

Review Article

Potential of Mushroom Compounds as Immunomodulators in Cancer Immunotherapy: A Review

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Since time immemorial, plants and their compounds have been used in the treatment and management of various ailments. Currently, most of conventional drugs used for treatment of diseases are either directly or indirectly obtained from plant sources. The fungal group of plants is of significance, which not only provides food directly to man but also has been source of important drugs. For instance, commonly used antibiotics are derived from fungi. Fungi have also been utilized in the food industry, baking, and alcohol production. Apart from the economic importance of the microfungi, macrofungi have been utilized directly as food, which is usually got from their fruiting bodies, commonly known as mushrooms. Due to their richness in proteins, minerals, and other nutrients, mushrooms have also been associated with boosting the immune system. This makes mushrooms an important food source, especially for vegetarians and immunosuppressed individuals including the HIV/AIDS persons. In complementary and alternative medicines (CAMs), mushrooms are increasingly being accepted for treatment of various diseases. Mushrooms have been shown to have the ability to stimulate the immune system, modulate humoral and cellular immunity, and potentiate antimutagenic and antitumorigenic activity, as well as rejuvenating the immune system weakened by radiotherapy and chemotherapy in cancer treatment. This potential of mushrooms, therefore, qualifies them as candidates for immunomodulation and immunotherapy in cancer and other diseases' treatment. However, a critical review on mushroom's immune modulating potential in cancer has not been sufficiently addressed. This review puts forward insights into the immune activities of mushroom associated with anticancer activities.

1. Introduction

Humanity continues to suffer the scourge of cancer, a disease that is associated with uncontrolled cell growth. In 2013, it was reported to be among the leading causes of death, second to cardiovascular diseases. It is estimated that death due to cancer will rise to thirteen million in 2030 [1–3]. The fight against cancer has intensified in the past decades with multidirectional approach including behavioral and dietary change, chemotherapy, radiotherapy, surgery, and recently immunotherapy. Unfortunately, these approaches are not void of serious side effects spanning from recurrence and weakened immune system to reduced quality of life (QoL) of patients. This has ruffled scientists, leading to concerted efforts of finding better therapies that, apart from managing the cancerous cells, boost the immune system to fight cancer

and other diseases [4]. Among these therapies, complementary and alternative medicine (CAM) has been fronted as an alternative due to its potential of holistic treatment including augmenting the immune system. Many CAMs are plant-derived, including algae and mushrooms that have been used widely in many parts of the world, where they are regarded as biological response modifiers (BRMs) and immunocuticals [5]. Mushrooms are the spore-producing reproductive structures of fungi. Ancient classification placed fungi in plant kingdom, but current classification recognizes fungi as an independent group of organisms under the kingdom Mycota, basically due to possession of chitin within their cell walls. Mushrooms are the fleshy, spore-bearing fruiting body of a fungus, typically produced above ground on soil or on its substrate, mainly by the Basidiomycota and Ascomycota group. Although in wild mushrooms are seasonal and can