

Plasma and urine metabolite profiling reveals the protective effect of *Clinacanthus nutans* in an ovalbumin-induced anaphylaxis model: ¹H-NMR metabolomics approach

ABSTRACT

The present study sought to identify the key biomarkers and pathways involved in the induction of allergic sensitization to ovalbumin and to elucidate the potential anti-anaphylaxis property of *Clinacanthus nutans* (Burm. f.) Lindau water leaf extract, a Southeast Asia herb in an in vivo ovalbumin-induced active systemic anaphylaxis model evaluated by ¹H-NMR metabolomics. The results revealed that carbohydrate metabolism (glucose, myo-inositol, galactarate) and lipid metabolism (glycerol, choline, sn-glycero-3-phosphocholine) are the key requisites for the induction of anaphylaxis reaction. Sensitized rats treated with 2000 mg/kg bw *C. nutans* extract before ovalbumin challenge showed a positive correlation with the normal group and was negatively related to the induced group. Further ¹H-NMR analysis in complement with Kyoto Encyclopedia of Genes and Genomes (KEGG) reveals the protective effect of *C. nutans* extract against ovalbumin-induced anaphylaxis through the down-regulation of lipid metabolism (choline, sn-glycero-3-phosphocholine), carbohydrate and signal transduction system (glucose, myo-inositol, galactarate) and up-regulation of citrate cycle intermediates (citrate, 2-oxoglutarate, succinate), propanoate metabolism (1,2-propanediol), amino acid metabolism (betaine, N,N-dimethylglycine, methylguanidine, valine) and nucleotide metabolism (malonate, allantoin). In summary, this study reports for the first time, *C. nutans* water extract is a potential anti-anaphylactic agent and ¹H-NMR metabolomics is a great alternative analytical tool to explicate the mechanism of action of anaphylaxis.

Keyword: *Clinacanthus nutans*; Medicinal plant; Ovalbumin; Active systemic anaphylaxis; NMR metabolomics; Multivariate analysis