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ALLERGENIC PROPERTIES OF HEAT-DENATURED COLLAGEN ARE DIFFERENT DEPENDING ON THE COLLAGEN TYPE AND THE SOURCE

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Backgrounds and Objectives:

Gelatin is prepared from animal skins and bones by processing with alkaline or acid, extraction, purification, and so forth. Gelatin has widely been used as an ingredient of medicines, cosmetics and foods, and regarded as safe, particularly nonallergenic. However, studies on side effects of live vaccines have proved that gelatin allergy sometimes occurs in hypersensitive individuals. Therefore, development of gelatin substitutes with lower allergenic properties is urgently required.

We compared the allergenic properties of heat-denatured collagen types I and II prepared from various sources.

Materials and Methods:

Serum samples containing anti-gelatin IgE: Serum samples were collected from 15 gelatin-allergic and 15 healthy donors with informed consent.

Heat-denatured collagen: Collagen types I and II were prepared in our laboratory from chicken, porcine and bovine skins, bones and cartilages by limited pepsin digestion and purification by salt precipitation. The purities of these collagen preparations were confirmed by SDS-PAGE. These collagen preparations were heated for 30 min at 50 °C and used as gelatin preparations. Commercially available gelatin preparations were purchased at nearby retail shops.

Assessment of allergenic properties of gelatin preparations: Allergenic properties of various gelatin preparations were determined by chemiluminescence ELISA with serum specimens from gelatin-allergic donors.

Table 1. Clinical profiles of gelatin-allergic patients

Donor	Sex	Anti-gelatin IgE (Ua/ml)	Sensitizing antigen agent	Symptom
1	F	7.14	Mumps vaccine	Anaphylaxis
2	F	6.72	Measles vaccine	Rash
3	F	6.05	Gummy candy	Anaphylaxis
4	M	9.09	Rubella vaccine	Anaphylaxis
5	M	22.3	Rubella vaccine	Anaphylaxis
6	M	<0.35	Rubella vaccine	Anaphylaxis
7	F	8.26	Rubella vaccine	Anaphylaxis
8	M	1.01	Varicella vaccine	Rash
9	M	0.43	Measles vaccine	Rash
10	F	46.9	Measles vaccine	Rash
11	F	<0.35	Gummy candy	Anaphylaxis
12	F	1.9	Gummy candy	Anaphylaxis
13	F	<0.35	Measles vaccine	Rash
14	F	<0.35	Varicella vaccine	Rash
15	M	88.0	Egg, milk, meet, soybean	Anaphylaxis

Results and Discussions:

Clinical characteristics of the gelatin-allergic donors are listed in Table 1. Anti-gelatin IgE antibodies with titers higher than 0.35 Ua/ml, regarded as IgE positive and equivalent to radioallergosorbent-test (RAST) score 1, were found in most serum samples, although no anti-gelatin IgE antibody was found in four serum samples, of which donors had clinically been diagnosed as allergic to gelatin. Participation of not only humoral but also cellular immunities has proved as the cause of gelatin allergy as in other allergy. No anti-gelatin IgE antibody was found in the serum samples from healthy donors.

Using the serum samples from gelatin-allergy donors, we examined commercially available gelatin preparations for allergenic properties. As shown in Fig. 1, most (13/15) serum samples proved to be allergenic to gelatin (>0.35 Ua/ml). These gelatin preparations may have been derived from porcine and/or bovine skins and bones: i.e., heat-denatured collagen types I and III.

Then, we examined various heat-denatured collagen in our laboratory for allergenic properties (Fig. 2). From preparations of the IgE levels and the number of the serum samples possessing IgE higher than 0.35 Ua/ml, the following were concluded: (1) bovine gelatin is most allergenic; chicken gelatin least allergenic and; porcine gelatin intermediate, and (2) gelatin from type-II collagen was much less allergenic than that from type-I collagen.

Conclusions:

We found the following; (1) the ordinary gelatin preparations commercially available were allergenic to most hypersensitive individuals, and (2) the allergenic properties of gelatin may depend on the collagen type and the source: i.e., gelatin derived from type-II chicken collagen was much less allergenic than that from type-I bovine collagen.

References:

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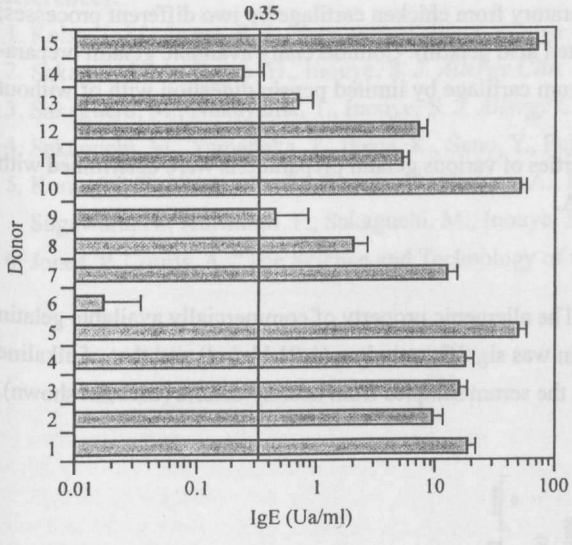

Fig. 1. Allergenic properties of commercially available gelatin (n=6)

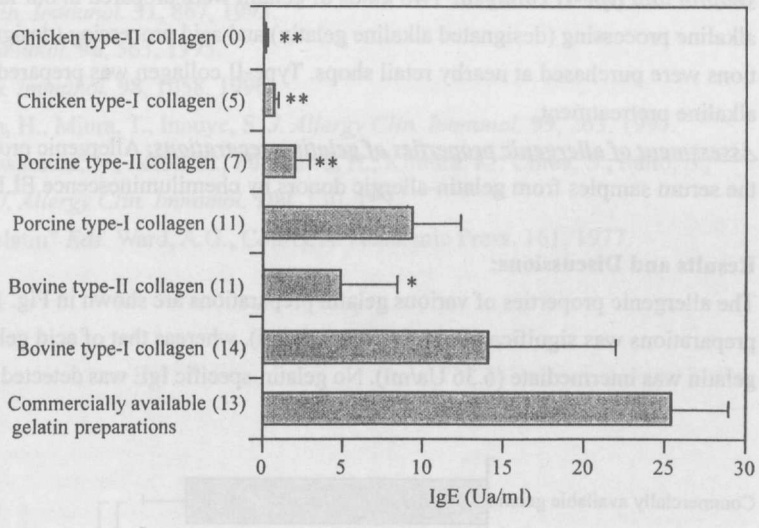

Fig. 2. Allergic properties of various gelatin preparations Number of the serum samples hypersensitive to gelatin (> 0.35 Ua/ml) is indicated in parenthesis. Significant difference from commercially available gelatin:(*:p <0.05, ** :p <0.01)