# Identification of multitarget Phytochemicals from Ganoderma Against Breast Cancer via in-silico and in vitro studies

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**Specific problem being addressed**: In the last ten years, there has been no discernible decrease in patient mortality, despite advances in research leading to a greater understanding of the disease. Chemotherapy, radiotherapy, and surgery remain the standard treatments. Here, we aim to identify phytochemicals from a fungus (Ganoderma species) that can combat this fatal illness by drawing on prior knowledge (oncogenes and signaling pathways). We expect to discover efficacious phytochemical to kill tumor cells, with limited toxicity to the normal cells. We anticipate finding potent phytochemicals that kill tumor cells while posing little threat to healthy cells.

**Project Summary:** According to scientific reports, phytochemicals have a high potential for preventing cancer. Approximately half of approved anticancer medications between 1940 and 2014 derived directly or indirectly from natural sources. They have complementary and overlapping mechanisms that scavenge free radicals, inhibit the survival and growth of malignant cells, and lessen the invasiveness and angiogenesis of tumors. These medications affect a wide range of molecular targets and signal transduction pathways in diverse and interesting ways.

The genus Ganoderma of mushrooms has been proven to be a never-ending supply of physiologically active metabolites. Among the possible anticancer Ganoderma species include Ganoderma lucidum, G. sinense, G. atrum, G. tsugae, G. neo-japonicum, and, most recently, G. hainanense. Among the bioactive substances that have been isolated, examined, and found from Ganoderma spp. are triterpenoids, polysaccharides, nucleosides, sterols, proteins, and alkaloids. It has been proposed that the reasons for Ganodrma's effectiveness are either the polysaccharide part, which boosts the immune system, or the triterpenes, which exhibit cytotoxic action against a variety of cancer cells. Studies indicate that the phytochemicals in this mushroom are ideal and suitable for use as a herbal medicine because of its infrequent or negligible negative effects and substantial health advantages. In this work, molecular dynamics (MD) modeling, in vitro investigations, and phytochemicals from Ganoderma spp. will be used for virtual screening.

The objectives of our study include
> 1. *Identification of a phytochemical against potent oncogenes of breast cancer by computational analysis.*
> 2. *Understanding effects of selected compounds on cancer cell viability and cell cycle using in vitro models*

The most often overexpressed receptors in breast cancer cells are those belonging to the EGFR family of receptor tyrosine kinases. Elevated levels of EGFR and HER2 are seen in about 40% and 20% of breast cancers, respectively, and are assumed to be associated with aggressive tumor behavior and a bad prognosis. Research has demonstrated that the cooperation of membrane tyrosine kinase receptor (c-MET) and hepatocyte growth factor (HGF) is often associated with aggressive features of cancer and enhanced metastasis. Targeting of these proteins of breast cancer using phytochemical may provide a key role in breast cancer therapy

**Impact of this innovation:** Breast cancer is a prevalent malignancy that affects women worldwide. WHO figures from 2020 show that 2.3 million women received a breast cancer diagnosis and 685,000 women died worldwide. Although

a few publications have shown that whole organism extract from Ganoderma spp. has anti-cancer actions, the phytochemical's potential is still completely unknown. In this work, we suggested screening the Ganoderma spp. individual phytochemical library against a range of breast cancer target proteins. This study will have a significant influence, particularly in a developing nation like India where the focus will be on the multitargeting of a single medicine in the treatment of breast cancer.