

# Kaempferol-3-*O*-rhamnoside isolated from the leaves of *Schima wallichii* Korth. inhibits MCF-7 breast cancer cell proliferation through activation of the caspase cascade pathway

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**Abstract.** Plants consumed by non-human primates represent potential drug sources for human disease management. In this study, we isolated kaempferol-3-*O*-rhamnoside as an active compound from the leaves of *Schima wallichii* Korth., a plant commonly consumed by non-human primates. Its anti-cancer activities, including its ability to induce apoptotic mechanisms, were investigated in MCF-7 breast cancer cells. Results showed that in MCF-7 cells, kaempferol-3-*O*-rhamnoside inhibits cell proliferation in a dose-dependent manner and promotes apoptosis via the activation of the caspase signaling cascade, which includes caspase-9, caspase-3 and PARP. Our results provide a basis for further exploration of kaempferol-3-*O*-rhamnoside as an active compound for potential anti-cancer therapeutics.

## Introduction

With over 12.5 million new cases and 7.5 million mortalities annually, cancer is becoming one of the most malignant diseases worldwide. Among the various cancer types, breast cancer contributes to more than 1.2 new cases and 0.5 million mortalities annually, making it the most malignant form of cancer among women (1). Due to this high incidence, the identification of novel compounds that inhibit cancer development has become a crucial objective for scientists. Of the hundreds

of chemicals that have been and are being evaluated for their anti-cancer activities, natural products derived from medicinal plants rank among the most promising.

In an effort to identify novel agents that may inhibit cancer development, we have focused our investigations on discovering bioactive compounds from plants commonly consumed by primates. Due to the high degree of physiological similarity between primates and humans, primate disease often exhibits similarities to human disease, and certain human diseases are known to have originated from primates. Notably, since primate survival largely depends on daily food intake, the food consumed by primates is considered a promising source of products applicable for human disease management.

In our previous study, we found that the leaves of *Schima wallichii* Korth., a primate-consumed plant, demonstrated anti-tumor and anti-mutagenic properties (2,3). These preliminary studies suggest that *Schima wallichii* Korth. may be further developed as a source of anti-cancer agents. Thus, in this study, we investigated and characterized the pro-apoptotic activities of *Schima wallichii* Korth. leaf extracts.

## Materials and methods

**Plant materials.** *Schima wallichii* Korth. leaves were collected from Lembang, West Java, Indonesia. The plant species was identified by the Department of Biology, Faculty of Mathematics and Natural Sciences, University of Padjadjaran, Indonesia.

**Extraction and isolation.** The dried leaves of *Schima wallichii* Korth. (5 kg) were extracted with 70% ethanol (3x24 h) at room temperature. The solvent was subsequently evaporated under reduced pressure at 50°C to yield a concentrated extract. The ethanol extract (506.05 g) was fractionated between n-hexane and water to obtain an n-hexane extract (43.90 g) and a water layer. The water layer was then extracted with ethyl acetate to obtain an ethyl acetate fraction (47.35 g) and a water fraction

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