

Risk assessment in elderly for sensitization to food and respiratory allergens

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Abstract

For elderly people, epidemiological data are rare for respiratory allergies and completely missing for food allergies.

The aim of this study was to examine the prevalence and risk factors for sensitizations in 109 people with a mean age of 77 years, who are living in a geriatric nursing home. The cross-sectional study included a detailed interview, skin prick tests, and serum tests for specific and total IgE, IFN- γ , and ST2, a marker for Th2-lymphocyte activity.

Almost all study subjects ($n = 101$) suffered from co-morbidity, 14 from type I allergy, 25 from gastrointestinal disorders treated with anti-ulcer drugs, 25 were chronic alcoholics and 21 were smokers. The total IgE levels were significantly higher in men ($P = 0.025$), and not affected by smoking or alcohol consumption. Skin prick tests were positive in 41.7% of tested patients. Specific IgE to respiratory allergens was found in 40.4% of all patients and was elevated in men ($P = 0.013$), with a significant correlation to smoking ($P = 0.029$). Specific IgE to food allergens was detected in 24.8%, apparently without connection to the investigated risk factors. However, positive skin prick tests with food allergens could be correlated with chronic alcohol consumption ($P = 0.036$). The intake of anti-ulcer medication was significantly correlated with elevated ST2 levels as an indirect readout for Th2-cell activity ($P < 0.001$).

The risk factors for sensitization in elderly to respiratory allergens were chronic damage of respiratory epithelia due to smoking, and for sensitization to food allergens chronic alcohol consumption.

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1. Introduction

Most allergological studies today focus on allergic diseases in children and young adults. However, due to the shift of age distribution in the population in industrialized countries towards elderly, there is a growing need to investigate the prevalence of allergy in aged people. It is known since long that the proportion of asthmatics in this population has been underestimated and, therefore, undertreated [1,2]. Roughly 10–30% of the asthmatics

are above age 60 [3]. Previous studies reported a decrease of specific IgE with age [4]. However, recently a discussion whether allergy evaluation would be valuable in elderly patients has been taken up again [5,6], and house dust mite has been identified as an important allergen source for asthma in this population [7]. In a French cohort with a mean age above 65 years, rhinitis and asthma were associated with smoking as an environmental factor [8], and thus paralleling the results from a younger population in the European Community Respiratory Health Survey report [9].

In the general population precise data on prevalence of food allergies are lacking, but anecdotic studies in younger cohorts indicate that the prevalence of food allergies is on the rise [10,11]. Epidemiologic data on food allergy are completely missing and are rare for respiratory allergies in the elderly. This is also due to the fact that elderly are not given true attention by

Abbreviation: SPT, skin prick test

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allergologists today [6]. Therefore, food allergy-related symptoms like dyspepsia, vomiting, diarrhea, and skin efflorescences might easily remain undiagnosed. Moreover, our recent studies indicated that the peptic stomach milieu is protective against food sensitizations [12,13] and hypersensitivity reactions [14]. Thus settings with reduced gastric acid output, e.g. due to anti-ulcer drugs or chronic atrophic gastritis are likely to facilitate sensitization to food allergens and to trigger symptoms. Atrophy of the gastric mucosa advances with age, especially in connection with chronic alcohol abuse, being negatively correlated with the secretory capacity of the stomach [15]. Several studies have already pointed towards a relationship between alcohol consumption, IgE formation and allergic skin manifestations [16,17].

Immunosenescence leads to an increased incidence and severity of infectious diseases in the elderly, and also vaccination induces only limited protective immunity. These effects are likely due to an accumulation of dysfunctional memory-phenotype cells, especially CD8⁺CD28[−] cells, poor T-cell proliferative responses, and relatively lower B-cell numbers with increasing age [18,19]. An earlier Swiss study indicated that antibody titers against a number of infectious and food antigens can be detected in old people [20], still the antibody quality in elderly seems to be reduced [21]. Animal studies indicated a defect in type 2 cytokine responses and in IgE isotype switch in senescent mice [22]. In contrast, in human studies the type 2 responses including cytokines, IgE and CD23 were functional in a cohort of elderly with an age between 70 and 93 years [23,24], indicating a discrepancy between the murine and human aged immune system. Thus, from an immunological point of view IgE-responses not only to respiratory but also to food allergens are likely to occur also in the geriatric population.

This study aimed, therefore, to collect epidemiologic data on the prevalence of sensitizations to respiratory and, importantly, also to food allergens by investigating an elderly, partly geriatric cohort of a nursing home. These individuals had throughout their lives lived in villages or on farms in a small rural town situated in an agricultural region in the middle of Hungary.

2. Materials and methods

2.1. Study subjects

The investigated population of a geriatric nursing home in Újszász, a small rural town in Hungary, consisted of 183 people, 109 (59.6%) of which participated in the study. Seventy-four residents of the nursing home were excluded from the study because of their poor mental or physical conditions or their absence from the nursing home at the time of the study. Patients included in the study were all able to understand and answer the questions during the interview. Thirty-six young and middle-aged adults living in the same town with a mean age of 36.7 ± 11 years were analysed in parallel. The study was conducted in accordance with the 2002 guidelines of the Ministry of Health in Hungary for clinical studies with permission number 2012-39/2004.

2.2. Patients' interview

A detailed interview with readily understandable questions including the previous living conditions, the case history and the family history related to allergy and co-morbidity was filled in for each study subject by two qualified study nurses. Data on the case history and on the current and past medical treatment were supplemented from the medical documentation of each patient.

2.3. Measurements of total and allergen-specific IgE

Total IgE serum levels were measured in a fully automated microplate system (ALLERgen Total IgE, Adaltis, Italy), following the manufacturer's instructions. Allergen-specific IgE antibodies were measured by immunoblotting (AllergyScreen, MEDIWISS Analytic, Moers, Germany). Standard series of 20 food allergens (hazelnut, peanut, walnut, almond, milk, casein, egg white, egg yolk, celery, carrot, tomato, potato, wheat flour, rye flour, soy, apple, orange, sesame, cod, crab) and 19 respiratory allergens (alder, birch, hazel, grasses, rye, ragweed, mugwort, plantain, *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, cat, dog, guinea pig, golden hamster, rabbit, *Penicillium*, *Cladosporium*, *Aspergillus* and *Alternaria*) were tested simultaneously. Specific IgE levels of 0.35 kU/l (class 1) and above were considered as elevated.

2.4. Skin prick test

For skin prick test (SPT) a standard panel of 14 food allergens (hazelnut, peanut, milk, casein, egg white, egg yolk, potato, celery, carrot, wheat flour, rye flour, soy, apple, banana) and 15 respiratory allergens (birch, hazel, ragweed, mugwort, grasses, rye, plantain, *D. pteronyssinus*, *D. farinae*, cockroach, cat, dog, feathers, *Candida*, mould-mix; Lofarma, Milan, Italy) were tested. Histamine served as a positive control and 0.9% saline solution as a negative control. SPTs were performed in accordance with the position paper of the European Academy of Allergology and Clinical Immunology. A diameter greater than 5 mm was defined as positive (+) [25].

2.5. Cytokine assays

IFN- γ and ST2 levels in the patients' sera were determined by commercial ELISA, using monoclonal antibodies against human IFN- γ (Bioscience, San Diego, CA), and polyclonal anti-human IL-1R4/ST2 antibodies (R&D Systems, Minneapolis, MN). The assays were performed following the manufacturers' instructions. The sensitivity of the ELISA was 4 pg/ml for IFN- γ , and 25 pg/ml for ST2.

2.6. Statistical analysis

In order to obtain homogeneity of variance, total IgE values were log-transformed. Averages and standard deviations are expressed as geometric means and scatter factors. Differences between groups with respect to total IgE were tested by Student's *t*-tests based on the transformed values. Because age did

Table 1

Age distribution and co-morbidity of elderly patients of a geriatric nurse home ($n = 109$) in comparison to young adults ($n = 36$)

Age groups	<i>n</i>	% of all patients	Co-morbidity (% of patients)*											
			1	2	3	4	5	6	7	8	9	10	11	12
60–69	29	26.6	55.2	20.7	–	24.1	6.9	10.3	17.2	6.9	3.4	–	–	17.2
70–79	33	30.3	54.5	15.2	–	42.4	9.1	3.0	33.3	6.1	3.0	6.1	3.0	33.3
80–89	36	33.0	69.1	19.4	2.8	61.1	5.6	–	33.3	5.6	–	8.3	2.8	22.2
90–97	11	10.1	83.6	27.3	–	90.9	–	–	54.5	–	–	–	–	9.1
Age groups	<i>n</i>	% of all controls	Co-morbidity (% of controls)*											
			1	2	3	4	5	6	7	8	9	10	11	12
20–39	23	63.9	4.3	–	–	–	–	4.3	–	–	–	4.3	4.3	21.7
40–59	11	30.6	18.2	9.1	–	–	–	–	–	–	–	–	–	18.2
60–69	2	5.5	–	50.0	–	–	–	–	–	–	–	–	–	50.0

* The percentage of patients or controls within the respective age group suffering from the following diseases is given: (1) hypertonia; (2) diabetes mellitus; (3) glaucoma; (4) ischemic heart disease; (5) cerebrovascular stroke; (6) mental retardation; (7) encephalopathia vascularis; (8) hypercholesterinaemia; (9) epilepsy; (10) pancreatitis; (11) psychopathy; (12) gastrointestinal disorders treated by anti-ulcer drugs (Quamatel®, Ranitidine®, Umaren® or Zantac®).

not correlate with total IgE, *t*-tests were chosen instead of analysis of covariance. Comparisons of groups for differences in the number of positive SPT or positive IgE responses were accomplished by Mann–Whitney *U*-tests. No correction for multiple testing was applied. For all tests, *P*-values below 0.05 were considered significant and values below 0.1 as a tendency.

3. Results

3.1. Study subjects

The study included 109 patients (38 men and 71 women), aged from 60 to 97 years (mean 77 ± 9.3 years) (Table 1). They were all residents in the nursing home for a mean of 6.3 years and had previously lived in the same region, in villages or on farms. All but 8 study subjects ($n = 101$) suffered from co-morbidity as given in Table 1. Among the 109 study subjects, 25 were moderate to heavy alcoholics according to the criteria from the Rotterdam study [26] (current consumption of at least 20–25 g of alcohol per day, i.e. two or more drinks with 10 g; ratio men:women = 15:10), and 21 subjects were smokers (ratio men:women = 17:4). Fourteen patients (12.8%) had diagnosed type I allergy and suffered from the following symptoms: bronchial asthma, rhinitis, pruritus, urticaria and eczema. None of the other patients had previously documented or outgrown food allergy. In 40 patients diarrhea was induced by various foods, but they did not consider it an allergy.

The control group consisted of 36 adults with a mean age of 36.7 ± 11 (33 women, 3 men). In the control group, seven patients suffered from co-morbidity (Table 1). Four of them suffered from type I allergy, one from atopic eczema.

3.2. Evaluation of total IgE values

Total IgE was measured in 109 inhabitants of a geriatric nurse home, aged between 60 and 97 years as outlined in Table 1. The geometric mean value was $28.4^*/4.1$ kU/l. The total IgE was significantly higher in men ($43.9^*/4.6$ kU/l) than in women

($22.5^*/3.7$ kU/l) ($P = 0.018$). Smokers had a higher mean level of total IgE ($42.8^*/4.6$ kU/l) than the non-smokers ($25.7^*/4.0$ kU/l) ($P = 0.140$). No difference was observed in total IgE levels between alcoholics and abstinent patients ($28.5^*/4.4$ kU/l versus $28.1^*/4.1$ kU/l) ($P = 0.970$).

3.3. Specific IgE in sera of elderly

The age-dependent data concerning the prevalence of specific IgE ($\geq$ class 1) against food allergens are listed in Table 2, to outdoor and/or indoor respiratory allergens in Table 3. Forty-four patients (40%) were sensitized to respiratory allergens. Among the respiratory sensitizations in all patients, dog dander (22%), *D. farinae* (12%), *D. pteronyssinus* (8%), and pollen of grasses (6%), rye (11%), birch (4%), hazel (9%) and ragweed (7%) were most common. Specific IgE to food allergens was found in 27 (25%) of the patients with hazelnut (9%), milk (5%), casein (8%), carrot (7%) and celery (9%) being the most common food allergens. For none of the tested allergens any difference between age groups could be observed.

3.4. Analysis of skin reactivity in elderly

Thirteen of 109 patients declined to participate in SPTs, therefore, SPTs with standard series of food and inhalative allergen were performed in 96 patients. In 10 further patients SPTs could not be evaluated because the histamine control was negative (<5 mm). For seven of these patients this could be explained by the intake of anti-depressants ($n = 6$, clomipramide and $n = 1$, cloprazine) with H1-receptor blocking effects. The histamine reactivity was 14.7 ± 9.9 mm in the patients with a negative allergen SPT, and 19.8 ± 12.0 mm in the patients with a positive SPT ($P = 0.032$). Results of SPTs with food allergens combined with specific IgE reactivities are shown in Table 4, results of respiratory allergens in Table 5. The SPT results were positive in 40 patients (41.7%). Nine patients (9.4%) were monosensitized, while eight (8.3%) were sensitized against two allergens, nine (9.4%) against three allergens, four (4.2%) against four aller-

Table 2
Specific IgE to food allergens in different age groups among elderly and controls

Age	n	Number (%) of patients in the respective age group																			
		Hazelnut	Peanut	Walnut	Almond	Milk	Casein	Egg white	Egg yolk	Celery	Carrot	Tomato	Potato	Wheat	Rye	Soy	Apple	Orange	Sesame	Cod	Crab
60–69	29	2 (6.9)	2 (6.9)	2 (6.0)	0	2 (6.9)	3 (10.3)	0	0	3 (10.3)	3 (10.3)	2 (6.9)	2 (6.9)	2 (6.9)	2 (6.9)	2 (6.9)	0	2 (6.9)	0	0	1 (3.4)
70–79	33	4 (12.1)	0	1 (3.0)	0	2 (6.1)	3 (9.1)	2 (6.1)	0	4 (12.1)	1 (3.0)	1 (3.9)	1 (3.0)	2 (6.1)	1 (3.0)	1 (3.0)	0	1 (3.0)	0	0	0
80–89	36	4 (11.1)	0	1 (2.8)	0	0	1 (2.8)	1 (2.8)	0	3 (8.3)	4 (11.1)	0	1 (2.8)	2 (5.6)	0	0	0	2 (5.6)	0	0	0
90–97	11	0	0	0	0	1 (9.1)	2 (18.2)	0	0	0	0	0	0	0	0	1 (9.1)	0	0	0	0	1 (9.1)
All	109	10 (9.2)	2 (1.8)	4 (3.7)	0	5 (4.6)	9 (8.3)	3 (2.8)	0	10 (9.2)	8 (7.4)	3 (2.8)	4 (3.7)	6 (5.5)	3 (2.8)	4 (3.7)	0	5 (4.6)	0	0	2 (1.8)

Age	n	Number (%) of controls in the respective age group																			
		Hazelnut	Peanut	Walnut	Almond	Milk	Casein	Egg white	Egg yolk	Celery	Carrot	Tomato	Potato	Wheat	Rye	Soy	Apple	Orange	Sesame	Cod	Crab
20–39	23	0	0	0	0	2 (8.7)	3 (13.0)	1 (4.3)	0	1 (4.3)	1 (4.3)	0	0	1 (4.3)	0	1 (4.3)	0	0	0	0	0
40–59	11	0	0	0	0	1 (9.1)	2 (18.2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60–69	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All	36	0	0	0	0	3 (8.3)	5 (13.9)	1 (2.8)	0	1 (2.8)	1 (2.8)	0	0	1 (2.8)	0	1 (2.8)	0	0	0	0	0

Table 3
Specific IgE to respiratory allergens in different age groups among elderly and controls

Age	n	Number (%) of patients in the respective age group														
		Alder	Birch	Hazel	Ragweed	Grasses	Rye	Mugwort	Plantain	<i>D. pteronyssinus</i>	<i>D. farinae</i>	Cat	Dog	Guinea pig	Rabbit	<i>Penicillium</i>
60–69	29	2 (6.9)	2 (6.9)	4 (13.8)	3 (10.3)	2 (6.9)	3 (10.3)	2 (6.9)	2 (6.9)	2 (6.9)	5 (17.2)	2 (6.9)	9 (31.0)	0	0	0
70–79	33	3 (9.1)	2 (6.1)	4 (12.1)	2 (6.1)	1 (3.0)	5 (15.2)	1 (3.0)	0	3 (9.1)	4 (12.1)	1 (3.0)	7 (21.2)	0	0	0
80–89	36	2 (5.6)	0	2 (5.6)	3 (8.3)	3 (8.3)	4 (11.1)	0	0	3 (8.3)	3 (8.3)	2 (5.6)	5 (13.9)	0	0	0
90–97	11	0	0	0	0	1 (9.1)	1 (9.1)	0	0	1 (9.1)	1 (9.1)	2 (18.2)	3 (27.3)	0	0	1 (9.1)
All	109	7 (6.4)	4 (3.7)	10 (9.2)	8 (7.3)	7 (6.4)	12 (11.0)	3 (2.8)	2 (1.8)	9 (8.3)	15 (11.9)	7 (6.4)	24 (2.2)	0	0	1 (0.3)

Age	n	Number (%) of controls in the respective age group														
		Alder	Birch	Hazel	Ragweed	Grasses	Rye	Mugwort	Plantain	<i>D. pteronyssinus</i>	<i>D. farinae</i>	Cat	Dog	Guinea pig	Rabbit	<i>Penicillium</i>
20–39	23	0	0	0	5 (21.7)	2 (8.7)	2 (8.7)	0	0	2 (8.7)	3 (13.0)	0	2 (8.7)	0	0	0
40–59	11	0	0	0	3 (27.3)	1 (9.1)	1 (9.1)	1 (9.1)	0	0	0	2 (18.2)	2 (18.2)	0	0	1 (9.1)
60–69	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All	36	0	0	0	8 (22.2)	3 (8.3)	3 (8.3)	1 (2.8)	0	2 (5.6)	3 (8.3)	2 (5.6)	4 (11.1)	0	0	1 (2.8)

Table 4

Sensitizations to food allergens in the elderly and control subjects were evaluated by specific IgE and SPT

Food allergens	Patients				Controls			
	IgE (n = 109)		SPT (n = 96)		IgE (n = 36)		SPT (n = 36)	
	n	%	n	%	n	%	n	%
Hazelnut	10	9.2	4	4.2	0	0	1	2.8
Peanut	2	1.8	7	7.3	0	0	2	5.6
Milk	5	4.6	14	14.6	3	8.3	5	13.9
Casein	9	8.3	16	16.7	5	13.9	2	5.6
Egg white	3	2.8	11	11.5	1	2.8	3	8.3
Egg yolk	0	0	7.3	7.3	0	0	4	11.1
Potato	4	3.7	3	3.1	0	0	1	2.8
Celery	10	9.2	4	4.2	1	2.8	4	11.1
Carrot	8	7.4	4	4.2	1	2.8	3	8.3
Wheat flour	6	5.5	10	10.4	1	2.8	5	13.9
Rye flour	3	2.8	8	8.3	0	0	4	11.1
Soy	4	3.7	8	8.3	1	2.8	3	8.3
Apple	0	0	10	10.4	0	0	2	5.6
Banana	n.d.	–	9	9.4	n.d.	–	0	0

gens, and 10 (10.4%) were polysensitized reacting with 5–13 allergens.

3.5. Risk assessment for specific sensitization in elderly

The occurrence of specific IgE was analyzed regarding the correlation with gender, alcohol consumption and smoking. We found a trend towards higher numbers of positive IgE reactivities to nutritive allergens in men than in women ($P=0.076$), and men also showed much higher numbers of sensitizations to respiratory allergens ($P=0.013$). Smoking was significantly correlated with higher numbers of elevated specific IgE to respiratory allergens ($P=0.029$). Also alcoholics had a higher rate of sensitization to respiratory allergens ($P=0.036$), as compared to abstinent. No difference between chronic alcoholics and abstinent was found with respect to the numbers of IgE

Table 5

Sensitizations to respiratory allergens in the elderly and control subjects were evaluated by specific IgE and SPT

Respiratory allergens	Patients				Controls			
	IgE (n = 109)		SPT (n = 96)		IgE (n = 36)		SPT (n = 36)	
	n	%	n	%	n	%	n	%
Birch	4	3.7	9	9.4	0	0	4	11.1
Hazel	10	9.2	7	7.3	0	0	3	8.3
Ragweed	8	7.3	8	8.3	8	22.2	7	19.4
Mugwort	3	2.8	10	10.4	1	2.8	6	16.7
Grasses	7	6.4	9	9.4	3	8.3	5	13.9
Rye	12	11	10	10.4	3	8.3	5	13.9
Plantain	2	1.8	7	7.3	0	0	0	0
<i>D. pteronyssinus</i>	9	8.3	25	26	2	5.6	9	25.0
<i>D. farinae</i>	15	11.9	24	25	3	8.3	4	11.1
Cockroach	n.d.	–	13	13.5	n.d.	–	1	2.8
Cat	7	6.4	2	2.1	2	5.6	5	13.9
Dog	24	22	4	4.2	4	11.1	5	13.9
Moulds	1	0.3	10	10.4	6	16.7	3	8.3
Feathers	n.d.	–	1	1	n.d.	–	4	11.1

reactivities to food allergens. Still, alcoholics had a significantly higher number of positive skin prick tests with food allergens ($P=0.036$) than abstinent. There was only a trend, but no correlation between anti-ulcer drug intake and sensitization to food allergens.

3.6. Evaluation of Th1 and Th2 cytokines in the elderly

Low levels of IFN- γ as a marker for Th1 lymphocyte reactivity, and ST2 levels for Th2-lymphocytes were detected in most patients. However, in patients treated with anti-ulcer drugs 13 of 25 (52%) had detectable levels of ST2 while this was only the case in 10 (12%) of 84 untreated elderly ($P<0.001$).

4. Discussion

Recent studies indicate that in senescent humans the Th2 branch of the immune system is as functional as in younger adults [24]. This explains the increased prevalence of allergic asthma in elderly [7]. Previous studies have indicated that the diagnosis of asthma in elderly may be difficult due to comorbidity of the patients, leading to underdiagnosis [5]. Most elderly included in this study suffered from concomitant other diseases like diabetes or heart failure. They had not been suspected for type I allergy during their residence in the nursing home, except the 12.8% with previously diagnosed allergy.

In accordance with these previous reports, our study showed that the prevalence of total and specific IgE to respiratory allergens did not decrease with age. Specific IgE to inhalant allergens were detected in 40.4% and to food allergens in 24.8% of all patients. Interestingly, the skin reactivity to histamine indicated adequate skin reactivity in advanced age, as the overall histamine reactivity did not decrease within the investigated age groups and wheal-and-flair-reactions of size comparable to younger patients were seen. Based on this observation, the specific IgE values could be well correlated with allergen skin prick tests and we suggest that the relevance of type I skin tests among elderly is underestimated. Moreover, our data indicate that in elderly also sensitizations to food can be frequently diagnosed, as evaluated by specific IgE and skin reactivity. We can, however, not comment on the correlation of sensitization with clinical symptoms in all cases. Even though respiratory allergies could be clearly diagnosed and patients treated accordingly, the reported food-adverse reactions (e.g. slight urticaria or dyspepsia upon hazelnut or milk ingestion) were only weak, thus not justifying provocation tests. Sensitization to orange is an example for sensitization with doubtful clinical relevance: the major IgE-binding protein Cit s 1 is a germin-like protein and binds IgE in 60% of orange-allergic patients, however, exposing complex N-linked glycans as a possible reason for the observed clinically non-relevant IgE-binding [27].

Tobacco smoking can be associated with increased total IgE, but its role in atopy has been debated [9,28]. Kerkhof et al. reported that elevated IgE in males is independent of smoking [4], whereas in a recent study smoking was identified as a clear risk factor for respiratory sensitization [8]. Our data confirm that respiratory allergy and increased IgE levels in older people are

associated with the same factors previously reported for young subjects, namely male gender and tobacco smoking.

Interestingly, with respect to sensitization against food allergens, alcohol consumption was revealed as a significant risk factor [8,16]. Alcohol consumption has been related to allergic skin manifestations, regardless of the extent of the underlying liver disease [29]. Furthermore, it has been shown that alcohol biases the immune response towards Th2 [30], and elevated IgE has been also observed in connection with chronic alcohol-induced pancreatitis [31]. Associations between alcohol consumption and pollen sensitization or atopic dermatitis were described previously [17,32]. Even though in our study regular alcohol consumption seemed not to affect total or specific IgE levels, it was significantly correlated with positive SPTs to food, but not respiratory allergens. It is known that alcohol has a histamine-liberating effect and alters the histamine catabolism, which induces food intolerance. However, there is some epidemiological evidence for the induction of true food allergy in chronic alcoholics [33]. Alcohol has a direct cytotoxic effect on the gastrointestinal mucosa, causes inflammation, and may lead to increased permeability and facilitated penetration of allergens. More importantly, there is a direct link between chronic alcoholism and atrophic gastritis with consecutive hypoacidity [12,15]. Hypoacidity affects protein digestion as the total enzyme activity of pepsin has an optimum between pH 1.8 and 3.2. In this setting harmless, digestion-sensitive proteins survive the gastric transit conformationally intact and may act as food allergens [34]. Therefore, the chronic alcohol abuse might support sensitization to food proteins by two mechanisms: (1) hindrance of tryptic digestion in cases of exocrine pancreatic insufficiency [31] and (2) impairment of peptic digestion through atrophic gastritis and hypoacidity in the stomach.

Our study revealed low levels of both ST2 and IFN- γ of most elderly. With respect to type I allergy, especially ST2 (also designated T1, Fit-1, DER4) is of interest, as it is preferentially expressed on activated Th2 cells, but not Th1 cells [35,36]. In our previous epidemiologic study on adult food allergy, we revealed ST2 as a useful marker for monitoring Th2 immunity in food allergy [13]. Also in the present study significantly elevated ST2 levels could be observed in the group medicated with anti-ulcer drugs. This may indicate an induced disposition for Th2 responses in these patients, although not yet associated with sensitization to food antigens.

Taken together, respiratory sensitizations were more frequently found in males and smokers. Moreover, our data show that an appreciable number of sensitizations against food allergens could be detected in elderly, with chronic alcohol consumption being a risk factor. In line with other reports, it can thus be concluded that IgE-induction and sensitization in elderly is influenced by sociodemographic parameters.

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