Piper betle shows antioxidant activities, inhibits MCF-7 cell proliferation and increases activities of catalase and superoxide dismutase

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Abstract

Background: Breast cancer is the most common form of cancer and the focus on finding chemotherapeutic agents have recently shifted to natural products. Piper betle is a medicinal plant with various biological activities. However, not much data is available on the anti-cancer effects of P. betle on breast cancer. Due to the current interest in the potential effects of antioxidants from natural products in breast cancer treatment, we investigated the antioxidant activities of the leaves of P. betle and its inhibitory effect on the proliferation of the breast cancer cell line, MCF-7.

Methods: The leaves of P. betle were extracted with solvents of varying polarities (water, methanol, ethyl acetate and hexane) and their phenolic and flavonoid content were determined using colorimetric assays. Phenolic composition was characterized using HPLC. Antioxidant activities were measured using FRAP, DPPH, superoxide anion, nitric oxide and hydroxyl radical scavenging assays. Biological activities of the extracts were analysed using MTT assay and antioxidant enzyme (catalase, superoxide dismutase, glutathione peroxidase) assays in MCF-7 cells.

Results: Overall, the ethyl acetate extract showed the highest ferric reducing activity and radical scavenging activities against DPPH, superoxide anion and nitric oxide radicals. This extract also contained the highest phenolic content implying the potential contribution of phenolics towards the antioxidant activities. HPLC analyses revealed the presence of catechin, morin and quercetin in the leaves. The ethyl acetate extract also showed the highest inhibitory effect against the proliferation of MCF-7 cells (IC50=65 µg/ml). Treatment of MCF-7 cells with the plant extract increased activities of catalase and superoxide dismutase.

Conclusions: Ethyl acetate is the optimal solvent for the extraction of compounds with antioxidant and anti-proliferative activities. The increased activities of catalase and superoxide dismutase in the treated cells could alter the antioxidant defense system, potentially contributing towards the anti-proliferative effect. There is great potential for the ethyl acetate extract of P. betle leaf as a source of natural antioxidants and to be developed as therapeutics in cancer treatment.

Keywords: Piper betle, Antioxidant, Phenolic, MCF-7, Cytotoxicity, Catalase, Superoxide dismutase, HPLC

Background

Breast cancer is the third most common cause of cancer deaths worldwide and is the most common form of cancer in women. The cause of breast cancer is multifactorial, with hormonal, genetic and environmental factors playing a role in its pathogenesis. The current treatment strategies involve chemotherapy, radiation therapy, hormones and surgery. More recently, the focus on finding chemotherapeutic agents have shifted towards natural products. Various plants and their bioactive compounds have been shown to have anticarcinogenic and anti-proliferative effects towards breast cancer cells [1,2]. Studies have also reported positive correlation between antioxidant activities of plants and their anti-proliferative effects, suggesting the potential action of antioxidants in inhibiting cancer cell growth [3]. Phenolic compounds such as epigallocatechin gallate and quercetin, which have high antioxidant activities, demonstrated anti-proliferative effects against breast