Berberine suppresses IL-1β-induced MUC5AC expression in human airway epithelial cells

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ABSTRACT

Background: Berberine is a bitter-tasting, yellow, plant alkaloid with a long history of medicinal use in Chinese and Ayurvedic medicine. There is some evidence to support its use in the treatment of heart failure, diabetes, veterinary medicine, and certain parasitic infections. It has been used as an antidiabetic, anti-cancer, and anti-inflammatory agent and has also been used for respiratory diseases. However, there is no information on whether berberine can suppress the expression of IL-1β-induced MUC5AC gene expression in NCI-H292 cells and to investigate which mitogen-activated protein kinases (MAPKs) were related to MUC5AC gene suppression.

Methods: After pretreatment with berberine, cells were stimulated with IL-1β (10 ng/mL) and MUC5AC expression was determined by RT-PCR and real-time PCR. MAPKs proteins were determined by Western blot analysis after pretreatment berberine.

Results: Treatment with berberine for 24 hours suppressed MUC5AC mRNA expression in a dose-dependent manner, with significant inhibition starting at 25 μM berberine. MAPKs proteins were determined by Western blot analysis after pretreatment with 25 μM berberine. Berberine suppressed phosphorylation of extracellular signal regulated kinase (ERK) and p38 MAPK. Suppression of IL-1β-induced MUC5AC mRNA was also observed in cells pretreated with ERK- or p38 MAPK-specific inhibitors, suggesting that berberine-mediated suppression of IL-1β-induced MUC5AC mRNA expression via the ERK- and p38 MAPK-dependent pathways.

Conclusion: Our data suggested that berberine can suppress MUC5AC mRNA expression in ERK and p38 MAPK-dependent manner and may play a clinical valuable role in controlling mucin hypersecretion in airway inflammation.

MATERIALS AND METHODS

Berberine: a quaternary ammonium salt from the group of isoquinoline alkaloids found in such plants as Berberis, Dogwood, Cascade, and Capitulum chinesis in the roots, rhizomes, and stem bark.

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Materials

- Berberine (C22H18NO6): FW 371.4, Sigma Co., St. Louis, MO
- Human recombinant IL-1β, PharMingen, San Diego, CA
- NCI-H292 human bronchial epithelial cells (American Type Culture Collection, Rockville, MD)
- Triplab (CFX96): Biorad, Hercules, CA
- Optical density using spectrophotometer (490 nm)
- Pigment powder (Sigma-Aldrich, St. Louis, MO)
- Anti-MUC5AC Ab (1:1000, Santa Cruz Biotech, CA)
- Anti-p-ERK Ab (1:1000, Cell Signaling, Beverly, MA)
- Anti-p-p38 MAPK Ab (1:1000, Cell Signaling, Beverly, MA)
- Alamar blue (In Vitro Diagnostics, Los Angeles, CA)
- Real-time PCR assay
- TaqMan 

CONCLUSIONS

Berberine, the natural plant alkaloid significantly suppressed IL-1β-induced MUC5AC expression in human airway epithelial cells via the ERK- and p38 MAPK-dependent signal transduction pathway. Therefore, berberine may be considered as a possible anti-hyperssecretory agent.