

Research Progress on the Antitumor Effect of Polysaccharides from Fungus Used in Traditional Chinese Medicine

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Abstract: Cancer is a serious threat to human health. Fungal polysaccharide is a polar biological macromolecule with low toxicity. It has a wide range of biological activities, including immune regulation, antitumor activity, and antiviral activity. In recent years, the research results have shown that polysaccharides from fungus in traditional Chinese medicine have excellent antitumor effect in liver cancer, gastric cancer, breast cancer, colon cancer, esophageal cancer, and lung cancer. Therefore, the research and development of fungal polysaccharides are of great significance for the development of antitumor drugs in the future.

Keywords: Fungal polysaccharide; Traditional Chinese medicine; Antitumor; Action mechanism

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1. Introduction

Cancer, being a serious threat to human health, is the leading cause of death worldwide. Statistics have shown that 18.1 million new cases of cancer are expected in 2018^[1]. Therefore, it is necessary to strengthen the research on tumor prevention and treatment to reduce the burden of cancer^[2].

Natural products are effective ways to develop new drugs. The statistics on the sources of clinical drugs show that more than 50% of clinical drugs are derived from natural products and their derivatives. Fungal polysaccharides have been widely used in the development of functional foods and health products^[3].

In recent years, research have suggested that the polysaccharides from fungus, including *Grifola frondosa*, *Lentinus edodes*, *Auricularia auricula*, and *Inonotus obliquus*, have good curative effect for various tumors. This research reviews the therapeutic effect of fungal polysaccharides through the research progress in recent years in regard to a few types of tumors.

2. Liver cancer

Dongxia LV and other researchers^[4] used *Grifola frondosa* polysaccharide with cisplatin in liver cancer, resulting in a significantly enhanced antitumor effect. A study^[5] have found that 58.3% of patients with liver cancer had significantly reduced symptoms after using *Grifola frondosa* polysaccharide. In another research^[6], it was found that the inhibitory rate of *Ganoderma lucidum* polysaccharide on tumor in hepatoma-bearing mice was dose-dependent. Other studies^[7] have shown that *Cordyceps* polysaccharide can significantly inhibit the growth of H22 tumors in mice.

3. Gastric cancer

In a study that used chemotherapy and lentinan groups to treat patients with advanced gastric cancer ^[8], the result showed that the number of cytotoxic T cells in the peripheral blood of patients increased significantly. Studies ^[9] have found that using *Poria cocos* polysaccharide oral solution along with Western medicine can improve the quality of life and immune function of patients with advanced gastric cancer.

4. Breast cancer

It was found that letinous edodes polysaccharide, as an adjuvant chemotherapy in breast cancer, can effectively inhibit the growth of tumor blood vessels and regulate immune function ^[8]. It has also been found that letinous edodes polysaccharide can inhibit the expression of drug resistance genes (MDR1, MRP1, and BCRP), enhance the sensitivity of MCF-7 cells to taxol, as well as promote cell inhibition and apoptosis ^[10]. On the other hand, polysaccharides with the function of inhibiting MDA-MB-231 cell migration have been successfully isolated from *Poria cocos* ^[11].

5. Colon cancer

It was found that the *Inonotus obliquus* polysaccharide can induce tumor cell apoptosis by affecting Bax/Bcl-2 ratio and activating caspase-3 ^[12]. In a research, it has been proven that *Ganoderma lucidum* polysaccharide can induce the apoptosis of colon cancer cells ^[12]. The apoptosis of LoVo cells is related to cell cycle arrest, a specific death receptor (Fas), mitochondrial pathway, and MAPK pathway. In addition, the apoptosis of HCT-116 cells is also related to cell cycle arrest, a specific death receptor (Fas) pathway, and mitochondrial pathway.

6. Esophageal cancer

Xiaolei Huo and other researchers ^[13] found that *Lentinus edodes* polysaccharide plus taxol can significantly increase the apoptosis of esophageal cancer cells as well as inhibit the cell adhesion and migration related to tumor metastases.

7. Lung cancer

Grifola frondosa β Polysaccharides can induce the apoptosis of lung cancer cells by activating oxidative stress ^[14]. *Grifola frondosa* polysaccharide can inhibit the proliferation of A549 cells, where its mechanism is related to the dissipation of mitochondrial membrane potential ^[15]. Junqiang Qiu and other researchers ^[16] found that the complex formed by polysaccharides from *Auricularia auricula* and cisplatin has excellent antitumor cell proliferation property.

8. Conclusion and prospect

Cancer is a major disease which threatens human health. Patients with cancer require long-term radiotherapy, chemotherapy, or surgery, which would harm to their bodies. Fungal polysaccharides have excellent antitumor effect, low toxicity, and minimal side effects, thus having inherent advantages in the research and development of antitumor drugs. Hence, it is worthwhile to further explore on polysaccharides from fungus used in traditional Chinese medicine for new drugs in the treatment of cancer.

This article reviewed the progress of fungal polysaccharides in the treatment of several tumors. Polysaccharides from *Grifola frondosa*, *Lentinus edodes*, *Auricularia auricula*, *Inonotus obliquus*, and other fungi can alleviate malignant tumors, such as liver cancer, stomach cancer, breast cancer, colon cancer, esophagus cancer, as well as lung cancer, through various mechanisms and in combination with other drugs.

In conclusion, fungal polysaccharides, which play a unique role in inhibiting malignant tumors, are worth further discussion.

Disclosure statement

The authors declare that there is no conflict of interest.

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