pleurotus* mengandungi beberapa jenis cendawan yang biasa dimakan kerana keupayaan organoleptik dan mengandungi ciri-ciri perubatan, mudah dan cepat tumbuh serta tidak memerlukan masa atau kaedah yang rumit. Spesies *Pleurotus* mengandungi pelbagai metabolit sekunder termasuk beberapa jenis sebatian fenolik yang dikatakan berfungsi sebagai antioksidan yang baik dan juga mempunyai aktiviti antidiabetik. Tindakan aktiviti antioksidan oleh ekstrak miselium sembilan spesies *Pleurotus* dan tindakan antidiabetik oleh *Pleurotus citrinopileatus* dikaji.

Jumlah kandungan fenol dalam ekstrak-ekstrak miselium sembilan species *Pleurotus* dinilai melalui kaedah Folin-Ciocalteu manakala aktiviti antipengoksidaan ditentukan melalui dua asei yang berlainan iaitu kesan pemburuan terhadap radikal ,1-diphenyl-2-picrylhydrazyl (DPPH) dan kuasa antipengoksidaan penurunan ion ferik (FRAP). Ekstrak miselium *P. flabellatus* menunjukkan kandungan jumlah fenol yang paling tinggi dengan nilai  $233.53 \pm 3.60$  mg asid gallik /g ekstrak. Ekstrak miselium *P. sajor caju* menunjukkan FRAP yang tertinggi dengan nilai  $28.20 \pm 0.19$   $\mu\text{mol FeSO}_4 \cdot 7\text{H}_2\text{O}$  /g ekstrak. Ekstrak miselium *P. cystidiosus* pula menunjukkan kesan penyingkiran yang paling efektif terhadap radikal DPPH iaitu dengan nilai 0.599 mg/ml di mana 50% radikal terburu.

Aktiviti antidiabetik oleh *P. citrinopileatus* dikaji melalui analisis di mana paras glukosa dalam darah ketika puasa, berat badan ketika puasa dan takat insulin dan katalase semasa berpuasa diperolehi selepas 45 hari rawatan dengan harapan kelak cendawan ini boleh digunakan untuk merawat diabetik. Selepas 45 hari rawatan dengan ekstrak miselium, keputusan menunjukkan paras glukosa dalam darah ketika berpuasa tikus-tikus yang diaruh menjadi diabetik dengan menggunakan STZ menurun dan kembali ke paras normal bila dibandingkan dengan tikus-tikus normal. Tikus-tikus

diabetik yang dirawat dengan ekstrak miselium *P. citrinopileatus* menunjukkan peningkatan dalam berat badan selepas 30 hari rawatan bila dibandingkan dengan tikus-tikus diabetik yang dirawat dengan air sahaja.

Selepas berakhirnya rawatan selama 45 hari, diperhatikan bahawa tiada perbezaan signifikan dalam paras insulin ketika berpuasa antara tikus-tikus dalam kumpulan normal dan tikus-tikus diabetik yang dirawat dengan ekstrak miselium pada dos tinggi. Paras katalase ketika puasa juga tidak menunjukkan sebarang perbezaan yang signifikan di antara tikus-tikus normal dan tikus-tikus diabetik yang dirawat dengan ekstrak miselium *P. citrinopileatus*. Keratan histologi ginjal tikus yang diaruh menjadi diabetik oleh STZ dan dirawat dengan 1000mg/kg ekstrak miselium menunjukkan glomeruli menjadi padat dan wujud interstitium stroma dalam korteks ginjal. Maka, pengambilan spesies *Pleurotus* tertentu yang ditanam di kawasan yang beriklim tropika berkemungkinan berguna dalam meningkatkan status kesihatan apabila diambil dalam dos yang berpatutan sebagai nutrisi sampingan dalam kehidupan seharian.

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## LIST OF SYMBOLS AND ABBREVIATIONS

$A_{\text{reagent blank}}$	Absorbance of reagent blank
$A_{\text{sample}}$	Absorbance of sample
$A_{\text{sample blank}}$	Absorbance of sample blank
$\alpha$	Alpha
AR	Analytical reagent
ANOVA	Analysis of variance
$\beta$	Beta
Cu/Zn	Copper/Zinc
$^{\circ}\text{C}$	Degree celcius
DNA	Deoxyribonucleic acid
DMSO	Dimethyl sulfoxide
DPPH	1,1-diphenyl-2-picrylhydrazyl
$\text{EC}_{50}$	50% effective concentration
$\text{Fe}^{3+}$	Ferric
FRAP	Ferric reducing ability of plasma or ferric reducing antioxidant power
$\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$	Ferric trichloride hexahydrate
$\text{Fe}^{2+}$	Ferrous
$\text{FeCl}_4 \cdot 7\text{H}_2\text{O}$	Ferrous sulphate
GAEs	Gallic acid equivalents
GDM	Gestational diabetes mellitus
GSH	Gluthathione

GSHPx	Glutathione peroxidase
GYMP	Glucose yeast malt peptone
$\gamma$	Gamma
g	Gram
>	Greater than
H&E	Hemotoxilin and eosin
hr	Hour
HCl	Hydrochloride acid
H <sub>2</sub> O <sub>2</sub>	Hydrogen peroxide
OH·	Hydroxyl radical
O <sub>2</sub> <sup>-</sup>	Superoxidase anions
IDDM	Insulin dependent diabetes mellitus
OFR	Oxygen- free radicals
OGTT	Oral glucose tolerance test
<	Less than
l	Litre
$\mu$	Micro
$\mu$ g	Microgram
$\mu$ g/ml	Microgram per mililitre
$\mu$ l	Microlitre
$\mu$ M	Micromolar
$\mu$ mol FeSO <sub>4</sub> .7H <sub>2</sub> O equivalents / g	Micromole of ferric reducing antioxidant power equivalents per gram
$\mu$ mol/ml	Micromole per mililitre



mg	Miligram
mg of GAEs/g	Miligram of gallic acid equivalents per gram
mg/l	Miligram per litre
mg/ml	Miligram per millilitre
ml	Mililitre
mm	Milimeter
mM	Milimolar
Mmol/l	Milimole per litre
min	Minute
nm	Nanometer
NIDDM	Noninsulin dependent diabetes mellitus
lg	Natural log
%	Percent
psi	Pounds per square inch
rpm	Rounds per minute
Na <sub>2</sub> CO <sub>3</sub>	Sodium carbonate
NaCl	Sodium chloride
Na <sub>2</sub> HPO <sub>4</sub>	Sodium hydrogen phosphate
NaOH	Sodium hydroxide
S.D	Standard deviation
STZ	Streptozotocin
ROS	Reactive oxygen species
TPTZ	2,4,6-tripyridyl-s-triazine

TPC	Total phenolic content
v/v	Volume per volume
w/v	Weight per volume
±	Plus-minus
R <sup>2</sup>	R-squared
U/day	Unit per day