Investigation of the prebiotic properties of Ganoderma lucidum and Lentinula edodes polysaccharides

Mohaddeseh Larypoor[1], Neda Jameyi[1], Hoora Dadgostar[1], Jamileh Nowroozi[1]

1. Department of Microbiology, Faculty of Biological Sciences, Islamic Azad University, North Tehran Branch, Tehran, Iran

Abstract

Background and Aim : Probiotics are non-pathogenic and beneficial microorganisms that contribute to the health of the body. These bacteria require compounds known as prebiotics for their survival and long-term establishment in the digestive tract. Prebiotics are indigestible compounds resistant to the human body's digestive enzymes that selectively multiply in the large intestine and stimulate the activity of a specific population of probiotic bacteria. In countries such as China and Japan, polysaccharides from the mushrooms Ganoderma lucidum and Lentinula edodes are used as prebiotics in the treatment of diseases such as cancer, which leads to an increase in the quality of life in these people. The use of natural, available, inexpensive, and side effects-free compounds such as the use of polysaccharide lentinan found in the mushroom Lentinula edodes and the isolation, extraction, and purification of the effective compounds of this mushroom will be very efficient and useful in the treatment of patients with cancer.

Methods : In this study, 20 different samples of traditional and industrial dairy products were isolated, and appearance, biochemical, and probiotic tests such as growth in acidic conditions and growth in a medium containing bile salts, as well as antibiotic resistance tests, were performed on the isolated strains. Finally, 4 isolates (2 yeast isolates and 2 bacterial isolates) were isolated and purified. For molecular examination of the isolates, PCR was used to amplify the 16srRNA and 18srRNA genes, and after sequencing, similarity analysis was performed using bioinformatics software. To extract lentinan polysaccharides, fungal strains Lentinula edodes and Ganoderma lucidum were cultured in a liquid medium and polysaccharide extraction was performed by lyophilization of mycelium. The phenol-sulfuric acid method was used to determine the concentration of extracted polysaccharide, its structure was identified using Fourier transform infrared, the resistance to acidic and enzymatic digestion of extracted polysaccharides was investigated by simulating digestive juices, and the DPPH method was used to investigate antioxidant activity. To investigate the effect of extracted polysaccharides on the growth of probiotic bacteria, the extracted polysaccharide was added to a sugar-free medium.

Results : The isolates had good resistance at low pH and their optimal growth temperature was 37 °C. The final strains also grew in a medium containing bile salt. According to phenotypic, biochemical, and sugar fermentation patterns, isolates A10 were close to Candida tropicalis, A3 to Saccharomyces cerevisiae, B1 to Lactobacillus casei, and B3 to Lactobacillus acidophilus. Bacterial strains were resistant to ceftazidime, streptomycin, and vancomycin and sensitive to tetracycline, clindamycin, and chloramphenicol antibiotics. Fungal strains were resistant to fluconazole and sensitive to ketoconazole. Also, isolated polysaccharides have water retention, fat absorption, antioxidant activity, and prebiotic ability comparable to or even better than inulin.

Conclusion : Based on the results of this study, isolated polysaccharides with desirable technological and bioactive properties and having several desirable properties at the same time can be a good option for improving food quality and health effects. This requires further studies in animal and human models.

Keywords : Probiotic, Prebiotic, Lentinula edodes, Ganoderma lucidum, Polysaccharide, Lentinan

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