



Letter

Occupational rhinitis, asthma, and contact urticaria caused by hydrolyzed wheat protein in hairdressers

Hydrolyzed wheat protein (HWP) is a common ingredient in food and cosmetic products. Immediate hypersensitivity to HWP has been reported,^{1,2} and HWP present in foods may cause severe allergic reactions.³ HWP in cosmetic products has been reported to cause allergic contact urticaria (CU)^{1,4} and even to induce wheat-dependent exercise-induced anaphylaxis (WDEIA) in consumers.⁵

We describe 2 hairdressers in whom the use of HWP-containing hairdressing products at work led to the development of HWP hypersensitivity, occupational rhinitis (OR), and occupational CU. One of them also developed occupational asthma (OA). In addition, both hairdressers developed symptoms consistent with WDEIA.

Hairdresser 1 had milk allergy during infancy, with no allergies or atopic symptoms thereafter. After working as a hairdresser for 2 years, she developed watery rhinitis, conjunctivitis, asthma-like symptoms at work, and CU associated with the use of a sprayable hair conditioner (product 1). Her work-related rhinitis was associated with the use of product 1 and another hairspray (product 2), both of which contained HWP (laurdimonium hydroxypropyl HWP). She also experienced asthma symptoms at work when using these products or hair dyes. At the same time, she had several attacks of dyspnea, angioedema of the eyelids, and burning and tingling of the hands and soles when exercising after having eaten wheat-containing foods. She was diagnosed as having asthma and WDEIA and referred for further examinations because suspected OR, OA and CU.

Hairdresser 2 had a history of atopic eczema. Having worked as a hairdresser for 6 months, she started developing urticarial wheals from skin contact with 2 hairdressing products she used in her work: a sprayable hair conditioner (product 1) and another hair conditioner (product 3), which contained laurdimonium hydroxypropyl HWP. After 4 years of hairdressing work, the patient developed work-related sneezing, nasal itching, and watery rhinitis. Rhinitis was associated with the use of products 1 and 3. At the same time, the patient experienced generalized urticaria and eyelid edema twice while exercising after having eaten wheat-containing food. The exercise-induced symptoms ceased after she switched to a grain-free diet. She was referred for further examinations because of suspected OR and CU.

Skin prick tests (SPTs) with a series of common aeroallergens (tree and grass pollen, mugwort, animal dander, house dust mites, and environmental molds) and natural rubber latex were performed with standardized extracts (ALK, Copenhagen, Denmark, and Stallergenes SA, Antony, France), histamine hydrochloride (10 mg/mL), and diluent controls. In addition, wheat, oat, barley and rye flours, gliadin,

hair-bleaching agents, and paraphenylenediamine, hairdressing products 1 through 3 *as is* and their ingredients obtained from the manufacturer were skin prick tested (Table 1).

In the open skin application test, the test substance was applied on a 5 × 5-cm area of healthy skin on the forearm. The test area was inspected at 20 minutes, and if the result was negative, application was repeated for another 20 minutes and the area interpreted again. A positive reaction was defined as urticarial wheals appearing on the test area (Table 1).

Specific inhalation challenge or nasal provocation tests were performed to confirm suspected OA and/or OR. To assess asthma, peak expiratory flow (PEF) and forced expiratory volume in 1 second (FEV₁) measurements were performed before, during, and after the challenge, until the next morning.⁶ A decrease of 15% or greater in PEF or FEV₁ within 1 hour after the challenge (immediate reaction) or a decrease of 20% or greater in later follow-up (late reaction) as compared with the baseline values was considered positive. Rhinitis was evaluated by anterior rhinoscopy before, during (in nasal provocation), and after the challenge. Rhinorrhea and nasal blockage were scored bilaterally, and the amount of nasal secretion was measured. Acoustic rhinometry volume changes in 2 to 5 cm and anterior rhinomanometry inspiratory resistance changes were measured. OR was considered if the control test result was negative and the score had changed by 4 points or more in allergen provocation.⁷ A large amount of nasal secretion and nasal blockage in rhinometry measurements supported the scoring positivity.

Serum total and specific IgE was measured with Phadia ImmunoCap (Phadia, Uppsala, Sweden). Values of specific IgE below 0.35 kU/L were considered normal.

Both patients had strong positive SPT and urticarial reactions in open skin application tests to hairdressing products containing HWP. Of the products' ingredients, the laurdimonium hydroxypropyl HWP gave a strong positive SPT reaction in both patients, whereas all other tested product ingredients were SPT negative. Three atopic and 4 healthy volunteers were SPT negative to the same HWP. Both patients were SPT negative to wheat flour, persulfate salts, and paraphenylenediamine. In hairdresser 1, OA was diagnosed based on a specific inhalation challenge test with product 1, which caused a significant immediate reaction of –18% in FEV₁ in the first challenge and a significant late reaction of –24% in PEF in a rechallenge the next day. In the rhinitis follow-up, a rhinitis reaction with itching and marked watery rhinorrhea was recorded, consistent with OR. In hairdresser 2, nasal provocation with the HWP caused marked rhinorrhea with swelling of the nasal mucosa, which was confirmed with rhinometric changes. The results of nasal provocation with HWP in 2 volunteers were negative.

Disclosures: Authors have nothing to disclose.

Table 1
Patient characteristics and main findings

Variable	Hairdresser 1	Hairdresser 2
Age, y	23	22
Sex	Female	Female
Smoking	No	No
Duration of exposure, y		
Before contact urticaria	2	½
Before rhinitis	2	4
Before WDEIA and exercise-induced urticaria	2	½–1
Clinical history		
Symptoms related to work exposure	Rhinitis, contact urticaria, asthma	Rhinitis, contact urticaria
Symptoms related to physical exercise	WDEIA	Generalized urticaria
SPT reactions		
Histamine hydrochloride	5 mm	7 mm
Common aeroallergens	Negative	Dog, 6 mm
Flour series	Negative	Gliadin, 6 mm
Work-related allergens	Product 1: 5 mm with pseudopods; product 2: 8 mm with pseudopods; laurdimonium hydroxypropyl HWP 0.1%: 6 mm	Product 3: 14 mm; laurdimonium hydroxypropyl HWP 2%: 15 mm
Specific inhalation challenges in inhalation chamber		
Control challenge (2 mL of phenol 0.4% in sodium chloride 0.5% and sodium hydrogen carbonate sprayed in 15 min)	Negative, no secretion, unspecific rhinometry changes	NT
Challenge with product 1 (2 puffs 3 times in 30 min)	Rhinorrhea, 0.53 g; unspecific rhinometry changes; PEF, –12%; FEV ₁ , –18% (immediate reaction)	NT
Challenge with product 1 (2 puffs 4 times in 40 min)	PEF, –24 % (late reaction); FEV ₁ , –14%; rhinitis follow-up not performed	NT
Nasal provocation tests		
Sodium chloride 0.9% control	NT	Negative
Laurdimonium hydroxypropyl HWP 10% (35 min)	NT	Rhinorrhea, 5.77 g; nasal volume change, –59%; nasal resistance change, +272%
Open skin application tests		
Product 1	Urticarial wheals	NT
Product 2	Urticarial wheals	NT
Product 3	NT	Urticarial wheals
Total IgE, kU/L	79	48
Specific IgE	Wheat, oat, barley and rye flours, <0.35 kU/L; gliadin, <0.35 kU/L; ω5-gliadin, <0.35 kU/L	Wheat, oat, and barley flours, <0.35 kU/L; rye flour, 0.52 kU/L; ω5-gliadin, <0.35 kU/L

Abbreviations: FEV₁, forced expiratory volume in 1 second; HWP, hydrolyzed wheat protein; NT, not tested; PEF, peak expiratory flow; SPT, skin prick test; WDEIA, wheat-dependent exercise-induced anaphylaxis.

Immediate hypersensitivity to HWP in foods and cosmetics has previously been reported in consumers.^{1,3,4} To our knowledge, this is the first report on occupational hypersensitivity to HWP. Our patients were previously healthy hairdressers who used HWP-containing hair conditioning and styling products in their work and developed occupational OR and CU (one of them also developed OA) caused by immediate hypersensitivity to HWP. Both patients also developed symptoms consistent with WDEIA. Previously, hypersensitivity to HWP has been reported as inducing WDEIA, with no or low ω5-gliadin specific IgE.⁵

Respiratory symptoms are frequent occurrences among hairdressers.⁸ Major known causes of OA, OR, and CU among hairdressers include persulfate salts in hair-bleaching products, paraphenylenediamine in hair dyes, and natural rubber latex in gloves.^{9,10} HWPs are commonly used in cosmetics, such as hairdressing products, and should be considered as a possible cause of hairdressers' OR, CU, and OA.

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