Original Article

Phytochemical Profiling and *in vitro* Screening for Neuritogenic and Antioxidant Activities of *Spirulina platensis*

Ee-Ling Ngu[1], Chen-Lin Ko[1], Cheng-Yau Tan[1], Kah-Hui Wong[2], Siew-Moi Phang[3,4], Yoon-Yen Yow[1,*]

[1]Department of Biological Sciences, School of Medical and Life Sciences, Sunway University, Bandar Sunway, Selangor Darul Ehsan, MALAYSIA.
[2]Department of Anatomy, Faculty of Medicine, Universiti Malaya, Kuala Lumpur, MALAYSIA.
[3]Faculty of Applied Sciences, UCSI University, Cheras, Kuala Lumpur, MALAYSIA.
[4]Institute of Ocean and Earth Sciences, University of Malaya, Kuala Lumpur, MALAYSIA.

ABSTRACT

Background: In neurological diseases, neuronal loss is frequently associated with overproduction of free radicals and reduced level of endogenous neurotrophic factors. The blue-green microalga, *Spirulina platensis* is a well-known superfood with a high content of diverse nutrients and possesses several therapeutic properties. Here, we aimed to study the neuritogenic and antioxidant activities of *Spirulina platensis* UMACC 159. **Materials and Methods:** PC-12Adh (rat pheochromocytoma) cell was used to investigate the cytotoxicity effect of *S. platensis* UMACC 159 extracts (water, methanol, and ethanol) via 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay. Neuritogenic activity of the extracts towards PC-12Adh cell line was studied using neurite outgrowth assay and immunofluorescence imaging of neurofilaments. The extracts were screened for the phytochemical contents, and antioxidant activities using 2,2′-Azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS), 2,2-Diphenyl-1-pircrylhydrazyl (DPPH) and reducing power. **Results:** Ethanol extract was found to exhibit the highest neuritogenic effect and enhanced the cytoskeleton formation in PC-12Adh cells at 6.25 µg/mL. Ethanol extract also showed the highest total phenolic content (49.09 ± 1.35 mg GAE/g), ABTS (EC_{50} of 1.34 ± 0.01 mg/mL) and DPPH (EC_{50} of 0.45 ± 0.04 mg/mL) scavenging activities ($P \leq 0.05$), suggesting that the neuritogenic effect of ethanol extract was attributed to the phenolic compound(s) via antioxidant activity. **Conclusion:** Ethanol extract contains bioactive compound(s) with similar neuritogenic activity as nerve growth factor for neuronal survival, growth, and axonal regeneration. *S. platensis* has been proposed as a promising cognitive supplement.

Key words: *Spirulina platensis,* Antioxidants, Cytotoxicity, Neuronal outgrowth, Phytochemicals.

INTRODUCTION

Deaths caused by dementia increased more than doubled within 16 years, making dementias the 5th leading cause of global deaths in 2016.[1] Currently, drugs approved for Parkinson's Disease (PD) by the Food and Drug Administration (FDA), such as levodopa and rivastigmine are symptomatic therapies. These drugs come with adverse effects, for example motor fluctuations and dyskinesias for levodopa; nausea, dyspepsia, and asthenia for rivastigmine.[2,3] Therefore, there is a need to discover novel compounds to counter against neurodegenerative diseases.

In various neurodegenerative diseases, the loss of neuron is a common hallmark accompanied by excess free radicals and insufficient endogenous neurotrophic factors. Reactive oxygen species (ROS) are byproduct of aerobic metabolism, and are highly reactive whereby overproduction can induce oxidation of biomolecules including

Submission Date: 08-04-2021;
Revision Date: 19-05-2021;
Accepted Date: 07-07-2021

DOI: 10.5530/ijper.55.3.154
Correspondence:
Dr. Yoon-Yen Yow
Department of Biological Sciences, School of Medical and Life Sciences, Sunway University, 47500 Bandar Sunway, Selangor Darul Ehsan, MALAYSIA.
Phone: +60 (3) 74918622
Email id: yoonyeny@sunway.edu.my

www.ijper.org