Suppression effects of *Tinospora crispa* extract on microneme protein inhibit host cell invasion in *Toxoplasma gondii* infection *in vitro*

Sharif A. A, Ngah ZU, Norshirizah N, Rasila B, Wana, M N, Danji IM, Yahaya H, Rostain AM

**INTRODUCTION**

Infection with *Toxoplasma gondii* still remains of public health significance. Host cell invasion is actively coordinated by calcium-dependent protein kinases (CDPK). The chemotherapeutic agents used against toxoplasmosis are mainly antibiotics and anti-malaria. However, treatment failures with these agents, attributed to host drug intolerance with severe side effects as well as development of resistance have been reported. This study aims to evaluate the effect of the ethanolic extract of *T. crispa* (EETC) on CDPK genes of *T. gondii* that facilitate host cell invasion during infection.

**METHODS**

**Figure 1.** Shows the steps in the lytic cycle of *T. gondii* infection (A) and (B) functions of CDPKs and (C) the proposed mechanism of action of EETC.

**RESULTS**

**Figure 3.** Quantification of major phytochemicals in EETC

**Figure 4.** Shows cytotoxicity assay (A & B) and anti-parasitic assays (C & D) of clindamycin and EETC with estimated 50% inhibitory concentration

**Figure 5.** infection index and intracellular proliferation of *T. gondii*. More parasites are seen in the nontreated control (A) than (B) treated with clindamycin. There is marked reduction of the parasite in extracts treated group (C).

**Figure 6.** Relative expression of protein kinase genes after exposure to the extract in 4 hr (A and B) and 24 hr (C and D) post-infection treatment. It is shown that there is downregulation of all the PK genes.

**CONCLUSION**

This study shows that EETC modulates expression of protein kinase genes and significantly decreased expression of microneme proteins thereby inhibiting host cell invasion in *T. gondii* infection. The EETC therefore contains phytochemicals that are effective against *T. gondii* that can be developed into effective drugs for treatment of toxoplasmosis.

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