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use the energy flow method. Therefore, in this research, we discussed Oyster mushroom (*Pleurotus ostreatus* (Jacq.:Fr.) P. Kumm., Pleurotaceae, higher Basidiomycetes) energy balance sheet of West Azerbaijan in 2008. To assess the energy balance sheet in this semi-Industrial research institute (Azad University), all data was converted to equivalent amounts of used and produced energy with applications of special indices and formulas and then energy efficiency was computed. The amount of used energy in production for each period was assessed at 9,607,282.9 kilocalories and the amount of produced or output energy including biomass was separately calculated as 2,649,390 kilocalories for each growth period. Also, the amount of energy efficiency for biomass function was separately computed as 0.275. The data show that most of the energy in this plain was accordingly related to gas oil fuel and electrical energy, respectively, and the least consumed energy was the fungi spawn and poisons for release that this can be caused by compost kinds and climate conditions (humidity, temperature, air condition). However, the results show that energy in mushroom production to become useless strongly and the continue this condition and using extra energy for production can threaten sustainable development in agriculture.

Antioxidant Activities of Two Edible Mushroom Extracts: Health benefits and Risks

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Mushrooms have been used as a food for human consumption for centuries because of their excellent nutritional value and high-protein content. They became more attractive recently when they were recognized as a source of physiologically beneficial components that contain variable medical and therapeutic activity. Mushrooms accumulate a variety of secondary metabolites, including compounds with antioxidant activity. The oxidative stress is implicated in the development of many diseases including diabetes mellitus, which is characterized by progressive loss of insulin-secreted pancreatic β-cells. Therefore, there is a growing interest in the identification of natural products that could be helpful in the prevention of β-cell loss.

The objective of this study was to examine potential beneficial effects of ethanolic extracts of two edible mushrooms, *Lactarius deterrimus* and *Megacollybia platyphylla*, on pancreatic β-cell death mediated by oxidative stress. In a DPPH test both extracts exhibited radical scavenging activity. *L. deterrimus* extract was much more effective than *M. platyphylla* extract since it reached higher inhibiting levels, and its IC_{50} was significantly lower. The effect of mushroom extracts was further tested *in vitro* on rat insulinoma Rin-5F cell line. First of all, the potential cytotoxic effects of extracts were estimated using MTT viability test. Treatment of Rin-5F cells with extracts at concentrations that provided 50% of inhibition in DPPH assay did not result in a decrease in the number of viable cells. To test the probability that mushroom extracts have protective effects on β-cell death, Rin-5F cells were treated simultaneously with extracts and streptozotocin (STZ).

STZ is a toxic glucose analogue, which induces β-cell death through its DNA-alkylating properties and induction of oxidative stress, mediated by the generation of ROS and RNS. Based on representative markers of oxidative stress, glutathione redox state (GSH) and lipid peroxidation (TBARS), STZ induced strong oxidative stress in Rin-5F cells. Treatment with both mushroom

extracts improved the oxidative status in STZ-treated cells, although *L. deterrimus* extract displayed stronger antioxidant activity in both tests. Viability assays confirmed protective effects of *L. deterrimus* extract on STZ-mediated cell death with an increase in number of viable cells for more than 20%. However, treatment with *M. platyphylla* additionally reduced cell viability after co-treatment with STZ, inducing death in 90% of the cells. In agreement with viability tests, the presence of DNA damage assessed by the Comet assay revealed a significantly reduced level of DNA damage after simultaneous cell treatment with *L. deterrimus* extract and STZ, while *M. platyphylla* extract in combination with STZ induced higher extent of DNA breaks than STZ treatment alone. PARP-1 is a nuclear enzyme that is widely used as a biochemical marker that can distinguish between types of cell death, as its proteolysis results in cell death type-specific proteolytic fragments. PARP-1 cleavage profile determined by Western blot revealed that STZ treatment results in predominantly necrotic β-cell death, co-treatment with *L. deterrimus* extract reduces PARP-1 degradation, while *M. platyphylla* extract additionally induces apoptotic cell death, which explains the considerable decrease in cell viability. In conclusion, *L. deterrimus* extract possesses antioxidant potential and protective effects on β-cell death induced by STZ. On the other hand, *M. platyphylla* extract, although without cytotoxic effect *per se*, in conditions of oxidative stress turns into cytotoxins, and therefore its consumption should be avoided.

In silico Screening and Analysis of Ganoderma spp. for Potential Anticancer Activities

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The *Ganoderma* mushroom has the longest historical usage for medicinal properties dating back at least 4,000 years. In Japan it is called Reshi, and in China and Korea it is called Ling Chu and Ling Zhi. It belongs to the Polyporaceae family of higher Basidomycetes. Traditionally, it has been used widely in treatment of hepatopathy, chronic hepatitis, nephritis, hypertension, arthritis, insomnia, bronchitis, asthma, and gastric ulcer. Also, dried powder of *G. lucidum* is recommended as a cancer chemotherapy agent in traditional Chinese medicine.

Recent researches showed that extracts of *G. lucidum* have anti-diabetic, antioxidant, immunomodulatory, antitumor, anti-metastatic activities, and some fungal proteins have hemagglutin, deoxyribonuclease, ribonuclease and protease inhibitory activity. Its extracts had also been analyzed for the presence of terpenes (conferring cytotoxicity), ganoderic acids (A and C, inhibit farnesyl protein transferase), polysaccharides (beta-glucanes, gluconoglucane, arabinoglucan, proteoglucane, and amino polysaccharides. Other species of *Ganoderma* have largely been ignored despite having an ancient medicinal background. *In silico* studies using bioinformatic tools can be used to detect the presence of medicinal compounds among different species of *Ganoderma* and to find their possible targets in cancer cells.

None of the species of *Ganoderma* have been completely sequenced up till now. To find the relation between the *Ganoderma* species Clustal W analysis was done. Nucleotide sequence of 18s – rRNA of 15 *Ganoderma* species were obtained in FASTA format from NCBI. Clustal-W results showed that *G. valesiacum, G. ahmadii, G. carnosum, G. lucidum,* and *G. oregonense* were closely related, hence, these spp. may also produce the same compounds. About 30 different protein sequences of *G. lucidum* (FASTA format, NCBI) were analyzed in the Conserved Domain Database of NCBI (e value= 0.01, PSSM). Four sequences viz, Lz8 (Chain B- PDB Id= PDB:3F3H_B and Chain