Rhinovirus-induced type I interferon responses and viral load in primary nasal epithelial cells of subjects with & without atopic rhinitis and asthma

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Background: Defective type I interferon (IFN) production and consequent enhanced viral load have already been described in the bronchial epithelium of atopic asthmatic patients. The aim of the present study was to evaluate rhinovirus (RV) mediated IFN-β expression and RV load in upper airway epithelial cells of individuals with or without allergic rhinitis and asthma.

Methods: Primary nasal epithelial cells were collected with the use of a curette from adults with allergic rhinitis (n=7), allergic rhinitis (n=7) and asthma and from non-allergic, healthy volunteers (n=7). Cells were exposed to 1 multiplicity of infection of RV1b or control medium. Culture supernatants and total RNA were harvested after incubation for 6-72h. RV-induced cytotoxicity was evaluated by a crystal violet colorimetric assay and by measuring lactate dehydrogenase (LDH) release in cell supernatants. RV-mediated RANTES release in cell supernatants was determined with the use of ELISA. In order to investigate viral load we evaluated the intracellular RV RNA levels by real-time PCR. RV-induced IFN-β expression was also measured by real-time PCR.

Results:

Fig. 1a Crystal Violet Cytotoxicity

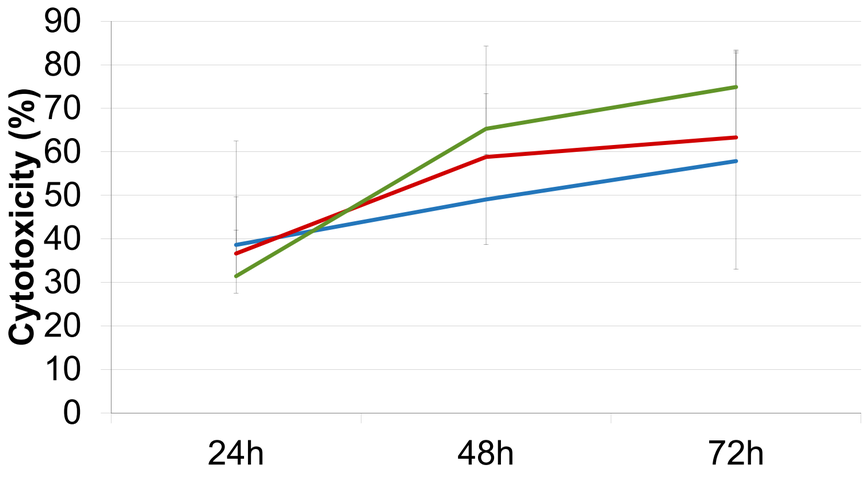

Fig. 1b LDH Cytotoxicity

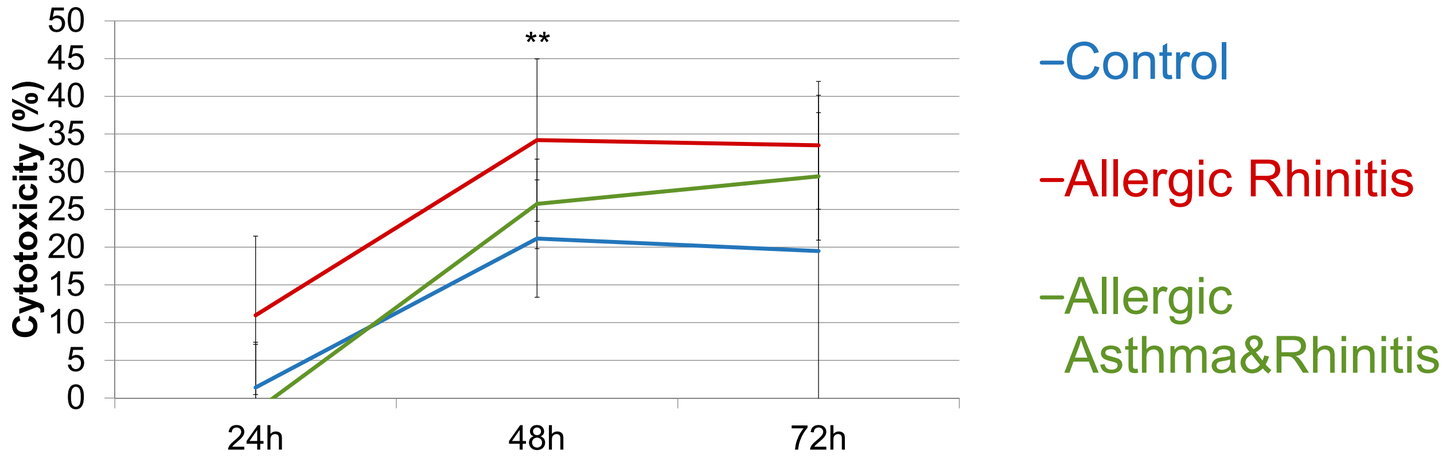

Fig.1: (a) RV infected cells did not exhibit significant differences in terms of cytotoxicity between the three groups at any timepoint examined with crystal violet staining. (b) RV infection of rhinitic cells induced higher LDH levels at 48h as compared to controls. (*p<0.01)

RANTES release

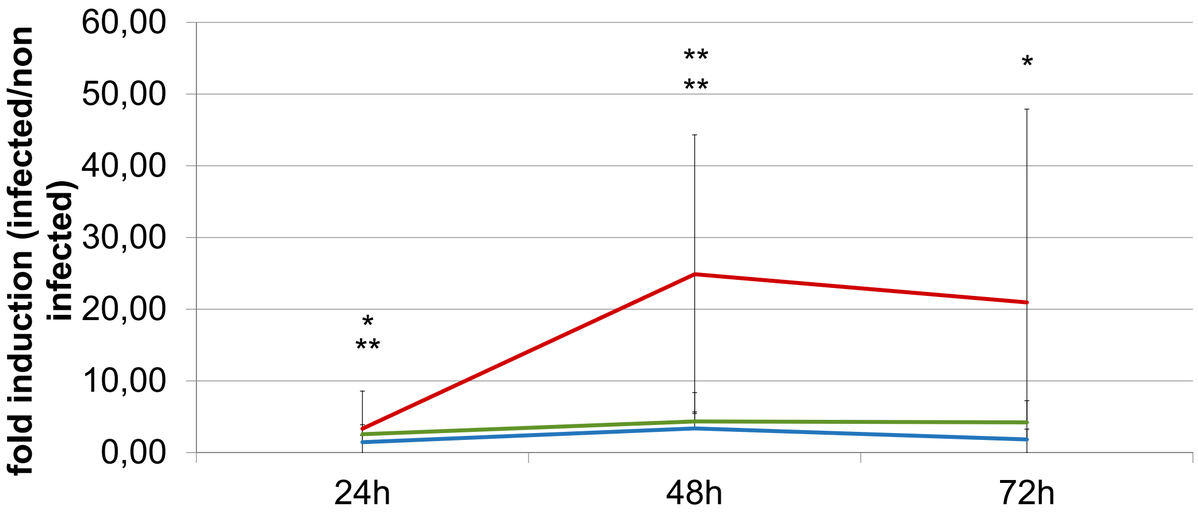

Fig.2: RV-mediated RANTES production by rhinitic donors was higher than control cells at 24h to 72h post-infection and than allergic asthmatic cells at 24h and 48h. (*p<0.05, **p<0.01)

RV replication

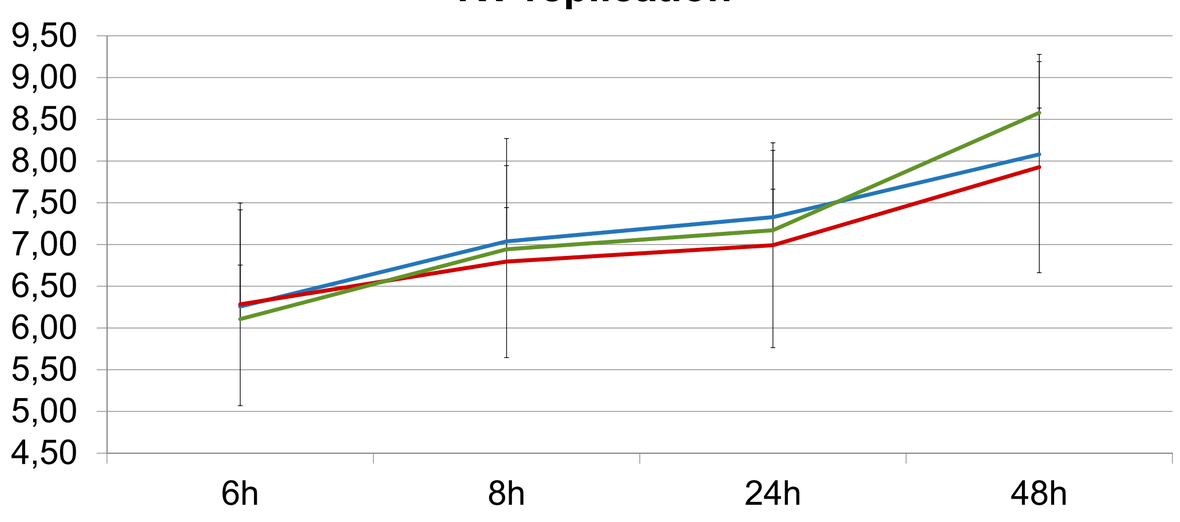

Fig.3: Infected cells from asthmatic donors displayed enhanced RV RNA levels at 72h compared to the other two groups, but differences were not significant.

IFN-β

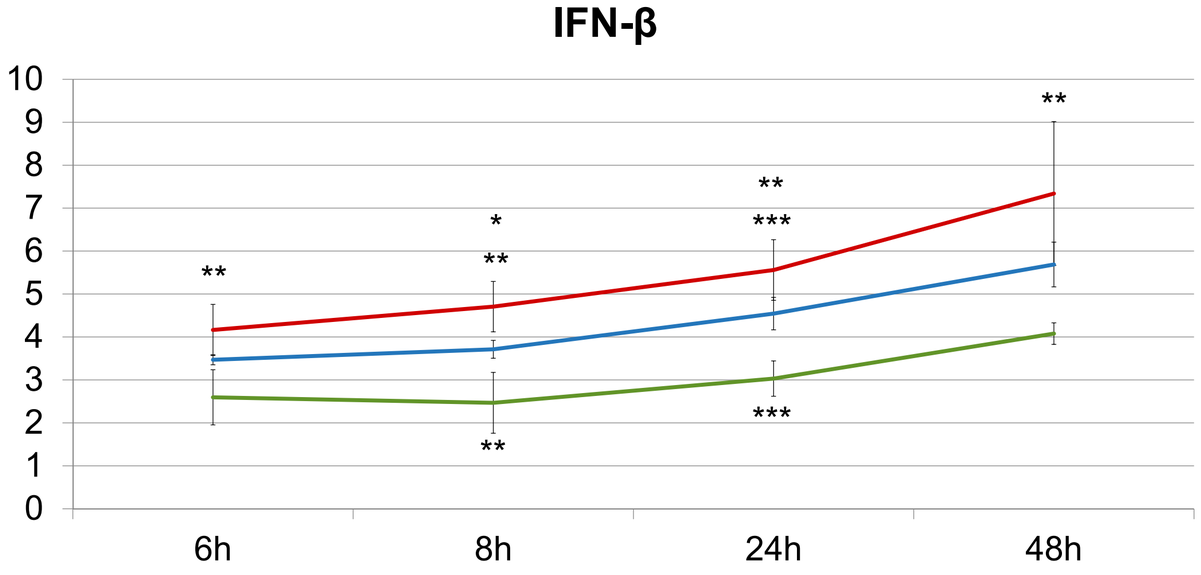

Fig.4: Cells from asthmatics expressed significantly lower IFN-β at all timepoints examined as compared to rhinitic and at 8h and 24h as compared to healthy individuals. Rhinitic cells expressed significantly higher IFN-β levels at 8h and 24h as compared to controls.
(*p<0.05, **p<0.01, ***p<0.001)

Conclusion: Impaired IFN-β antiviral response of asthmatic nasal epithelium may account for the presence of higher RV load in this clinical group. Additional data are required to explain the enhanced IFN-β expression by RV-infected cells of patients with allergic rhinitis.

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