

Anti-malarial and anti-inflammatory effects of *Gynura procumbens* are mediated by kaempferol via inhibition of glycogen synthase kinase-3 β (GSK3 β)

Abstract

Gynura procumbens is a medicinal plant, traditionally used to treat inflammation and fever. A yeast-based assay detected GSK3 β -inhibitory activity in the aqueous extract of *G. procumbens*. GSK3 β is now known to have a central role in the modulation of host inflammatory response during bacterial infections. In this study, we investigated the involvement of GSK3 β in the anti-malarial and anti-inflammatory effects of an aqueous extract of *G. procumbens*. Our results showed that *G. procumbens* inhibited growth of *P. falciparum* 3D7. Consecutive four-day administration of 250 mg/kg body weight (b.w.) *G. procumbens* resulted in strong chemosuppression and improved survivability in *P. berghei*-infected mice. *B. pseudomallei*-infected mice treated with *G. procumbens* (50 mg/kg b.w.) showed increased survivability. TNF- α and IFN- γ levels in liver and serum of *B. pseudomallei*-infected mice were lowered by *G. procumbens* treatment. IL-10 level was higher in serum of *G. procumbens*-administered infected mice. *G. procumbens* treatment of *P. berghei*- and *B. pseudomallei*-infected animals each resulted in increased hepatic GSK3 β (Ser9) phosphorylation. It is noteworthy that kaempferol (one of the compounds in *G. procumbens*) also inhibited the growth of *P. falciparum* 3D7; showed strong chemosuppression and improved survivability in *P. berghei*-infected mice at 5 mg/kg b.w. *B. pseudomallei*-infected mice treated with kaempferol (10 mg/kg b.w.) showed improved survivability. Concomitantly, the described effects due to kaempferol also involved enhanced GSK3 β (Ser9) phosphorylation as observed with *G. procumbens*. In summary, the observed anti-malarial and anti-inflammatory effects of *G. procumbens* involved inhibition of GSK3 β and kaempferol may in part be responsible for the pharmacological effects.