Construction of a recombinant allergen-producing probiotic bacterial strain: Introduction of a new line for a live oral vaccine against Chenopodium album pollen allergy

Leila Roozbeh Nasiraie¹, Farideh Tabatabaie¹, Mojtaba Sankian², Fakhri Shahidi¹, Abdolreza Varasteh*³

Abstract

Background: During the last two decades, significant advances have been made in the fields of lactococcal genetics and protein expression. Lactococcus lactis (L. lactis) is an effective vector for protein expression and can be used as an antigen delivery system. Hence, L. lactis is an ideal candidate for mucosal immunotherapy. Profilin (Che a 2), the major allergen in Chenopodium album, is one of the most important causes of allergic diseases in desert and semi-desert areas, especially in Iran, Saudi Arabia, and Kuwait that was cloned and expressed in L. lactis for the first time.

Methods: To construct L. lactis that expressed Che a 2, a DNA sequence was cloned and used to transform bacteria. Expression of Che a 2 was analyzed via monitoring of related RNA and protein. Hydrophobicity, adherence to HT-29 cells, antibiotic resistance, resistance to gastrointestinal contents, pH, and bile salt in recombinant and native L. lactis were evaluated.

Results: Immunoblot analyses demonstrated that recombinant Che a 2 is expressed as a 32 kDa dimeric protein immunological studies showed it can bind human IgE. Both native and recombinant bacteria were sensitive to low pH and simulated gastric conditions. Bacterial survival was reduced 80-100% after 2 h of exposure to pH 1.5-2. Both native and recombinant bacteria were able to grow in 0.3 and 2% bile salts. After incubation of recombinant L. lactis in simulated gastric and intestinal juices for one and two hours, respectively, cell survival was reduced by 100%. Adhesion capability in both strains was minimal and there were no significant differences in any of our tests between native and recombinant bacteria.

Conclusion: Successfully recombinant L. lactis with capability of expression Che a 2 was produced and revealed it is sensitive to gastrointestinal contents.

Keywords: Recombinant L. lactis, Probiotic bacteria, Chenopodium pollen allergen, Oral vaccines

Introduction

Type I allergy is a major health problem that affects more than 25% of the population in industrialized countries (1). Pollens from anemophilous plants are a major problem in Type I allergy and the most predominant source of allergens in the outdoor environment (2). Chenopodium album (C. album, Lambs quarter) is a perennial plant that belongs to the...