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ORIGINAL ARTICLE

# Catechin Isolated from *Garcinia celebica* Leaves Inhibit *Plasmodium falciparum* Growth through the Induction of Oxidative Stress

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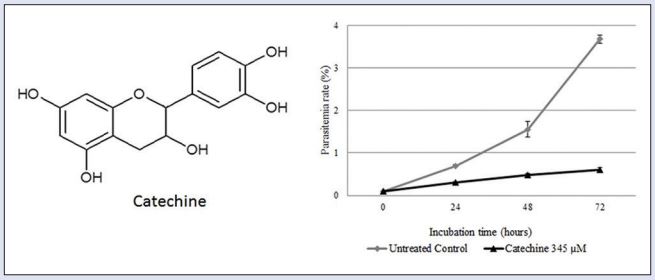
## ABSTRACT

**Background:** Resistance of antimalarial drugs to *Plasmodium falciparum* has become a major concern in malaria eradication. Although it is also affected by several socioeconomic factors, a new antiplasmodial agent is needed for a global malaria control program. **Objective:** In this study, we attempted to uncover the antiplasmodial properties of *Garcinia celebica*, an Indonesian medicinal plant, along with the responsible compound and its possible mechanism. **Materials and Methods:** The *G. celebica* leaves were ethanol extracted and fractionated based on their polarity using *n*-hexane, ethyl acetate, and water. The antiplasmodial activity was tested *in vitro* against chloroquine-resistant *P. falciparum* at 100 μg/ml for 72 h. The active compound of the most active ethyl acetate fraction was subsequently isolated using column chromatography and identified by nuclear magnetic resonance. **Results:** The $IC_{50}$ of (+)-catechin, the characterized compound, against *P. falciparum* was 198 μM in 24 h and experiment. The isolated catechin inhibited *P. falciparum* growth in both trophozoite and schizont stages. An additional experiment also suggests that the antiplasmodial property of catechin occurs through the induction of the oxidative stress to *P. falciparum*. **Conclusion:** This result shows that the potential of catechin and its antimalarial properties should be explored further.

**Key words:** Catechin, *Garcinia celebica*, malaria, *Plasmodium falciparum*

## SUMMARY

- *Garcinia celebica* leaf extract and fractions inhibit *Plasmodium falciparum* growth
- Catechin, the active compound of Garcinia celebica leaf extract, inhibits Plasmodium falciparum growth in a time- and dose-dependent manner
- Catechin inhibits Plasmodium falciparum growth in both trophozoite and schizont stages, through induction of oxidative stress.




**Abbreviations used:** RBC: Red Blood Cells; IC50: Inhibition Concentrattino 50; MeOH: Methanol; RPMI: Roswell Park Memorial Institute; EI: Electron Ionization.

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## INTRODUCTION

Malaria is a deadly parasitic disease[1] and causes 2 million deaths annually worldwide.[2] The biggest problem in its eradication is the growing resistance of *Plasmodium falciparum*, which may cause the most fatal form of malaria,[3] to almost all of the currently available malarial drugs.[4] Even with the current multidrug therapy program, *P. falciparum* has developed drug resistance against the latest antiplasmodial drug from the artemisinin family.[5] Although malaria drug resistance is also affected by several socioeconomic factors, a new antiplasmodial agent is needed for a global malaria control program.

From the hundreds of compounds tested for their antiplasmodial activities, plants and other natural compound are among the most promising.[6-8] Quinine, the first antimalarial agent, and the next generation of antimalarial agents, including lapachol and artemisinin, have been isolated from plants.[9,10] We previously reported the antiplasmodial activity of kaempferol-3-*O*-rhamnoside isolated from *Schima wallichii* leaves against chloroquine-resistant *P. falciparum*.[11] Furthermore, our group also reported the antiplasmodial potential of several selenium compounds to induce apoptosis-like cell death in *P. falciparum*.[12]

One of the approaches to find a novel drug from plants is using plants that are consumed by particular groups.[13] In recent years, we focused our research on discovering bioactive compounds from plants commonly consumed by nonhuman primates, as they are considered to be a promising source of products applicable for the management of human disease.[14] In the present study, we focused on the exploration of the antiplasmodial activities of *Garcinia celebica* leaves, one of the plants that is consumed by nonhuman primates with anticancer potential.[15] In our previous studies, we reported the anticancer potential of kaempferol-3-*O*-rhamnoside,[16,17] a compound that is



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