

## In Vitro and in vivo Studies of *Ganoderma lucidum* in Cancer

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### Abstract

Current cancer therapy such as chemotherapy and radiography are known to possess many side effects that could lead to serious complications. The application of natural product as complementary and alternative treatment provides significant advantages. It could increase the sensitivity of chemotherapy and radiography while at the same time reducing their associated side effects and complications. With regards to anticancer drugs, more than 50% of the modern oncological drugs are derived from natural products. An edible mushroom, *Ganoderma lucidum* has long been used in traditional and conventional medicine in China, for the prevention and treatment of various human diseases.

The fungus possesses a wide variety of bioactive compounds present in its fruiting bodies, mycelium and spores, including anticancer property that has been proven in in vitro and in vivo studies. The carcinostatic effects of *G. lucidum* have been shown in a variety of cancer cell lines, including breast, pancreas, lung, colon, skin and prostate. This paper presents in vitro and in vivo studies of the anticancer properties of *G. lucidum* in cancers.

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### Introduction

From thousands of years ago, medicinal herbs have long been used as a natural remedy by the ancient people. Even in this 21<sup>st</sup> century, medicinal plants still continue to play a central role in the healthcare system of the world's population<sup>1</sup>. Currently, western medicine has started accepting natural products from Traditional Chinese Medicine. There is also an increasing popularity of herbal therapies for the treatment of cancer in the United States.<sup>2</sup> Most of the commercially available mushrooms contain free radical scavenging, reducing power, chelating effects on metal ions, and antioxidant properties.<sup>3</sup> Among these mushrooms, *G. lucidum* has long been used in traditional and

conventional Chinese medicine for the prevention and treatment of various human diseases.<sup>4, 5</sup> Contemporary research indicates that *G. lucidum* and some other species of the *Ganoderma* genus contain bioactive constituents, including polysaccharides like beta-glucans and tripterpenes like ganderic acids.<sup>6</sup> Hence, scientific justification based on the elucidation of mechanisms responsible for the biological effects of these natural products could help validate their use in alternative or adjuvant cancer therapies.<sup>7</sup>

The primary reason for using this type of plant-based medicine is because it could reduce the side effects and complications associated with chemotherapy and radiotherapy. Currently, the major standard cancer therapies widely used are still surgery, chemotherapy, and radiotherapy.<sup>8</sup> Although chemotherapy and radiotherapy are effective against cancer, they also possessed serious side effects and complications such as fatigue, pain, diarrhea, nausea, vomiting, and hair loss.<sup>9</sup> The clinical use of the chemotherapy drug is limited due to cellular resistance and dose-dependent toxicity in normal tissue.<sup>10</sup> Hence, the use of natural

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