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Prevalence of sensitisation to aeroallergens and food allergens

Results of the German Health Interview and Examination Survey for Adults (DEGS1)

Background and purpose

The prevalence of allergic diseases has increased considerably in recent decades, and allergies are now one of the biggest health problems in modern societies worldwide [1, 2]. According to the data from the first wave of the German Health Interview and Examination Survey for Adults (DEGS1, 2008–2011), the lifetime prevalence for allergies is just under 30% [3].

Allergic reactions are abnormal responses of the immune system to foreign substances that enter the body and that are normally harmless (allergens). In type I allergy ("immediate type"), specific type E immunoglobulins (IgE antibodies) react with allergens and cause allergic reactions. The presence of IgE antibodies in the blood is an essential precondition for the clinical manifestation of an allergy in this allergy type. The presence of specific IgE antibodies in the blood is called "allergic sensitisation" [2]. Sensitisation may—but does not always—cause an allergic reaction. The German National Health Interview and Examination Survey 1998 (GNHIES98), for example, showed that the prevalence of allergic rhinoconjunctivitis (hay fever), which is generally caused by aeroallergens, was 13%, whereas a far higher percentage of participants (30%) exhibited a sensitisation to aeroallergens [4]. Moreover, the German Health Interview and Examination Survey for Children and Adolescents (KiGGS, 2003–2006) showed that 82.2% of children with a single sensitisation and 53.1% of the children with more than one sensitisation did not have any atopic diseases [5].

Various studies [6, 7, 8, 9] from the early to the mid-1990s investigated the prevalence of sensitisation among the adult residents of various German cities. Using the same tests for specific IgE antibodies, these studies found considerable variations in the prevalence of allergic sensitisation depending on sex, age, social status and region (West vs. East Germany). Moreover, the prevalence of sensitisation appears to change over time, just as the prevalence of allergies does. A comparison of three population-based cross-sectional studies in Copenhagen (Denmark) showed that the prevalence of sensitisation to at least one of 19 aeroallergens among 40-year-olds had increased from 14.9% in the period 1976–1977 to 19.7% in the period 1982–1984. During 1999–2001, the prevalence of sensitisation was even higher at 27.6% [10]. In Germany, the prevalence of sensitisation to frequently occurring aeroallergens was investigated in two random samples representative of the adult population aged between 25 and 69 years in West and East Germany during 1991–1992 using a test for frequently occurring aeroallergens (SX1 test) [11]. In 1991, 27.4% of West German adults and in 1992 24.2% of East German adults were sensitised to at least one of the aeroallergens screened for by the SX1 test [12]. GNHIES98 collected representative data on the occurrence of allergic sensitisation in the German adult population aged between 18 and 79 years using the same test procedure. The findings showed that the prevalence of sensitisation to at least one of the aeroallergens screened for by the SX1 test was 30% [4]. For an update on the prevalence of sensitisation, DEGS1 collected representative data on sensitisation to 50 allergens and combinations of frequent aeroallergens or grass pollen (screening tests) in the adult resident population of Germany between 2008 and 2011. The aim of this paper is to present the first descriptive findings. The change in the prevalence of sensitisation to aeroallergens between 1998 and 2008–2011, measured using the SX1 test, is described by comparing the results of GNHIES98 with those of DEGS1.

Methods

The "German Health Interview and Examination Survey for Adults" (DEGS) is part of the health monitoring system at the Robert Koch Institute (RKI). The

Tab. 1 Tests for specific IgE in the serum in the "German Health Interview and Examination Survey for Adults" (DEGS1)

Food allergens			
f1	Chicken protein		
f2	Milk protein/cow's milk	**Animal dander**	
f4	Wheat/wheat flour	e1	Cat dander
f5	Rye/rye flour	e3	Horse dander
f6	Barley	e5	Dog dander
f9	Rice	**Mould**	
f10	Sesame	m2	*Cladosporium herbarum*
f13	Peanut	m3	*Aspergillus fumigatus*
rf352	Recombinant peanut, rAra h8	m6	*Alternaria alternata*
f14	Soy	**Grass pollen**	
rf353	Recombinant soy, rGly m4	g6	Timothy
f17	Hazelnut	g12	Rye pollen
f20	Almond	**Tree pollen**	
f24	Shrimp	t2	Alder
f25	Tomato	t3	Birch
f31	Carrot	t4	Hazel
f35	Potato	t25	Ash
f44	Strawberry	t215	Recombinant birch, rBet v1
f49	Apple	**Weed pollen**	
f84	Kiwi	w1	Ragweed
f85	Celery	w2	Perennial ragweed
f242	Cherries	w3	*Ambrosia trifida*
f309	Chickpea	w230	Major allergen, Ambrosia, nAmb a1
f335	Lupin seed	w6	Mugwort
f351	Recombinant shrimp tropomyosin rPen a1	w231	Major allergen, mugwort, nArt v1
f419	Peach, molecular, rPru p1	**Other allergens**	
House dust mites		K82	Latex
d1	House dust mite, *Dermatophagoides pteronyssinus*	Ro214	Cross-reactive-carbohydrate-determinant (CCD)
Insect venom		**Allergen combinations**	
i1	Bee venom	SX1	Aeroallergens: t3, g6, g12, w6, e1, e5, d1, m2
i3	Wasp venom	GX1	Grass[a]: g3, g4, g5, g6, g8

[a]g3= cocksfoot, g4= meadow fescue, g5= rye grass, g8= meadow grass

concept and design of DEGS are described in detail elsewhere [13, 14, 15, 16, 17]. The first wave (DEGS1) was conducted from 2008 to 2011 and comprised interviews, examinations and tests [18, 19]. The study population comprises the residents of Germany aged 18–79 years. DEGS1 has a mixed design that permits both cross-sectional and longitudinal analyses to be made. For this purpose, a random sample from the local population registries office was drawn to complete the participants of the "German National Health Interview and Examination Survey 1998" (GNHIES98) who re-participated. A total of 8,152 persons participated, including 4,193 first-time participants (response rate, 42%) and 3,959 revisiting participants in GNHIES98 (response rate, 62%). In all, 7,238 persons attended one of the 180 examination centres, and 914 were interviewed only. The net sample (n=7,988) permits representative cross-sectional and time trend analyses for the age range 18–79 years to be performed in comparison with GNHIES98 (n=7,124) [17]. The data of the revisiting participants can be used for longitudinal analyses.

Blood and urine samples were taken during the physical examination for the purpose of laboratory diagnosis. Quantitative detection of specific IgE antibodies in the serum was performed for the allergy diagnosis using the IMMUNOCAP test system from the company Phadia (now Thermo Fisher Scientific). These tests were conducted on the UNICAP 1000 system (Phadia). The concentration of the specific IgE antibodies was reported in kU/l. The data were classified into seven categories (<0.35 kU/l; 0.35–0.69 kU/l; 0.70–3.49 kU/l; 3.50–17.49 kU/l; 17.50–49.99 kU/l; 50.00–99.99 kU/l; ≥100.00 kU/l). The test result was considered positive if the concentration of the specific IgE reached or exceeded a value of 0.35 kU/l (≥0,35 kU/l). A total of 50 specific IgE antibodies were tested for (**Tab. 1**), covering the most important sensitisations from indoor areas (house dust mite excrement, animal dander and mould) and outdoor areas (grass, tree and weed pollen) as well as sensitisation to food allergens and insect venom. In addition, two screening tests were performed: the SX1 test for frequently occurring aeroallergens [house dust mite (d1), birch pollen (t3), timothy pollen (g6), rye pollen (g12), mugwort (w6), cat dander (e1), dog dander (e5) and *Cladosporium herbarum* (m2)] and the GX1 test for important types of grass pollen [cocksfoot (g3), meadow fescue (g4), rye grass (g5), timothy grass (g6) and common meadow grass (g8)].

To determine the change in the prevalence of sensitisation to aeroallergens over time, the relevant data from DEGS1 were compared with those from GNHIES98. GNHIES98 was conducted between October 1997 and March 1999 among a representative sample of the resident adult German population comprising 7,124 18–79-year-olds and used the same screening test for aeroallergens (SX1) as DEGS1 for allergy diagnosis [4].

The sociodemographic characteristics that are of relevance for this evaluation were taken from the self-administered questionnaires completed by participants. Social status was determined using an index that includes information on school education and vocational training, professional status and net household income (weighted by household needs) and which enables a classification into low-, middle- and high-status groups [20]. Regional classification was based on place of residence in East

Germany (including Berlin) and West Germany. The West was further subdivided into North West (Schleswig-Holstein, Hamburg, Bremen and Lower Saxony), North Rhine-Westphalia, Central (Hessen, Saarland and Rhineland-Palatinate) and South (Bavaria and Baden-Württemberg). As in other allergy evaluations [3], stratification by type of municipality was based on number of inhabitants as follows: rural with fewer than 5,000 inhabitants, small town with 5,000 to 20,000 inhabitants, medium-sized town with 20,000 to 100,000 inhabitants and large town with 100,000 and more inhabitants.

The cross-sectional and trend analyses were conducted with a weighting factor that corrects deviations in the sample from the population structure (as of 31 December 2010) with regard to age, sex, region and nationality as well as type of municipality and education [17]. A separate weighting factor was prepared for the examination part of the survey. Calculation of the weighting factor also considered the re-participation probability of the GNHIES98 participants, based on a logistic regression model. For the purpose of conducting trend analyses, the data from GNHIES98 were age-adjusted to the population level as of 31 December 2010. A non-responder analysis and a comparison of selected indicators with data from the census statistics revealed a high level of representativity of the net sample for the resident population aged 18–79 years of Germany [17]. In order to take account of both the weighting as well as the correlation of the participants within a community, the confidence intervals were determined with methods for complex samples using the statistics package "R", version 12.2 [21, 22, 23], based on the beta distribution [24, 25]. Differences were regarded as statistically significant if the respective 95% confidence intervals did not overlap.

Results

It was possible to test blood samples from 7,025 of the 7,116 (98.7%) participants aged 18–79 years who were interviewed and examined in DEGS1 study for specific IgE antibodies.

Abstract · Zusammenfassung

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Prevalence of sensitisation to aeroallergens and food allergens. Results of the German Health Interview and Examination Survey for Adults (DEGS1)

Abstract

In view of the increasing prevalence of allergies, up-to-date data on the prevalence of allergic sensitisation are of major interest. In the German Health Interview and Examination Survey for Adults (DEGS1) (2008–2011), blood samples from a population-based sample of 7,025 participants aged 18 to 79 years were analysed for specific IgE antibodies against 50 common single allergens and screened for common aeroallergens (SX1) and grass pollen (GX1). In all, 48.6% of the participants were sensitised to at least one allergen. Overall, men were more frequently sensitised to at least one allergen than women were. Sensitisations to at least one allergen were more common among younger than older participants and among participants with a higher socio-economic status. In all, 33.6% of the participants were sensitised to common aeroallergens, 25.5% to food allergens and 22.6% to wasp or bee venoms. Compared with the German National Health Interview and Examination Survey 1998 (GNHIES98), the prevalence of sensitisation to common aeroallergens increased from 29.8 to 33.6%.This increase was statistically significant only in women. The results of DEGS1 still showed a high prevalence of allergic sensitisation.

Keywords

Allergic sensitisation · Adults · Population-based · Health survey

Prävalenz von Sensibilisierungen gegen Inhalations- und Nahrungsmittelallergene. Ergebnisse der Studie zur Gesundheit Erwachsener in Deutschland (DEGS1)

Zusammenfassung

Aufgrund der Zunahme von Allergien in Deutschland sind aktuelle Daten zur Prävalenz allergischer Sensibilisierungen von großem Interesse. Im Rahmen der „Studie zur Gesundheit Erwachsener in Deutschland (DEGS1)" (2008–2011) wurden an einer bevölkerungsbezogenen Stichprobe von 7025 18- bis 79-Jährigen Blutproben auf spezifische IgE-Antikörper gegen 50 verbreitete Einzelallergene untersucht sowie 2 Tests mit jeweils einer Mischung aus Inhalationsallergenen (SX1) und Gräserpollen (GX1) durchgeführt. 48,6% der Teilnehmer wiesen mindestens eine Sensibilisierung auf. Mehr Männer als Frauen waren gegen mindestens ein Allergen sensibilisiert. Zudem waren mehr jüngere als ältere Teilnehmer und mehr Personen mit höherem Sozialstatus von mindestens einer Sensibilisierung betroffen. Gegen Inhalationsallergene waren 33,6% der Teilnehmer sensibilisiert, gegen Nahrungsmittelallergene 25,5% und gegen Insektengifte 22,5%. Im Vergleich zum Bundes-Gesundheitssurvey 1998 (BGS98) hat die Prävalenz einer Sensibilisierung gegen Inhalationsallergene von 29,8% auf 33,6% zugenommen. Dieser Trend war nur bei Frauen signifikant. Die Ergebnisse des DEGS1 zeigen eine nach wie vor hohe Prävalenz allergischer Sensibilisierungen.

Schlüsselwörter

Allergische Sensibilisierung · Erwachsene · Bevölkerungsbezogen · Gesundheitssurvey

Almost one in two of these participants (48.6%) was sensitised to at least one of the tested allergens (**Tab. 2**). More than three in four of the sensitised persons (37.2% of all participants) exhibited more than one sensitisation. Only 11.2% were sensitised to a single allergen only. The most common mono-sensitisation was for wasp or bee venom. Half of all mono-sensitisations were to wasp venom and about 22% to bee venom.

Fig. 1 shows the frequency of sensitisation to the tested single allergens. The ten most important single allergens include grass pollen (timothy and rye pollen), most of the tested tree pollens (birch, the major birch allergen Bet v1, alder and hazel), wasp venom, house dust mite and

Tab. 2 Prevalence (in %, weighted) and 95% confidence interval (95% CI) of allergic sensitisation in the adult German population (DEGS1, n=7,025) by age and sex

	Sex	Age group in years						
		18–29	30–39	40–49	50–59	60–69	70–79	Total
		% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
At least one sensitisation	Women	55.0 (50.2–59.7)	50.9 (45.0–56.8)	46.5 (41.7–51.4)	41.8 (37.4–46.2)	36.1 (31.6–40.6)	39.3 (34.2–44.5)	45.3 (43.3–47.3)
	Men	55.2 (49.4–60.8)	60.3 (54.0–66.4)	55.0 (49.6–60.4)	46.6 (41.5–51.8)	45.5 (40.7–50.3)	44.9 (39.7–50.1)	51.8 (49.6–54.1)
	Total	55.1 (51.6–58.6)	55.7 (51.2–60.2)	50.9 (47.1–54.6)	44.2 (41.0–47.5)	40.6 (37.5–43.8)	41.8 (37.8–45.8)	48.6 (47.1–50.0)
Sensitisation to aeroallergens (SX1)	Women	45.6 (40.8–50.5)	40.9 (35.3–46.7)	35.3 (30.8–39.9)	26.8 (22.7–31.1)	20.9 (17.1–25.1)	18.0 (13.7–23.0)	32.0 (30.1–33.9)
	Men	44.7 (38.8–50.6)	45.1 (38.4–51.8)	36.7 (31.6–42.1)	31.5 (27.1–36.1)	25.4 (21.7–29.4)	21.3 (17.0–26.2)	35.2 (33.0–37.4)
	Total	45.1 (41.4–48.9)	43.0 (38.4–47.7)	36.0 (32.4–39.7)	29.1 (26.2–32.1)	23.1 (20.5–25.9)	19.5 (16.5–22.8)	33.6 (32.1–35.0)
Sensitisation to food allergens	Women	28.4 (24.2–32.9)	28.3 (23.2–33.9)	26.3 (22.1–30.9)	22.0 (18.4–25.9)	17.3 (13.6–21.4)	21.1 (16.5–26.1)	24.2 (22.3–26.1)
	Men	29.8 (25.0–34.9)	31.8 (27.2–36.8)	30.4 (25.6–35.5)	22.6 (18.8–26.9)	23.3 (19.3–27.6)	20.2 (16.2–24.6)	26.9 (25.0–28.8)
	Total	29.1 (25.9–32.5)	30.1 (26.6–33.9)	28.4 (25.2–31.9)	22.3 (19.7–25.1)	20.2 (17.4–23.3)	20.7 (17.6–24.1)	25.5 (24.2–26.9)
Sensitisation to insect venom	Women	18.4 (14.8–22.3)	20.2 (15.4–25.6)	18.8 (14.9–23.1)	16.6 (13.5–19.9)	21.3 (17.4–25.5)	21.1 (17.0–25.5)	19.2 (17.3–21.1)
	Men	21.8 (17.2–26.9)	25.9 (20.6–31.7)	29.5 (25.1–34.2)	25.2 (21.3–29.5)	24.7 (20.5–29.3)	29.0 (24.3–34.0)	26.0 (23.8–28.2)
	Total	20.1 (17.2–23.2)	23.1 (19.4–27.1)	24.3 (21.3–27.5)	20.9 (18.2–23.8)	22.9 (20.1–26.0)	24.6 (21.2–28.3)	22.6 (21.0–24.2)
Sensitisation to grass pollen	Women	29.4 (24.9–34.1)	24.9 (20.1–30.0)	18.1 (14.8–21.7)	9.8 (7.6–12.4)	10.2 (7.6–13.4)	6.6 (4.5–9.0)	16.9 (15.4–18.4)
	Men	32.8 (27.8–38.1)	31.4 (25.9–37.2)	23.9 (19.8–28.3)	16.2 (13.0–19.9)	9.7 (7.4–12.5)	12.0 (8.7–16.0)	22.0 (20.3–23.8)
	Total	31.1 (27.9–34.5)	28.2 (24.3–32.3)	21.1 (18.5–23.7)	13.0 (11.0–15.3)	10.0 (8.2–12.0)	9.0 (7.1–11.2)	19.4 (18.3–20.6)
Sensitisation to tree pollen	Women	24.2 (20.6–28.0)	22.7 (18.2–27.6)	21.8 (17.9–26.0)	16.7 (13.6–20.2)	13.6 (10.5–17.2)	10.8 (7.2–15.3)	18.7 (17.2–20.3)
	Men	22.9 (18.8–27.3)	24.8 (20.1–29.8)	23.9 (19.7–28.6)	15.9 (12.8–19.3)	13.3 (10.2–16.9)	9.7 (6.9–13.2)	19.3 (17.7–20.9)
	Total	23.5 (20.9–26.2)	23.8 (20.3–27.4)	22.9 (19.8–26.2)	16.3 (14.1–18.7)	13.5 (11.2–16.0)	10.3 (8.0–13.0)	19.0 (17.9–20.1)
Sensitisation to house dust mites	Women	23.4 (19.4–27.9)	20.2 (15.8–25.3)	14.3 (11.2–17.8)	10.0 (7.3–13.2)	7.4 (4.9–10.6)	5.8 (3.7–8.7)	13.9 (12.4–15.4)
	Men	26.8 (22.1–32.0)	22.2 (17.5–27.5)	19.4 (15.7–23.6)	13.4 (10.2–17.2)	12.5 (9.7–15.9)	9.1 (6.0–13.1)	18.0 (16.3–19.8)
	Total	25.2 (21.8–28.8)	21.3 (17.9–24.9)	16.9 (14.6–19.5)	11.7 (9.7–14.0)	9.9 (8.1–11.9)	7.3 (5.4–9.6)	15.9 (14.8–17.1)
Sensitisation to weed pollen	Women	18.4 (14.8–22.5)	13.3 (9.2–18.3)	10.3 (7.7–13.4)	5.5 (3.9–7.5)	5.0 (3.3–7.2)	5.5 (3.3–8.3)	9.9 (8.6–11.3)
	Men	17.4 (13.8–21.4)	15.4 (11.6–19.7)	15.5 (12.2–19.1)	7.9 (5.8–10.4)	5.8 (3.9–8.1)	10.5 (7.5–14.1)	12.5 (11.2–13.9)
	Total	17.9 (15.3–20.7)	14.4 (11.4–17.6)	12.9 (10.7–15.4)	6.7 (5.2–8.4)	5.4 (4.1–6.9)	7.7 (5.8–10.0)	11.2 (10.3–12.2)
Sensitisation to animal dander	Women	14.7 (11.6–18.2)	12.5 (9.2–16.3)	11.7 (8.9–14.9)	7.4 (5.3–10.0)	6.3 (4.1–9.2)	4.3 (2.3–7.1)	9.8 (8.6–11.0)
	Men	16.1 (12.2–20.5)	14.1 (10.3–18.8)	12.4 (9.5–15.9)	7.7 (5.4–10.5)	3.3 (2.2–4.8)	3.7 (1.7–6.8)	10.3 (8.8–11.8)
	Total	15.4 (12.8–18.3)	13.3 (10.4–16.6)	12.1 (10.1–14.3)	7.5 (5.8– -9.6)	4.9 (3.5–6.5)	4.0 (2.6–6.0)	10.0 (9.0–11.1)
Sensitisation to mould	Women	5.4 (3.5–7.8)	3.2 (1.8–5.2)	3.6 (2.1–5.7)	2.1 (1.1–3.4)	2.4 (1.0–4.7)	2.1 (1.0–3.7)	3.2 (2.6–3.9)
	Men	8.8 (5.9–12.3)	4.7 (2.8–7.2)	7.4 (5.1–10.2)	5.2 (3.5–7.3)	4.8 (2.8–7.5)	3.8 (2.1–6.2)	6.1 (5.1–7.1)
	Total	7.1 (5.3–9.3)	3.9 (2.5–5.8)	5.5 (4.1–7.3)	3.6 (2.6–4.9)	3.6 (2.3–5.2)	2.9 (1.8–4.2)	4.6 (4.0–5.3)
Sensitisation to latex	Women	4.4 (2.8–6.5)	6.8 (3.9–10.9)	4.0 (2.4–6.2)	3.1 (2.0–4.7)	2.0 (0.9–4.0)	2.8 (1.2–5.3)	3.9 (3.1–4.7)
	Men	6.6 (4.5–9.2)	6.5 (4.1–9.7)	6.5 (4.2–9.6)	2.5 (1.5–3.9)	2.9 (1.6–4.6)	4.3 (2.5–6.9)	5.0 (4.2–6.0)
	Total	5.5 (4.1–7.2)	6.7 (4.7–9.1)	5.3 (3.9–7.1)	2.8 (2.0–3.8)	2.4 (1.5–3.7)	3.5 (2.2–5.1)	4.4 (3.9–5.1)

the food allergens hazelnut and peach. The most seldom sensitisations were to the shrimp allergen tropomyosin Pen a1, the major allergen of Ambrosia (nAmb a1), the mould *Cladosporium herbarum* and milk and chicken protein.

A detailed description of all the tested allergens based on sociodemographic characteristics would go beyond the scope of this basic publication, and the sensitisation prevalence is therefore only outlined for the SX1 test and for the allergen groups. The classification system of the producer of the various tests was used to classify the allergens, resulting in the following nine groups: food allergens, insect venom, animal dander, grass pollen (including GX1 test), tree pollen and weed pollen, house dust mite, mould and latex (see **Tab. 1**).

Tab. 2 shows the prevalence of sensitisation to the listed allergen groups categorised by sex and age: 33.6% of women and men in DEGS1 were sensitised to

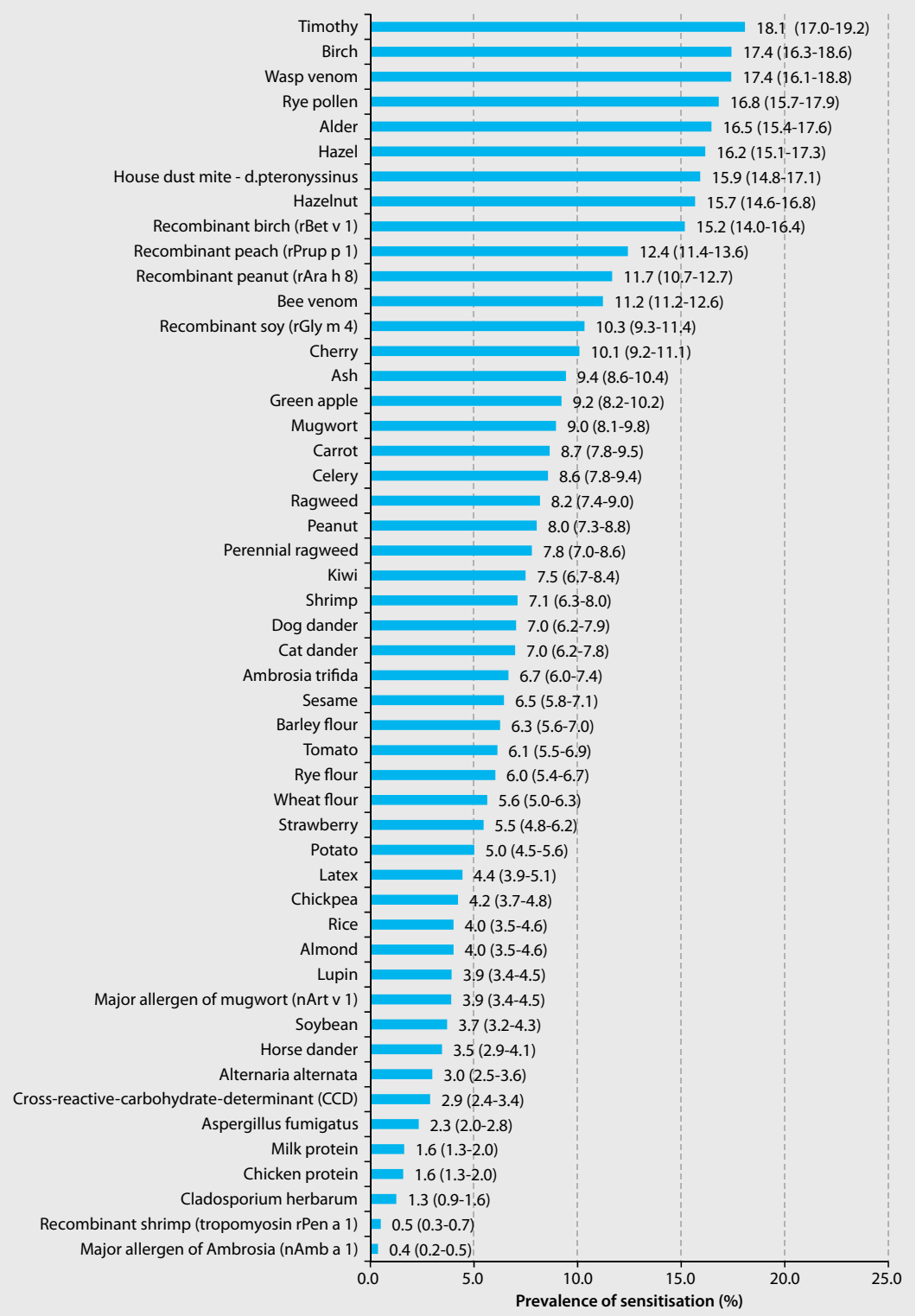

Fig. 1 ◀ Prevalence (in %, weighted) and 95% confidence intervals of sensitisation to 50 allergens in the adult German population (DEGS1, n=7,025)

aeroallergens in the SX1 test. One in four women and men (25.5%) exhibited a sensitisation to at least one of the 26 food allergens tested. The most important food allergens included pollen-associated food allergens like hazelnut, peach, soy and peanut. Most of the women and men who were sensitised to food allergens also showed a sensitisation to allergens in the other allergen groups; 1.7% were sensitised to food allergens only. The prevalence of sensitisation to insect venom was 22.6%. Sensitisation to wasp venom (17.4%) was more frequent than sensitisation to bee venom (11.2%). Almost one in five women and men were sensitised to grass pollen and the same percentage to tree pollen, while 11.2% were sen-

Tab. 3 Prevalence (in %, weighted) and 95% confidence interval (95% CI) of allergic sensitisation in the adult German population (DEGS1, n=7,025) by socioeconomic status

		Socioeconomic status		
		Low	Middle	High
	Sex	% (95% CI)	% (95% CI)	% (95% CI)
At least one sensitisation	Women	39.4 (34.7–44.2)	45.0 (42.4–47.6)	53.4 (48.5–58.2)
	Men	49.0 (43.8–54.1)	50.9 (47.7–54.0)	56.5 (52.2–60.7)
	Total	44.1 (40.6–47.6)	47.8 (45.9–49.7)	55.1 (51.8–58.3)
Sensitisation to aeroallergens (SX1)	Women	22.7 (18.8–27.0)	32.2 (29.8–34.7)	41.5 (36.8–46.3)
	Men	26.9 (22.8–31.3)	35.1 (32.2–38.0)	42.4 (38.2–46.6)
	Total	24.8 (22.0–27.7)	33.6 (31.8–35.4)	42.0 (39.0–45.0)
Sensitisation to food allergens	Women	18.6 (15.1–22.3)	24.6 (22.3–27.0)	28.9 (24.8–33.3)
	Men	23.0 (19.2–27.2)	26.1 (23.3–28.9)	32.6 (29.0–36.3)
	Total	20.7 (18.1–23.6)	25.3 (23.6–27.1)	30.9 (28.2–33.8)
Sensitisation to insect venom	Women	20.5 (16.6–24.7)	18.2 (15.9–20.6)	20.8 (17.3–24.6)
	Men	30.4 (25.3–35.8)	25.5 (22.8–28.4)	23.2 (19.6–27.0)
	Total	25.3 (22.0–28.9)	21.7 (19.7–23.8)	22.1 (19.5–24.9)
Sensitisation to grass pollen	Women	9.3 (6.8–12.2)	17.4 (15.6–19.4)	23.5 (20.0–27.2)
	Men	17.9 (14.5–21.7)	21.6 (19.3–24.0)	27.2 (23.4–31.3)
	Total	13.5 (11.3–15.9)	19.4 (18.0–20.8)	25.5 (22.9–28.3)
Sensitisation to tree pollen	Women	11.7 (8.7–15.2)	19.1 (17.1–21.2)	25.1 (21.1–29.4)
	Men	15.1 (11.8–18.8)	19.0 (16.8–21.3)	24.2 (21.1–27.4)
	Total	13.4 (11.0–16.0)	19.1 (17.7–20.5)	24.6 (22.0–27.3)
Sensitisation to house dust mites	Women	11.3 (8.6–14.5)	13.8 (12.0–15.9)	16.1 (12.6–20.0)
	Men	12.6 (9.5–16.1)	17.8 (15.5–20.3)	22.3 (19.1–25.8)
	Total	11.9 (9.8–14.3)	15.8 (14.3–17.3)	19.5 (17.0–22.2)
Sensitisation to weed pollen	Women	7.0 (4.7–9.8)	10.2 (8.5–12.0)	11.9 (9.3–14.8)
	Men	12.7 (9.8–16.1)	12.5 (10.7–14.5)	12.3 (9.8–15.0)
	Total	9.8 (7.9–11.9)	11.3 (10.1–12.6)	12.1 (10.3–14.0)
Sensitisation to animal dander	Women	6.3 (4.2–8.9)	10.1 (8.6–11.6)	12.2 (9.5–15.2)
	Men	6.9 (4.6–9.8)	10.2 (8.4–12.3)	12.8 (10.2–15.7)
	Total	6.6 (5.0–8.4)	10.1 (8.9–11.5)	12.5 (10.5–14.7)
Sensitisation to mould	Women	2.1 (1.1–3.4)	3.0 (2.2–4.0)	5.3 (3.7–7.2)
	Men	4.1 (2.4–6.4)	6.5 (5.2–7.9)	6.3 (4.5–8.3)
	Total	3.1 (2.1–4.3)	4.7 (3.9–5.5)	5.8 (4.6–7.2)
Sensitisation to latex	Women	3.2 (1.7–5.4)	4.0 (3.1–5.2)	3.5 (2.2–5.2)
	Men	5.7 (3.5–8.6)	5.3 (4.1–6.7)	3.7 (2.6–5.2)
	Total	4.4 (3.1–6.1)	4.6 (3.9–5.5)	3.6 (2.8–4.7)

sitised to weed pollen. The weed pollens also include pollen of the Ambrosia species, which is of major interest because of the rapid spread of these invasive neophytes in some regions of Germany. The prevalence of sensitisation to house dust mites was 15.9%, while the prevalence of sensitisation to animal dander was somewhat lower at 10%. Less than 5% of participants exhibited a sensitisation to mould allergens (4.6%) and latex (4.4%).

Sociodemographic characteristics

For most allergen groups, the sensitisation prevalence was higher among men than women. However, these differences were only statistically significant for sensitisation to insect venom, grass pollen, house dust mites and mould, and this did not apply to all age groups (**Tab. 2**).

There were no statistically significant differences in the prevalence of sensitisation to insect venom among age groups (**Tab. 2**). By contrast, there were statistically significant differences between the age groups with regard to the prevalence of sensitisation to the other allergen groups and in the test for aeroallergens, with sensitisation being exhibited significantly more frequently among younger than older participants. There were, however, different age curves for the various allergen groups. The prevalence of sensitisation to food allergens or latex was similar in the 18–29 and 40–49 years age groups, which showed a significantly higher prevalence than the older age groups, among whom there were no differences. There was no statistically significant difference in the prevalence of sensitisation to tree pollen between the 18–29 and 40–49 years age groups, after which the prevalence of sensitisation to tree pollen gradually declined with increasing age. The prevalence of sensitisation to aeroallergens and the prevalence in the allergen groups grass pollen, house dust mites and animal dander gradually decreased with increasing age. The prevalence of sensitisation to weed pollen was highest in the youngest age group but decreased up to the 60–69 years age group before showing a slight increase once again. Sensitisation to mould was significantly less frequent among participants in the three oldest age groups than among 18–29-year-olds.

Participants with high socioeconomic status exhibited sensitisation to aeroallergens, food allergens, grass and tree pollen, house dust mites and animal dander significantly more frequently than participants with low socioeconomic status (**Tab. 3**). The prevalence of sensitisation to insect venom was slightly higher among participants with low social status than among those with middle or high social status, but this difference was not statistically significant. The prevalence of sensitisation to weed pollen and latex did not differ to any statistically significant degree according to socioeconomic status.

Regarding regional variations, the only statistically significant differences in sensitisation prevalence were for aeroallergens, insect venom and house dust mites (**Tab. 4**). Participants from East Germany showed significantly less frequent sensitisation to aeroallergens than their counterparts from West Germany. A closer analysis regarding the further

Tab. 4 Prevalence (in %, weighted) and 95% confidence interval (95% CI) of allergic sensitisation in the adult German population (DEGS1, n=7,025) by region

		Region					
		East	West	North West	North Rhine-Westphalia	Central	South
	Sex	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
At least one sensitisation	Women	41.4 (37.7–45.2)	46.4 (44.0–48.7)	46.1 (40.5 -51.8)	43.6 (39.2–48.1)	44.2 (39.3–49.2)	49.7 (45.6–53.7)
	Men	53.3 (48.9–57.7)	51.4 (48.8–54.0)	53.6 (47.0–60.0)	50.8 (45.1–56.6)	50.8 (45.8–55.9)	50.9 (46.7–55.2)
	Total	47.4 (45.2–49.6)	48.9 (47.2–50.6)	49.8 (45.8 -53.8)	47.2 (44.3–50.0)	47.5 (43.3–51.8)	50.3 (47.3–53.3)
Sensitisation to aeroallergens (SX1)	Women	26.6 (22.8–30.8)	33.4 (31.3–35.5)	32.9 (27.3–38.9)	34.7 (30.5–39.1)	33.5 (28.6–38.7)	32.5 (29.2–35.9)
	Men	32.9 (28.9–37.2)	35.8 (33.3–38.3)	39.3 (31.7–47.3)	37.2 (33.2–41.5)	37.1 (30.8–43.6)	32.1 (28.5–35.9)
	Total	29.8 (27.3–32.3)	34.6 (32.9–36.3)	36.1 (31.4–41.0)	36.0 (33.4–38.6)	35.3 (30.5–40.3)	32.3 (29.8–34.9)
Sensitisation to food allergens	Women	21.9 (18.9–25.1)	24.8 (22.5–27.1)	25.3 (19.1–32.3)	25.3 (21.5–29.4)	23.2 (18.2–28.8)	24.8 (21.2–28.6)
	Men	26.9 (23.6–30.4)	26.9 (24.7–29.2)	25.9 (20.9–31.3)	27.2 (22.2–32.6)	27.9 (23.4–32.7)	26.8 (23.4–30.4)
	Total	24.4 (22.1–26.8)	25.8 (24.3–27.4)	25.6 (21.6–29.9)	26.3 (23.0–29.7)	25.5 (21.9–29.5)	25.8 (23.5–28.2)
Sensitisation to insect venom	Women	21.4 (17.9–25.1)	18.6 (16.5–20.9)	15.9 (12.3–20.0)	12.4 (9.4–15.8)	17.5 (13.4–22.1)	25.5 (21.7–29.6)
	Men	31.5 (27.2–36.0)	24.5 (22.1–27.0)	20.4 (16.4–24.8)	21.1 (17.0–25.6)	23.2 (18.5–28.5)	30.1 (25.5–35.0)
	Total	26.4 (23.7–29.3)	21.5 (19.6–23.5)	18.1 (15.2–21.3)	16.7 (14.1–19.5)	20.4 (17.2–23.8)	27.8 (24.1–31.7)
Sensitisation to grass pollen	Women	15.4 (12.3–19.0)	17.3 (15.6–19.0)	17.8 (14.2–21.8)	16.7 (13.5–20.2)	18.2 (14.9–21.9)	16.9 (13.8–20.4)
	Men	20.1 (16.9–23.6)	22.5 (20.5–24.6)	23.0 (17.4–29.4)	23.4 (20.5–26.4)	23.0 (18.5–27.9)	21.3 (17.9–25.0)
	Total	17.8 (15.7–20.0)	19.9 (18.5–21.3)	20.4 (16.8–24.3)	20.0 (17.8–22.4)	20.6 (17.5–24.0)	19.1 (16.9–21.5)
Sensitisation to tree pollen	Women	16.8 (14.1–19.9)	19.2 (17.5–21.1)	17.9 (13.3–23.2)	21.2 (18.1–24.5)	17.1 (13.3–21.2)	19.5 (16.6–22.7)
	Men	18.9 (16.0–22.0)	19.4 (17.5–21.3)	17.3 (13.6–21.5)	19.6 (16.0–23.6)	20.9 (16.1–26.3)	19.6 (16.5–22.9)
	Total	17.9 (15.7–20.2)	19.3 (18.0–20.6)	17.6 (14.6–20.9)	20.4 (18.0–22.9)	19.0 (15.8–22.5)	19.5 (17.5–21.7)
Sensitisation to house dust mites	Women	10.7 (8.2–13.5)	14.7 (13.1–16.5)	14.0 (10.8–17.6)	16.9 (13.4–20.8)	15.8 (11.3–21.3)	12.9 (10.3–15.9)
	Men	15.5 (12.5–18.8)	18.7 (16.7–20.8)	21.6 (16.5 -27.4)	22.5 (19.1–26.1)	14.6 (8.8–22.4)	16.1 (13.4–19.1)
	Total	13.1 (11.2–15.1)	16.7 (15.4–18.1)	17.7 (14.6–21.3)	19.6 (17.4–22.1)	15.2 (11.3–19.9)	14.5 (12.7–16.4)
Sensitisation to weed pollen	Women	10.7 (8.3–13.4)	9.7 (8.2–11.4)	10.3 (6.0–16.2)	7.6 (5.8–9.7)	11.0 (6.9–16.2)	10.4 (8.2–12.9)
	Men	15.4 (13.0–18.0)	11.7 (10.3–13.4)	12.3 (8.7–16.5)	10.3 (7.8–13.2)	14.7 (10.6–19.6)	11.2 (8.9–13.8)
	Total	13.0 (11.5–14.8)	10.7 (9.7–11.9)	11.3 (8.4–14.7)	8.9 (7.5–10.5)	12.8 (9.8–16.3)	10.8 (9.2–12.6)
Sensitisation to animal dander	Women	9.0 (7.0–11.2)	10.0 (8.7–11.4)	10.3 (7.4–13.7)	10.3 (7.9–13.1)	10.2 (7.4–13.5)	9.5 (7.2–12.2)
	Men	9.2 (7.0–11.7)	10.6 (8.9–12.4)	12.3 (7.8–18.0)	12.4 (9.2–16.1)	10.1 (6.1–15.3)	8.4 (6.2–11.0)
	Total	9.1 (7.5–10.8)	10.3 (9.1–11.5)	11.3 (8.0–15.2)	11.3 (9.2–13.7)	10.1 (7.2–13.7)	8.9 (7.3–10.8)
Sensitisation to mould	Women	3.3 (2.2–4.7)	3.2 (2.5–4.0)	3.2 (2.1–4.5)	2.8 (1.5–4.5)	3.3 (1.8–5.6)	3.4 (2.1–5.2)
	Men	6.7 (4.9–9.0)	5.9 (4.8–7.2)	9.0 (6.0–12.8)	5.1 (3.3–7.3)	5.9 (2.9–10.4)	4.7 (3.4–6.3)
	Total	5.0 (3.9–6.4)	4.5 (3.8–5.3)	6.1 (4.4–8.1)	3.9 (3.0–5.1)	4.6 (2.7–7.2)	4.1 (3.0–5.4)
Sensitisation to latex	Women	5.5 (3.6–8.0)	3.4 (2.7–4.3)	3.2 (1.4–6.0)	3.0 (1.9–4.6)	3.2 (1.6–5.9)	3.9 (2.6–5.6)
	Men	5.5 (4.0–7.4)	4.9 (3.9–6.0)	3.4 (1.8–5.8)	4.2 (2.5–6.7)	6.8 (3.8–11.0)	5.4 (3.9–7.4)
	Total	5.5 (4.3–6.9)	4.2 (3.5–4.9)	3.3 (2.1–4.8)	3.6 (2.5–5.0)	5.0 (3.0–7.9)	4.7 (3.7–5.8)

stratification of West Germany shows that this applies only to the comparison between North Rhine-Westphalia and the East region. Participants from East Germany were also less frequently sensitised to house dust mites than participants in West Germany. A closer analysis regarding the further stratification of West Germany shows that participants from the East and South were sensitised to house dust mites significantly less frequently than their counterparts from North Rhine-Westphalia. In contrast, participants from West Germany exhibited less frequent sensitisation to insect venom than their counterparts in East Germany. A closer analysis regarding the further stratification of West Germany shows that the prevalence of sensitisation to insect venom in both the East and South was significantly higher than in the North West and in North Rhine-Westphalia. Moreover, the participants from Central Germany showed far less frequent sensitisation to insect venom than participants from South Germany.

The prevalence of sensitisation by type of municipality based on number of inhabitants is shown in **Tab. 5**. The prevalence of sensitisation to aeroallergens, food allergens, grass pollen, tree pollen, house dust mites and animal dander increased with increasing size of the municipality, but this increase was only statistically significant for the two last-named groups. By contrast, the prevalence of sensitisation to insect venom among participants from rural regions and small towns was significantly higher than among participants from medium-sized and large towns.

Tab. 5 Prevalence (in %, weighted) und 95% confidence interval (95% CI) of allergic sensitisation in the adult German population (DEGS1, n=7,025) by type of municipality

		Type of municipality			
		Rural	Small town	Medium-sized town	Large town
	Sex	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
At least one sensitisation	Women	48.0 (41.8–54.3)	46.4 (42.4–50.4)	42.8 (39.1–46.5)	45.7 (42.3–49.0)
	Men	55.1 (50.5–59.6)	51.3 (46.6–56.1)	52.1 (48.2–56.0)	50.3 (45.6–55.0)
	Total	51.7 (47.5–55.9)	48.8 (45.9–51.8)	47.3 (44.9–49.8)	48.0 (45.5–50.4)
Sensitisation to aeroallergens (SX1)	Women	30.1 (25.4–35.1)	28.2 (24.6–32.0)	33.2 (29.6–36.9)	34.5 (31.1–38.0)
	Men	28.2 (23.2–33.7)	35.0 (31.1–39.1)	37.8 (33.7–42.0)	36.5 (32.5–40.6)
	Total	29.1 (25.1–33.4)	31.6 (28.9–34.3)	35.5 (32.7–38.3)	35.5 (33.2–37.8)
Sensitisation to food allergens	Women	23.9 (19.3–29.0)	20.6 (17.6–23.7)	24.6 (20.8–28.7)	26.7 (23.1–30.5)
	Men	24.9 (21.3–28.7)	26.0 (21.4–30.9)	28.1 (24.4–32.1)	27.5 (24.4–30.8)
	Total	24.4 (21.1–27.9)	23.3 (20.6–26.1)	26.3 (24.0–28.8)	27.1 (24.7–29.6)
Sensitisation to insect venom	Women	24.7 (20.1–29.8)	25.2 (21.4–29.3)	14.2 (11.2–17.6)	16.7 (13.9–19.9)
	Men	36.4 (30.9–42.1)	27.7 (23.0–32.7)	23.5 (20.1–27.0)	21.7 (18.3–25.4)
	Total	30.8 (26.2–35.6)	26.4 (23.1–29.9)	18.7 (16.3–21.3)	19.2 (17.0–21.5)
Sensitisation to grass pollen	Women	15.1 (11.9–18.9)	14.6 (12.4–17.0)	18.1 (14.9 -21.7)	18.3 (15.5 -21.4)
	Men	17.4 (14.0 -21.3)	20.2 (16.6 -24.2)	24.5 (21.4 -27.9)	23.4 (20.3 -26.7)
	Total	16.3 (13.6 -19.4)	17.4 (15.4 -19.4)	21.2 (18.9 -23.7)	20.8 (19.0 -22.7)
Sensitisation to tree pollen	Women	17.0 (13.4–21.1)	17.3 (14.8–20.1)	18.8 (15.9–22.1)	20.5 (17.5–23.8)
	Men	15.0 (10.9–20.0)	18.0 (15.2–21.1)	21.6 (18.6 -24.8)	20.2 (17.5–23.2)
	Total	16.0 (12.8–19.5)	17.7 (15.9–19.5)	20.2 (18.3–22.2)	20.4 (18.3–22.5)
Sensitisation to house dust mites	Women	12.1 (8.9–15.8)	12.6 (9.9–15.7)	13.9 (11.3–16.8)	15.6 (12.9–18.6)
	Men	13.0 (9.8–16.8)	16.4 (13.0–20.2)	20.1 (16.9–23.6)	19.9 (16.7–23.5)
	Total	12.5 (10.1–15.3)	14.5 (12.3–16.9)	16.9 (14.9–19.1)	17.7 (15.7–19.9)
Sensitisation to weed pollen	Women	11.9 (8.2–16.4)	9.3 (7.4–11.5)	8.6 (5.9–12.1)	10.7 (8.4–13.3)
	Men	9.7 (6.7–13.5)	13.0 (9.9–16.7)	12.9 (10.5–15.7)	13.2 (11.3–15.4)
	Total	10.7 (8.8–12.8)	11.1 (9.2–13.3)	10.7 (8.8–12.9)	11.9 (10.5–13.5)
Sensitisation to animal dander	Women	8.2 (6.3–10.4)	7.8 (6.3–9.6)	10.6 (8.0–13.6)	11.2 (9.1–13.6)
	Men	7.2 (4.6–10.5)	8.5 (6.2–11.2)	11.2 (8.7–14.2)	12.3 (9.2–16.0)
	Total	7.6 (6.1–9.4)	8.2 (6.7–9.8)	10.9 (9.0–13.1)	11.7 (9.6–14.1)
Sensitisation to mould	Women	2.9 (1.7–4.6)	3.3 (2.1–4.9)	3.9 (2.6–5.4)	2.7 (1.6–4.2)
	Men	5.3 (3.5–7.6)	4.4 (2.5–7.2)	6.0 (4.4–7.9)	7.8 (5.8–10.2)
	Total	4.1 (2.9–5.6)	3.9 (2.6–5.4)	4.9 (3.9–6.1)	5.2 (4.1–6.5)
Sensitisation to latex	Women	5.2 (3.5–7.4)	3.3 (2.1–5.0)	3.7 (2.4–5.4)	3.8 (2.3–5.7)
	Men	5.8 (3.9–8.2)	4.8 (3.3–6.7)	5.3 (3.8–7.3)	4.6 (2.9–6.7)
	Total	5.5 (4.2–7.0)	4.1 (3.1–5.2)	4.5 (3.4–5.8)	4.2 (3.1–5.4)

Trend in sensitisation to aeroallergens

In order to determine changes in sensitisation prevalence over time, the findings of the SX1 test for aeroallergens from GNHIES98 were compared with the DEGS1 results. Compared to GNHIES98, DEGS1 showed a significant increase in the prevalence of sensitisation to aeroallergens of almost 4%: from 29.8% (95% confidence interval: 28.2–31.5%) to 33.6% (32.1–35.0%). Prevalence among women showed a statistically significant increase of almost 7%, from 25.4% (23.4–27.6%) to 32.0% (30.1–33.9%), but this trend was not observed in men [34.1% (32.0–36.3%) in GNHIES98 compared to 35.2% (33.0–37.4%) in DEGS1 (**Fig. 2**)]. Whereas GNHIES98 found a significant difference in the prevalence of sensitisation to aeroallergens between men (34.1%; 32.0–36.3%) and women (25.4%; 23.4–27.6%), no such statistically significant difference was subsequently found in DEGS1.

Discussion

The data from DEGS1 can be used to describe the prevalence of allergic sensitisation, on a representative basis, for the adult German population aged between 18 and 79 years. Almost one in two adults in Germany is sensitised to at least one of the tested allergens. Studies conducted in different regions in West and East Germany in the early 1990s tested sensitisation to five allergens (grass pollen, birch pollen, cat dander, house dust mite and the mould *Cladosporium herbarum*) in adults [6, 7]. The prevalence of sen-

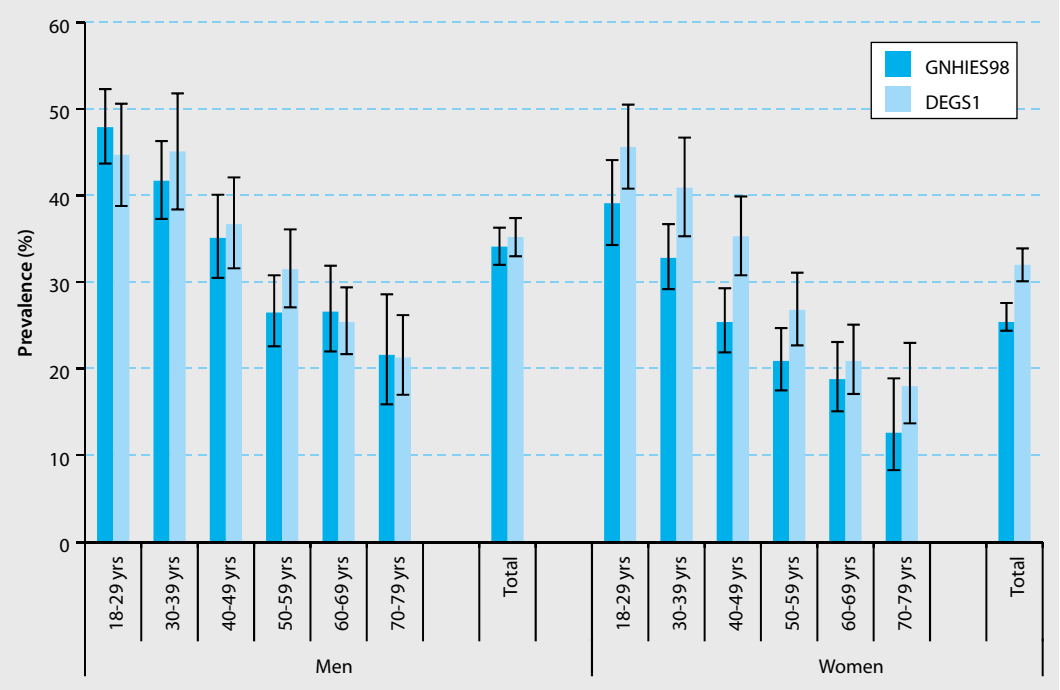

Fig. 2 ◀ Trend in sensitisation to aeroallergens (SX1), calculated by comparing the results of GNHIES98 (n=3,271 men and n=3,466 women) and DEGS1 (n=3,371 men and 3,651 women) stratified by sex and age. *yrs* years

sitisation to at least one of these allergens among 20–44-year-olds was 40.3% in Hamburg and 34.1% in Erfurt [7]. In a further study, 36% of 25–64-year-olds from Augsburg and 26% of 25–64-year-olds in Erfurt showed sensitisation to at least one of the five aforementioned allergens [6]. In the German Health Interview and Examination Survey for Children and Adolescents (KiGGS) conducted from 2003 to 2006, tests were performed for 20 allergens, and a total 40.8% of 3–17-year-olds in Germany exhibited sensitisation to at least one of the tested single allergens. The prevalence of sensitisation in 14–17-year-olds was even higher at 46.6% [26]. In the US "National Health and Nutrition Examination Survey (NHANES) 2005–2006", tests were performed for 19 allergens in a population-based sample comprising participants from the age of 6 years upwards. The prevalence of sensitisation to at least one of the tested allergens was 43.7% [27].

The results of DEGS1 indicate a high prevalence for sensitisation to food allergens among adults in Germany. In particular, German adults were frequently found to be sensitised to pollen-associated food allergens, i.e. food allergens that can cross-react with IgE antibodies to tree, weed or grass pollen, such as hazelnut, soy, peanut and green apple. A 1994/95 study of adults aged between 25 and 74 years in the Augsburg region used skin prick tests to investigate the prevalence of sensitisation to ten food allergens. The results showed that the prevalence of sensitisation to at least one of the tested food allergens was also high at 16.8%, but nevertheless lower than in DEGS1 [28]. This difference between DEGS1 and the Augsburg study may partly be due to the number of investigated food allergens. In the Augsburg study, it was shown that participants also exhibited sensitisation to pollen-associated food allergens most frequently of all tested food allergens. Moreover, sensitisation to food allergens was often observed together with sensitisation to aeroallergens. This suggests a high level of cross-sensitisation but does not rule out the possibility of co-sensitisation [28].

Many German adults are sensitised to insect venoms. The prevalence found in this survey is comparable with the findings of previous studies among the general population in Europe (9–29%) and in particular regions of Germany (27% for the rural state of Bavaria, 25% for Hamburg) [2, 29]. The prevalence of sensitisation to insect venom depends on the probability of exposure [29]. This partly explains the regional differences and the variations by type of municipality observed in DEGS1. It also explains the general lack of an association between age and prevalence of sensitisation and the slight increase in prevalence among older age groups. More in-depth analysis is necessary to determine whether cross-reactions are partly responsible for the high prevalence levels.

The results of DEGS1 also underline the importance of sensitisation to grass, tree and weed pollen. Climatic changes have extended the pollination phase of grass and tree pollen in recent decades [30, 31] resulting in an increased exposure time to pollen, and this may have had an effect on sensitisation prevalence. One remarkable development is the rapid spread in Germany of the highly allergenic Ambrosia pollen from North America [30, 31]. DEGS1 shows that around 11% of adults in Germany are sensitised to weed pollen, which also includes the pollen of the Ambrosia species. The prevalence levels for sensitisation to the three tested Ambrosia types measured by DEGS1 are comparable with those measured in Switzerland [32]. Initial intermediate evaluations show high cross-reactivity between mugwort and ragweed pollen [31].

Previous studies have often described the regional variations in sensitisation prevalence in Germany as East–

West differences [6, 7, 9, 11]. This evaluation shows that East–West comparisons do not adequately describe the regional differences in sensitisation prevalence in Germany. DEGS1 did not only show East–West differences but also North–South variations in sensitisation prevalence. However, the description of East–West differences allows the findings to be compared with previous studies. Like these studies, DEGS1 also found, for example, that the prevalence of sensitisation to house dust mites in West Germany was higher than in East Germany [7, 8]. On closer inspection, adults from North West Germany were slightly and adults from North Rhine-Westphalia were significantly more frequently sensitised to house dust mites than adults in South and East Germany. This may be due to climatic differences (more humid climate in the North West versus drier climate in the East and South).

In addition, DEGS1 showed some variations in the prevalence of sensitisation based on type of municipality, possibly due to different living conditions (differing pollutant loads, for example).

Sensitisation to mould is seldom. This is to be seen as a positive finding, since this type of sensitisation is a significant risk factor for asthma [33, 34, 35].

Sensitisation to latex is found most seldom. It is assumed that it is above all specific to occupational groups, such as employees in the healthcare sector, who suffer from a latex allergy [2].

The differences in sensitisation prevalence by age and sex observed in DEGS1 were also found in other studies [4, 6, 7, 9]. DEGS1 also showed, for example, that men are sensitised to insect venom, grass pollen, house dust mites and mould to a statistically significant more frequent degree than women. The differences may be due to differing levels and durations of exposure to allergens. Another possible explanation may be differences in immune reaction between men and women.

The positive connection between existing sensitisation and higher socioeconomic status also agrees with the findings of other studies [8, 11, 26]. This may be due to differences in living conditions. In 1989, Strachan discussed the protective effect of contact with micro-organisms, the so-called "hygiene hypothesis" [36], for the first time.

Conclusion and outlook

The initial findings of DEGS1 outlined here show that many adults in Germany are affected by allergic sensitisation. The prevalence of sensitisation to aeroallergens has increased during the past decade. More in-depth evaluations should be conducted to explore the associations between the occurrence of sensitisation and allergic diseases. The question of the cross-reactivity of allergens should also be the topic of in-depth evaluations. To date, there are only few studies that have depicted the individual changes in sensitisation status over time. Therefore, longitudinal analyses for the evaluation of sensitisation to aeroallergens are planned for people who participated in both GNHIES98 and DEGS1.

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