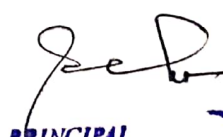


## TOPIC OF THE PROJECT: BIOMEDICAL APPLICATION OF POLYSACCHARIDES IN MUSHROOM

Mushrooms have been traditionally employed as medicinal agents due to their proven healthy properties. Among the occurring bioactive compounds, polysaccharides are responsible for a wide range of biological activities, the modulation of the immune system being the most studied. Polysaccharides from mushrooms showing a  $\beta$ -linkage have demonstrated a boost in the human immune system and the modulation of the immunological response under certain circumstances, thus they are commonly termed biological response modifiers (BRM). As a result of the activation of the host's immune system, these polysaccharides show significant antitumor, antiviral and antimicrobial activity, among other effects.

Polysaccharides from fungi have been widely employed in tumor therapies due to their properties as immunological enhancers. Research studies have demonstrated that polysaccharides isolated from different mushroom are capable of providing anti-tumoral activity, for instance, Agaricus, Calocybe, Ganoderma, Grifola, Inonotus, Lentinus, Phellinus, Pholiota, Pleurotus, etc. Polysaccharides can depress the E-selectin protein and gene expressions, which inhibit tumoral cell-to-cell adhesion. Other mechanisms include antiproliferative effects, apoptosis induction, and differentiation of the tumoral cells. Fungal polysaccharides have been widely employed as adjuvants in tumoral therapies. In this field, lentinan, a  $\beta$ -(1 $\rightarrow$ 3),(1 $\rightarrow$ 6)-linked polysaccharide from *Lentinus edodes*, has been used in a combined treatment of patients with advanced or recurrent gastric or colorectal cancer. In a study carried out with 89 patients of stomach cancer, lifespan increased in 80 days when 2 mg of intravenous lentinan per week were used. Similarly, lifespan increased in 106 days in patients with breast cancer when similar doses

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of lentinan were employed. In a study carried out with 30 patients of breast cancer, the combination of lentinan with chemoendocrine therapy was more effective than chemoendocrine therapy alone on the improvement of hormonal parameters.

Fungal polysaccharides may be beneficial for protection against cardiovascular diseases and its complications. Edible mushrooms are good candidates to be included in a healthy diet for the prevention of atherosclerosis, due to their high fiber and low fat content. Furthermore, the hypocholesterolemic effect can be associated to the antioxidant activity. Administration of black fungus polysaccharides had significantly enhanced myocardium and blood antioxidant enzyme activities and reduced lipid peroxidation levels in high fat mice. Studies with humans revealed that diets rich in  $\beta$ -glucans decreased the total cholesterol and LDL levels in serum, as well as the visceral fat area and the waist circumference in hypercholesterolemic patients. At the intestinal level,  $\beta$ -glucans reduced the absorption of cholesterol and long chain fatty acids and, furthermore, these polysaccharides downregulated the genes involved in lipogenesis and lipid transport.

Oxidative damage is related to the prevalence of a great number of common diseases. Therefore, substances capable of acting as antioxidant agents usually prevent the development of certain diseases. Polysaccharides from different mushrooms showed free radical scavenging activity, superoxide radical scavenging activity, reducing properties, lipid peroxidation inhibition, suppression of proliferation and oxidative stress, etc<sup>3</sup>. The activity not only depended on the fungal species but also on the chemical structure and arrangement of the active polysaccharide. Similarly, mixed carbohydrates, such as polysaccharide-peptide complexes, have also shown a potent antioxidant activity.

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