Behavioral and Histopathological Study of Changes in Spinal Cord Injured Rats Supplemented with *Spirulina platensis*

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Spinal cord injury (SCI) is a devastating disease that leads to permanent disability and causes great suffering. The resulting neurological dysfunction and paralysis is proportional to the severity of the trauma itself. Spirulina is widely used as a nutritional supplement due to its high protein and antioxidant content. In the present study, the protective effect of the Spirulina treatment on locomotor function and morphological damage after SCI was investigated. Seventy Sprague-Dawley (SD) rats were divided into three groups: Sham (laminectomy alone), Control (laminectomy with SCI), and Experimental (laminectomy with SCI +180 mg/kg per day *Spirulina platensis*). A laminectomy was performed at T12 and an Inox No.2 modified forceps was used to perform a partial crush injury on the spinal cord. The rats were then perfused at 3, 7, 14, 21, and 28 days after injury for morphological investigations. The injured rat spinal cord indicated a presence of hemorrhage, cavity, and necrosis. Pretreatment with Spirulina significantly improved the locomotor function and showed a significant reduction on the histological changes. The experimental results observed in this study suggest that treatment with *Spirulina platensis* possesses potential benefits in improving hind limb locomotor function and reducing morphological damage to the spinal cord.

1. Introduction

Spinal cord injury (SCI) is one of the leading clinical causes of disability in young adults for which no suitable natural remedies have been found for SCI management. As such, the exploration of novel therapeutic agents to enhance neuroprotection after SCI is needed [1]. The spinal cord does not have to be severed in order for loss of functioning to occur. In fact, in most people with SCI, the spinal cord is intact, but the damage to it results in loss of sensory or autonomic function and loss of normal motor function which may lead to paraplegia and quadriplegia. There are about 10,000 new SCI cases every year reported around the world, especially in the European countries. Males between the ages of 16 to 30 are among the majority who suffer from SCI and this occurs throughout the world with an annual incidence of 15 to 40 cases per million population [2].

There are some therapies available for SCI management such as erythropoietin, minocycline, inosine, rifazole, pioglitazone, and others [3]. At present, a high dose of methylprednisolone (MP) is the most common drug used for the treatment of spinal cord injury patients since the results of the landmark National Acute Spinal Cord Injury Studies (NASCIS) II trial in the 90s were published. However, many clinicians and scientists around the world have questioned the effectiveness of using MP due to conflicting results of experimental studies [4, 5] compared to the minor neurological improvements seen in patients [6, 7]. Furthermore, MP has been associated with certain side effects such as anxiety, dizziness, and mental depression and it can increase risk of infection both of wounds and at the site of trauma [8].

*Spirulina* is widely used as a nutritional supplement as it is complete with about sixty percent highly digestible protein, contains all the essential amino acids, and is rich in gamma-linolenic acid (GLA), minerals, trace elements, chlorophyll, and digestive and restriction enzymes [9]. In addition, it contains a wide range of antioxidants such as superoxide dismutase (SOD), provitamin-A (beta-carotene), vitamin C, E, selenium and phycocyanin, and flavonoids which have been proven in previous studies [10–15].