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北海道医療大学大学院歯学研究科

原　田　　文　也

**Abstract**

Astaxanthin (AST) has a strong antioxidant cellular membrane chaperone protective effect. Recently, a water-soluble nano-sized AST (nano-AST) form was produced and it is expected to improve the efficacy of oral intake effects. The purpose of this study was to examine whether oral nano-AST has therapeutic effects on UV-induced photokeratitis in mice.

C57BL/6 mice were administered twice with either nano-AST, AST oil, lutein or bilberry extracts 3 hours before and shortly before UV-irradiation (dose: 400 $mJ/cm^2$). The corneas were collected 24 hours after irradiation and stained with H&E and TUNEL. NF-κB, dihydroethidium (DHE), COX-2, p-IκB-α, c-caspase 3, TNFα and CD45 expression were evaluated through immunohistochemistry, western blot analysis, and qRT-PCR.

Corneal epithelium was significantly thicker in mice orally administered nano-AST than in the other groups ($p<0.01$), with significantly less NF-κB nucleus translocation ($p<0.001$) and significantly fewer TUNEL cells ($p<0.01$). Weaker DHE signals were detected in the nano-AST group ($p<0.05$) relative to the other groups. Furthermore, reduced inflammation and decreased cell death in corneal tissue was observed in the nano-AST group, as indicated by a reduction in the expression of COX-2, p-IκB-α, c-caspase 3, TNFα and CD45.

Oral administration of nano-AST demonstrated a protective effect on UV-induced photokeratitis via anti-oxidative, anti-inflammatory and anti-apoptotic activities.