Lectin-mediated inhibition of Pasteurella multocida adherence to rabbit respiratory epithelium in vitro

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Pasteurella multocida is a Gram-negative bacterium causing upper and lower respiratory tract infections in mammals including rabbits and the need for appropriate methods of control and prevention is mandatory. In this study, we asked whether the process of P. multocida adhesion to the rabbit respiratory epithelium and the subsequent colonization and lesion progression could be inhibited through the use of natural or recombinant lectins. To this aim, we cultured in vitro the nasal septa of 26-day-old rabbit embryos and evaluated the potential inhibitory activity of eighteen different lectins on P. multocida adhesion to the epithelium by using immunohistochemical analysis and semi-thin sections (0.5μm thick).

In a series of experiments where the nasal tissue culture was incubated with a lectin prior to infection with P. multocida, the lectins VVA, UEA, GSLI, ConA, LCA, PNA, WGA, RCA₁₂₀ and DBA inhibited significantly (p<0,01) P. multocida adhesion to the ciliated epithelium when compared to the control lectin-untreated nasal tissues. Interestingly, differential effects of a number of lectins on tissue changes were found, for example, PNA treatment was significantly associated with reduction of all lesions (p< 0,001), DBA, LCA, RCA₁₂₀ and WGA treatment was associated with reduced cell death, reduced intracytoplasmic vacuoles and decreased size of intercellular spaces, whereas Con A, and VVA treatments were associated with reduced intracytoplasmic vacuoles and decreased size of intercellular spaces, and GSL I treatment was also associated with reduced cell death and decreased size of intercellular spaces, when compared to lectin-untreated control tissues. These results indirectly indicate that similar to those lectins, P. multocida may use a wide number of adhesive structures that recognize different sugars on the apical membrane of the respiratory epithelium during the adhesion and colonization process to the host. Finally, another set of experiments assessing the inhibitory effects of lectins upon incubation with P. multocida prior to tissue infection revealed similar inhibition profiles. Together, our findings show indirect evidences of the potential of glycoproteins and oligosaccharides present on the apical membranes of respiratory epithelial cells and on the bacterial cell surface that may mediate the process of P. multocida adhesion and colonization into tissues.

The potential inhibitory effects of lectins on P. multocida adhesion, colonization and lesion progression in this study, would be of practical importance and suggest that less aggressive prophylactic or therapeutic strategies by using lectins or their counterpart carbohydrates could be used to explore prevention or control of bacterial infections.

Keywords P. multocida; lectins; bacterial adhesion inhibition; nasal septa culture.