



## Neurotrophic and anti-neuroinflammatory constituents from the aerial parts of *Coriandrum sativum*

Joon Min Cha<sup>a</sup>, DaHye Yoon<sup>b,c</sup>, Sun Yeou Kim<sup>b,c</sup>, Chung Sub Kim<sup>a</sup>, Kang Ro Lee<sup>a,\*</sup>

<sup>a</sup> Natural Products Laboratory, School of Pharmacy, Sungkyunkwan University, Suwon 16419, Republic of Korea

<sup>b</sup> Gachon Institute of Pharmaceutical Science, Gachon University, 191 Hambakmoero, Yeonsu-gu, Incheon 21936, Republic of Korea

<sup>c</sup> College of Pharmacy, Gachon University, 191 Hambakmoero, Yeonsu-gu, Incheon 21936, Republic of Korea

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### ABSTRACT

In the course of our continuing search for biologically active compounds from medicinal sources, we investigated the MeOH extract of the aerial parts of *Coriandrum sativum* Linn. An extended phytochemical investigation of the aerial parts of *C. sativum* led to the isolation and identification of seven compounds (1–7) including two new isocoumarin glycosides (1–2) and a new phenolic glycoside (5). The chemical structures of the new compounds (1, 2, and 5) were elucidated by analysis of 1D and 2D NMR (<sup>1</sup>H and <sup>13</sup>C NMR, COSY, HSQC, and HMBC) and HRESIMS data as well as by using chemical methods. All the isolates were evaluated not only for their potential neurotrophic activity by means of induction of nerve growth factor (NGF) in C6 glioma cells but also for production of nitric oxide (NO) levels in lipopolysaccharide (LPS)-activated murine microglia BV-2 cells to assess their anti-neuroinflammatory activity. Compounds 1–3 and 7 were stimulants of NGF release, with levels of NGF stimulated at 127.23 ± 1.89%, 128.22 ± 5.45%, 121.23 ± 6.66%, and 120.94 ± 3.97%, respectively. Furthermore, the aglycones of 1 and 2 (1a and 2a) showed more potent NGF secretion activity and anti-neuroinflammatory effect than did their glycosides (1a : 130.81 ± 5.45% and 2a : 134.44 ± 5.45%).

### 1. Introduction

Neurodegenerative diseases, including Alzheimer's disease (AD), Parkinson's disease (PD), Huntington's disease, and multiple sclerosis (MS), deteriorate the human body's activity for multiplex reasons with aging and led to cognitive/memory disorders [1]. These diseases can result from the structural breakdown and dysfunction of neurons including neuroinflammation and depletion of neurotrophic factors. Therefore, much studies have been focused on finding neuroprotective and neurotrophic substances for neurodegenerative diseases. BV-2 cells, mouse-derived microglial cells, are important cells involved in the central nervous system (CNS), and the increase in nitric oxide (NO) and cytokines is a major biomarker of neuroinflammation [2,3]. Activation of microglia by lipopolysaccharide (LPS) results in cytotoxicity and neuroinflammation through an increase in inflammatory mediators such as NO, cytokines and reactive oxygen species (ROS). In addition, increase of cytokines such as interleukin6 (IL6), nuclear factor kappa-light-chain-enhancer of activated B cells (NF-κB), tumor necrosis factor-α (TNF-α) by LPS lead to neuronal cell death [4]. Thus, we did screening of anti-neuroinflammatory effect of the compound in BV-2 cells. Additionally,

we screened the nerve growth factor (NGF) production in astrocyte C6 cells. C6 cells are rat-derived glial cells and are the most abundant cells in the brain. These cells play a very important function in repairing brain tissue when being damaged [5]. NGF is one of main neurotrophic factor which is related with nerve growth, maintenance, proliferation and neuronal survive. It is also responsible for the extension and maintenance of axons in neurons. Thus, the efficacy of NGF for neuronal repair may be a better alternative for the treatment of various neuronal disorders [6].

*Coriandrum sativum* Linn. (Apiaceae) generally known as "coriander" or "cilantro" is an annual plant native to regions spanning from Southern Europe and Northern Africa to Southwestern Asia [7]. In addition to the wide usage of *C. sativum* as a spice around the world, the aerial parts of this plant have been used in a traditional medicine for treating hypertension, gastrointestinal disorders, and anti-inflammation [8,9]. Previous phytochemical investigations have isolated isocoumarins, aliphatic lactones, and monoterpene derivatives [10–12] with a variety of biological effects such as cytotoxic, antioxidant, antibacterial, gastric mucosal protective, and anti-inflammatory activities [13–15]. In this study, an extended phytochemical investigation of the aerial parts of

\* Corresponding author.

E-mail address: [krlee@skku.edu](mailto:krlee@skku.edu) (K.R. Lee).

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