Medicinal Mushroom Therapeutic Use

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Medicinal mushrooms have important health benefits and exhibit a broad spectrum of pharmacological activities, including antiallergic, antibacterial, antifungal, anti-inflammatory, antioxidative, antiviral, cytotoxic, immunomodulating, antidepressive, antihyperlipidemic, antidiabetic, digestive, hepatoprotective, neuroprotective, nephroprotective, osteoprotective, and hypotensive activities.

medicinal mushrooms | pharmaceutical properties | biomolecules

1. Introduction

Mushrooms, which have always been appreciated for their culinary and nutritional value, are now increasingly valued for their many important medicinal properties, so much so that they are used not only as dietary food (functional foods) but also in the form of dietary supplements, nutraceuticals, and mycotherapy products [1][2]. Their use for promoting and maintaining a good state of health and the treatment of diseases has been around since ancient times in Asian regions, while in the West, this approach is considerably more recent. Medicinal mushrooms (MMs) are reported to have numerous pharmacological actions such as antimicrobial, anti-inflammatory, immunomodulatory, antidiabetic, cytotoxic, antioxidant, hepatoprotective, anticancer, antioxidant, antiallergic, antihyperlipidemic, and prebiotic properties, among others [2][3][4][5]. These activities are attributable to many bioactive metabolites present in the mycelium but above all in the fruiting body, whose biological effect varies according to the chemical nature and whose distribution varies according to the fungal species. A great deal of research has been carried out and is increasingly being undertaken to identify and characterize mycochemicals and to define their actions and mechanisms, due to the growing interest in the use of natural products, including as adjuvants in traditional therapies. The bulk of research carried out has focused on a few genera or species, for example, those of the oldest and most traditional use among Asian populations, while for those remaining, current scientific support is still lacking. Several studies have so far investigated the various activities of MMs, highlighting their enormous potential for use in the medical sector, but a particular effort has been put into studying their antitumor and immunomodulatory properties, as cancer remains one of the most difficult challenges to date.

2. Mushroom Therapeutic Use: An Overview of Dietary Supplement Affairs

Mushrooms have been traditionally used for the maintenance of physical well-being and the treatment of numerous diseases since ancient times, especially in Asian regions. Since fairly recent times, they have become part of the sphere of dietary supplements widely employed for their health benefits, the use of which has largely entered into

complementary alternative medicine (CAM) and complementary integrated medicine (CIM). Today, they are among the most commonly used of all integrative, complementary, and alternative therapies, especially in the field of oncology. This is especially the case in Asian countries, where mycotherapy has ancient and deep-rooted origins, while in Western areas, the application of mushrooms in medical therapies is still rather limited, especially in conventional medical institutions [5][6]. However, this is still a complex field in many respects. First of all, although a great deal of research has been carried out to highlight their various beneficial properties and thus their potential use in therapeutics, many mushrooms have only been tested in vitro or in vivo in animal models, mainly mice and rats, with little or no scientific support in vivo in humans [5][7]. Thus, although supplement companies often specify research to support their product claims, these are preclinical or even in vitro studies. Another aspect to take into account is undoubtedly the fact that there are innumerable mushroom supplements on the market today, but for the same species, doses, preparations, manufacturing practices, and claims vary considerably between manufacturers. In the absence of standardization, significant differences can be found even in different batches from the same manufacturer. This leads to considerable difficulties in the scientific practice of clinical trials, both because they are difficult to compare, but also and above all because there is no standardization of parameters such as dose, active ingredient/s, composition, adverse effects, and interactions, which ends up compromising the validity and repeatability of any results obtained and, consequently, their use in medical practice according to the criteria it requires.

It is precisely the heterogeneity, reduced quality, and lack of standardization of these mixtures that make it difficult for supplements to be considered by the Western medical community and integrated into conventional therapeutic practices [6]. However, there is a slow increase in the number of doctors using them in their daily practice. Another problem is the autonomous choices of people to take supplements, convinced of the efficacy of a “natural” substance.

Regarding claims about and labeling of dietary supplements, the American Food and Drug Administration (FDA) does not require manufacturers to prove safety and efficacy, although products must have a history of safety [8]. The European Food Safety Authority (EFSA) sets the rules for the use of nutritional health and disease risk reduction claims, requiring toxicological data; since 2011, a new “botanical” can only be registered as a food supplement and not as an actual drug, falling under EU Regulation No. 1924/2006 [9]. Therefore, for most mushroom-based supplements, safety and efficacy are generally supported by traditional use, in vitro studies, animal model studies, and some case reports.

It has to be said, however, that the increasing focus on these two attributes is resulting in more and more clinical investigative studies being carried out to prove them, albeit currently with the limitations mentioned above.

The lack of regulation and monitoring by many governments means that supplements are often not monitored to ensure that they contain the ingredients or the amount of active ingredient declared by the manufacturer. Indeed, unlisted components may be present, which may be either harmful or inert. Furthermore, the very fact that a fungal extract contains a multitude of demonstrably or potentially bioactive compounds often makes it difficult to link the effect to its true responsible agent, which also requires knowledge of the real concentration of the bioactive

compounds contained in a supplement. Moreover, there is a risk that the consumer will not ingest the correct dose of an active substance, which may be higher, lower, or even non-existent [8]. In addition to all this, the presence of several compounds in the same supplement makes it difficult to carry out rigorous clinical studies. This is due to the complexity of identifying both the “optimal dose” of the preparation needed to guarantee the desired effect and the cause–effect relationship, since the different substances may act on several parameters at the same time and, moreover, in a synergistic or antagonistic manner.

In addition to all this, numerous other factors often limit the validity of the clinical studies conducted to date, even in the case of promising results. They often involve too small a sample (among other things, the enormous variability in sample size makes it difficult to compare the various studies), or lack a control or placebo group, or the two groups compared are numerically very different, there is a very frequent lack of replication, adverse events are poorly reported or investigated, the statistical methods are deficient, and the results are poorly described in various respects [5][7][10][11].

However, many clinical investigations have shown very encouraging or promising results, thus underlining the great potential of mushrooms in therapeutic applications.

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