Research Article

Intrastrain Comparison of the Chemical Composition and Antioxidant Activity of an Edible Mushroom, Pleurotus giganteus, and Its Potent Neuritogenic Properties

Chia-Wei Phan, 1,2 Pamela David, 1,3 Yee-Shin Tan, 1,2 Murali Naidu, 1,3 Kah-Hui Wong, 1,3 Umah Rani Kuppusamy, 1,4 and Vikineswary Sabaratnam 1,2

1 Mushroom Research Centre, Institute of Biological Sciences, Faculty of Science, University of Malaya, 50603 Kuala Lumpur, Malaysia
2 Institute of Biological Sciences, Faculty of Science, University of Malaya, 50603 Kuala Lumpur, Malaysia
3 Department of Anatomy, Faculty of Medicine, University of Malaya, 50603 Kuala Lumpur, Malaysia
4 Department of Biomedical Science, Faculty of Medicine, University of Malaya, 50603 Kuala Lumpur, Malaysia

Correspondence should be addressed to Vikineswary Sabaratnam; viki@um.edu.my

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Two strains of Pleurotus giganteus (commercial and wild) were tested for their ability to induce neurite outgrowth in rat pheochromocytoma (P132) and mouse neuroblastoma-2a (N2a) cells. Treatment with the mushroom extracts resulted in neuronal differentiation and neuronal elongation, but not nerve growth factor (NGF) production. Linoleic acid (4.5–5.0%, w/w) which is a major fatty acid present in the ethanol extract promoted NGF biosynthesis when augmented with low concentration of NGF (5 ng/mL). The two strains of mushroom were found to be high in protein (154–192 g kg−1), total polysaccharides, phenolics, and flavonoids as well as vitamins B1, B2, and B3. The total phenolics present in the mushroom extracts were positively correlated to the antioxidant activity (free radical scavenging, ferric reducing power, and lipid peroxidation inhibition). To conclude, P. giganteus could potentially be used in well-balanced diet and as a source of dietary antioxidant to promote neuronal health.

1. Introduction

Neurite outgrowth is a critical process in neuronal formation and development. Malfunction of this event will lead to demineralization of synaptic connections and extended series of neuronal dysfunctions like Alzheimer’s disease (AD) [1]. As AD progresses, programmed apoptotic neuronal death is triggered as a result of nerve growth factors (NGFs) depletion and oxidative stress exerted by reactive oxygen species (ROS) [2]. Therefore, strategies aimed at preserving and restoring the neurite network might be beneficial in treating AD. Dietary intake of antioxidants is also important to improve the intrinsic antioxidant mechanisms (superoxide dismutase, catalase, and glutathione peroxidase) to avoid an environment where prooxidant species overwhelm antioxidant species.

Functional food plays a significant role in preventing or reducing severity of lifestyle diseases and improving physical and mental well-being of consumers. Edible and medicinal mushrooms are gaining recognition as preventative agents for age-related diseases including neurodegenerative diseases such as AD, Parkinson’s disease, and dementia [3]. At the current stage, medications are prescribed for mild, moderate, to severe Alzheimer’s disease to help delay or prevent behavioral symptoms, but that, too, is only for a limited time. Trials with NGF for Alzheimer’s disease had gained some degree of success, but the high molecular weight of the NGF protein seems to suggest that it could not cross the blood-brain barrier [4]. Considering the limitation of the existing preventive methods, intervention strategy using mushrooms as functional food is of utmost importance. Edible and medicinal mushrooms are packed with a wide array of bioactive and nutritional components that could scavenge reactive oxygen species (ROS) and exert neuroprotective effects and promote neuritogenesis and neuroregeneration.