

The production of hypoallergenic wheat flour and the analysis of its allergy suppressive effects

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Abstract. We propose a novel method to produce hypoallergenic wheat flour suitable for patients allergic to wheat by using enzymatic fragmentation with cellulase and actinase. The hypoallergenic flour displayed potent inhibitory activity against allergen absorption and actively suppressed allergic reactions, probably inducing oral tolerance. The results suggest that hypoallergenic wheat flour has allergy-suppressive effects without inducing side effects.

Keywords: Hypoallergenic wheat flour, wheat allergy, allergy suppression

1. Introduction

Complete removal of wheat flour from daily food consumption is very difficult to accomplish, because many processed foods contain varying amounts of the flour. Because of this, patients allergic to wheat have strongly desired the development of hypoallergenic flour. This study aims to produce hypoallergenic wheat flour by enzymatic fragmentation of the constituent allergens and to clarify allergy-suppressive effects of the hypoallergenic flour.

2. Materials and methods

2.1. Production of hypoallergenic wheat flour

Hypoallergenic wheat flour was produced by enzymatic fragmentation of wheat flour with cellulase and actinase preparations [1].

2.2. Determination of allergy-suppressive effects of hypoallergenic wheat flour

Ovalbumin (OVA) was used as a model of allergen, and its absorption from the intestinal tract was measured by using Caco-2 cell monolayers [2]. Allergy-suppressive effects of hypoallergenic wheat flour were measured by using a gluten-induced allergic asthma animal model [3].

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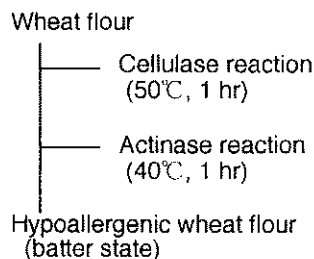


Fig. 1. Proposed process for producing hypoallergenic wheat flour by enzymatic treatment.

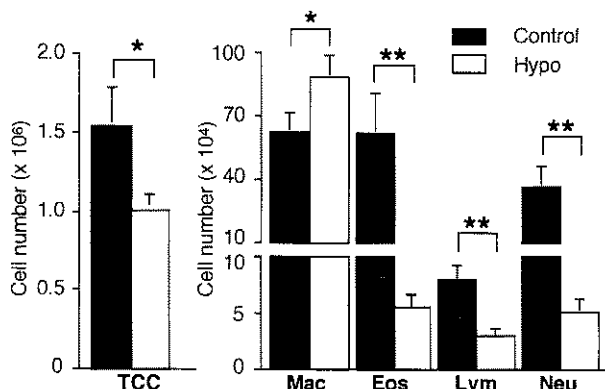


Fig. 2. Comparison of the total cell count and cell profile in bronchoalveolar lavage fluid between rats fed the control diet and those fed the hypoallergenic flour diet (Hypo) after allergen inhalation. TCC, total cell count; Mac, alveolar macrophages; Eos, eosinophils; Lym, lymphocytes; Neu, neutrophils.

3. Results and discussion

Wheat possesses proteinaceous and non-proteinaceous allergens. We selected actinase preparation to decompose proteinaceous allergens and cellulase preparation to decompose non-proteinaceous allergens (Fig. 1). Patients' IgE did not cross-react with the enzymatically treated flour. The hypoallergenic flour was difficult to handle because it was in a batter state. Cup cakes, pizza, cookies, wafers, pasta-like noodles and puffed snacks were produced from the gelatinized hypoallergenic batter.

We found that hypoallergenic wheat flour possessed potent inhibitory activity against OVA absorption, and that the active constituent was derived from the cellulase preparation. In gluten-induced allergic asthma models, rats receiving hypoallergenic wheat flour exhibited a significantly lower number of total cells and eosinophils in bronchoalveolar lavage fluid than those in the control diet group (Fig. 2). The serum wheat-specific antibody levels in the hypoallergenic wheat flour diet group were significantly lower than those in the control diet group. These results strongly suggest that hypoallergenic wheat flour actively suppresses allergic reactions, probably by induction of oral tolerance.

4. Conclusion

We developed a novel method to produce hypoallergenic wheat flour suitable for patients allergic to wheat. The hypoallergenic flour seemed to possess allergy suppressive effects since it inhibited allergen absorption from the intestinal tract and induced oral tolerance.

References

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