Occupational asthma and rhinitis due to yellow and red henna in a hairdresser

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Hairdressing is a profession that often requires handling large amounts of chemicals in conditions of humidity and temperature that favor the reactivity of these substances and cause them to penetrate the body. The most common occupational disease affecting hairdressers is allergic and irritant contact dermatitis, and one such chemical,p-phenylenediamine, is the main causative agent behind this illness. Regarding occupational asthma-rhinitis, the most frequent causative agent is persulfates[1].

Henna is a vegetable dye used in allergic patients as anatural alternative to chemical dyes, though it is also a frequent cause of allergic contact dermatitis. Two cases of asthma and one report of occupational rhinoconjunctivitis due to red henna (*LawsoniaInermis*) have been published previously [2,3]. However, the presence of allergy to red henna or to two different types of henna has never been described in the literature.

We present the case of a 30-year-old female hairdresser who developed rhinitis and occupational asthma (OA) despite no priorrelevant medical history. One year ago, new botanical hair dyes containing *Cassia Obovata* (yellow henna) and *LawsoniaInermis* (red henna) wereintroduced in her workplace.When handling the products, the patientcomplained of hives in areas of exposure as well as rhinorrhea, pruritus of the eyes and nose, and dyspnea. On one occasion, she required emergency caredue to bronchospasm.Her symptoms improved significantly outside of the workplace, though she never used respiratory protection devices. Her physician prescribed inhaled beclomethasone/formoterol every 12 hours,causing her symptoms to improve.

The patient was referred to our clinic, where we performed skin prick testswith the commercial product used in her workplace (NeoBarros) and pure yellow and red henna, with positive results (wheal diameter > 3 mm) for all three substances; three healthy patients (non-asthmatic, non-atopic) had negative results for this test. We also perform skin prick tests with the pneumoallergens of our environment including mites, grass pollen, fungi, dog and cat dander and tree pollen with negative result.We also carried

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out epicutaneous tests with the standard allergens recommended by the Spanish Research Group on Contact Dermatitis and Skin Allergy (GEIDAC) and with substances described as allergens in hairdressing (hydroxyethyl methacrylate, methyl methacrylate, ammonium persulfate, vitalizing cream, dye, and dye mud),producing negative results.

Seven months after the last exposure, the patient underwent a specific inhalation challenge(SIC) with red and yellow henna and a non-specific bronchial challenge test with methacholine.The methacholinetest was negative at baseline (PC20 >16 mg/mL). SIC in a challenge chamber under dust-concentration monitoring by DustTrak® (TSI, USA)with NeoBarros® (Secretos del Agua, Spain) (containing *Cassia obovata (*yellow henna*), LawsoniaInermis (*red henna*), Urticadioica, Betula pendula, Thymus Vulgaris, Kolin, Cinchona Succirubra, Camellia, Sinensis, LinumUsitatissimum, Montmorillonite, PimpinellaAnisum, SyzygiumAromaticum, Coffea*and Xantham Gum) was administered for two consecutive days (cumulative time, 5 hours)with negative results. No significant changes in forced expiratory volume in 1 s (FEV1) were observed over the following 24 h. FENO levels were not modified after SIC and remained below 25 ppb.A nonspecific bronchial challenge with methacholine performed24 hours after SICwas positive (PC20 3.5 mg/mL).

Acoustic rhinometrywas also performed to assess rhinitis before specific provocation and 30 minutes after. The values from this test were positive,revealing a 26% and 21% fall inminimum transverse area in the right and left nostrils, respectively, together with sneezing and rhinorrhea. The results of SIC and acoustic rhinometry confirmed the diagnosis of rhinitis and occupational asthma (OA)due to commercial henna extract.

The henna extract with NeoBarros® was analyzed by SDS-PAGE immunoblotting (Figure 1) under reducing conditions (with 2-mercaptoethanol) as previously described [4], detecting IgE-binding proteins of approximately 40, 60, 75, and 80kDa in the extract. These results further confirmed the initial diagnosis of asthma and occupational rhinitis due to a high molecular weight (HMW) agent.

The most frequent cause of sensitization to henna is through the skin and not byinhalation. This route is commonly seen in hairdressers who have tattoos [5]. The mean frequency of skin allergy to paraphenylenediamine (PPD) caused by black henna tattooing is estimated at 2.5% per application [6]. In the case presented here, the patient appeared to be sensitized via inhalation given the presence of respiratory symptoms such as rhinitis and bronchial hyperreactivityas of the time she began to handle the

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product. Most low molecular weight substances that cause OA act through a mechanism that, although likely to be immunologic, does not involve IgE [7]. Given the positive skin prick tests in this patient, the underlying mechanism seems to involve IgE, a mechanism most frequently involved in HMW substances such as henna. The present case has several characteristics that are typical of the HMW-OA phenotype: positive skin prick test and the presence of rhinitis, conjunctivitis, and urticaria. SIC did not significantly increase the FeNO level, a finding also described more frequently in low molecular weight (LMW) phenotypes [8]. This may be attributable to the lengthy time elapsed between the last occupational exposure and the SIC (seven months). The different clinical and immunological characteristics between this case and others previously described in the literature [2,5,6], may be due to the absence of PPD in the dye used by our patient,which contained a mixture of *CasiaObovata* and *LawsoniaInermis* as main components.

Diagnosis of OA remains a challenge for clinicians and requires a rigorous, protocol-based approach as well as better standardization and generalization of diagnostic tests. In the case described here, SIC and immunoblotting have proven helpful inreaching an accurate diagnosis. In the immunoblotting the bands can correspond to other products not only to the hennas. The diagnosis of allergy to the two hennas was made in, fundamentally based on positive skin tests for both hennas (the provocations and the immunoblot was done with the commercial product that contained other components)

Henna products with *LawsoniaInermis* and *CasiaObovata* should be considered potential allergens in hairdressersdue to their ability to cause rhinitis and occupational asthma, even in the absence of PPD.

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Conflict of interests

JS reports having served as a consultant to Thermofisher, Novartis, Sanofi, Leti, FAES FARMA, Mundipharma, and GSK; having been paid lecture fees by Novartis, GSK, Stallergenes, LETI, and FAES FARMA; and received grant support for research from Thermofisher and ALK.

VV, MJR, IE, CPV, and JC declare no conflicts of interest.

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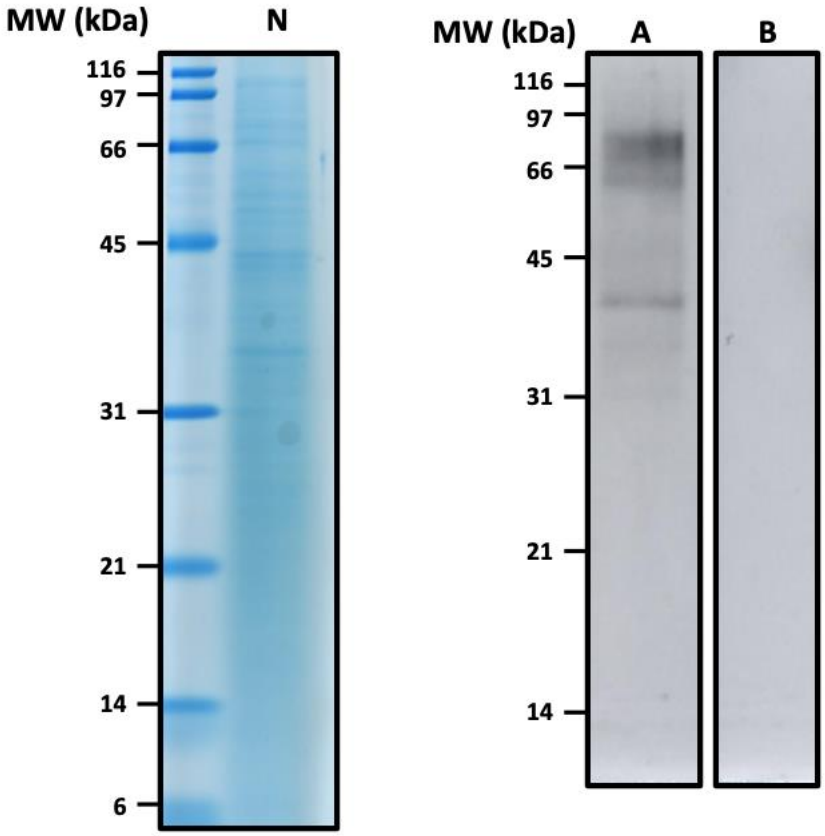
Figure 1. SDS-PAGE IgEimmunoblotting of the henna extract. Lane **A)** Patient serum; Lane B: control serum (non-atopic subject); Lane N: molecular mass standards.



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