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The Perspectives of Usage of Mushrooms in Nanomedicine

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ABSTRACT

Diabetes, cancer, cardiovascular and neurodegenerative diseases are associated with high mortality in the adult population worldwide. Researchers have tried to develop natural medicines from plants and mushrooms to prevent and treat such pathological conditions. Recent advances in fungal biology and myco-pharmacology have confirmed traditional knowledge about the therapeutic and biotechnological potential of mushrooms as valuable sources of healthy nutrients. Nowadays, mushroom-derived biotech products (pharmaceuticals, nutraceuticals, cosmeceuticals) are widely consumed worldwide. Recent studies have revealed the perspectives of usage of mushrooms in nanobiotechnology and nanomedicine. Several mushrooms have been utilized for the synthesis of metal (Ag, Au, Pt, Fe) and non-metal (Cd, Se) nanoparticles (NPs). Mushroom-derived silver nanoparticles (AgNPs) have been suggested for anticancer and antimicrobial therapies. A strong antimicrobial activity of AgNPs obtained from crude extracts of *Coriolus versicolor* (CV-AgNPs) and *Boletus edulis* (BE-AgNPs) has been reported against Gram-negative (*Pseudomonas aeruginosa*, *Klebsiella pneumoniae*) and Gram-positive (*Staphylococcus aureus*, *Enterococcus faecalis*) bacteria. Both NPs inhibited the proliferation of breast (MCF) and colorectal (HT-29) adenocarcinoma, hepatocellular carcinoma (HUH-7) and showed a wound-healing regenerative effect on L929 cells. Antimicrobial activity against *P. aeruginosa*, *K. pneumoniae*, *S. aureus*, *E. faecalis*, *Candida albicans* and *C. utilis* was reported for AgNPs synthesied from *Tricholoma ustale* and *Agaricus arvensis* extracts. Mushroom-derived NPs also possess anti-proliferative effects on breast (MCF-7), lung (A549), colorectal (HT-29) cancer cells and osteosarcoma (Saos-2) stimulating intrinsic apoptotic signaling pathways via up-regulation of Bax/Bcl-2 and decreasing expression of pro-Casp9 gene in cancer cells. NPs were also obtained from *Agaricus bisporus, Pleurotus*, *Ganoderma*, and *Lentinus* species. Thus, mushroom-derived NPs may be regarded as potential systems for drug design and delivery for treatment of infectious diseases and cancer. Further interdisciplinary trials are warranted to study their clinical application.

Keywords: mushrooms, cancer, nanoparticles, nanomedicine

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