Prevalence and Risk Factors of Occupational Asthma Among Hairdressers in Turkey

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This study was designed to evaluate the questionnaire-based prevalence and possible risk factors of occupational asthma among hairdressers in Turkey. We investigated occupational history and respiratory, ocular, dermal, and nasal symptoms using a standardized questionnaire, evaluated worksite pulmonary function tests, and performed allergen skin testing. We then determined asthma risk factors using age- and gender-adjusted logistic regression models. The prevalence of occupational asthma in hairdressers was 14.6%. The odds ratio for hairdressers in a high work intensity group was 3.6 (95% confidence interval, 1.2 to 10.9) with a significant dose-response trend ($\chi^2_{trend} = 4.875$; P = 0.027). The odds ratio for occupational asthma among workers with atopy was 4.5 (95% confidence interval, 1.2 to 17.2). We also observed an excess risk of occupational asthma with allergic rhinitis and conjunctivitis. Occupational asthma did not differ among subgroups of hairdressers. We observed an important risk of occupational asthma among hairdressers. The most prominent risk factors were work intensity and atopy. (J Occup Environ Med. *2002;44:585–590*)

Occupational factors play a role in the etiology of 2% to 15% of all asthma cases in industrialized countries.[1–3] Since the 1980s, the incidence of asthma has increased in many countries.[1,3,4]

Many occupations have been reported as a risk factor for asthma,[5,6] including hairdressers,[7–9] as first reported in 1963.[10] Some of the frequently used irritant and allergic chemicals in hairdressing are presented in Table 1,[11] including persulfate (S_2O_8), which is used for hair bleaching, and henna, which is used for dying.[8,10,12–14] These chemicals produce and provoke asthma by type I and type IV hypersensitivity reactions; however, the molecular mechanism is still not clear.[8–10,12,13,15] It has been reported that hair spray could also cause short-term reversible reactions in small airways.[16] Polyvinylpyrrolidone in hair sprays has been suspected of causing alveolitis and lung granulomatosis, but the results have been controversial and the association is weak.[17]

Few asthma studies have been published from developing countries, where occupational and environmental factors are distinct from industrialized countries.[2,18,19] We believe that new studies from developing countries are needed to understand the etiologic factors of occupational asthma. We planned a population-based cross sectional study to provide information on the prevalence of and risk factors for occupational asthma among hairdressers in Turkey.

Methods

This study was conducted between May and October 1996 in Izmir, the

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TABLE 1
Etiologic Factors of Occupational Asthma in Hairdressers

Immunogenic Agents*	Irritant Agents
Persulfates (L)	Cosmetic agents
Reactive dyes (L)	Reactive dyes
Epilating substances (L)	Epilating substances
Antiseptics (L)	Antiseptics
Formaldehyde (L)	Perfumes
Henna (L/H)	Shampoos
Fungi (H)	Hair creams and gels
Latex (H)	

* L, low molecular weight; H, high molecular weight.

third largest city of Turkey, located on the western shore. According to the records of the Association of Hairdressers, 56 (44.2%) of the hair salons for women were located in the Alsancak region of the city, and we selected all hairdressers in this area as a study population. Thirteen salons were excluded, because three were closed at two different scheduled visits, eight refused to participate, and two had incorrect information supplied by the association. Therefore, data were collected from 43 salons (76.8%), including 206 workers. Among them, 184 workers (89.3%) participated to the study. In terms of avoiding collection bias, all data, including questionnaires, were collected by an experienced pulmonologist. Demographic data, allergic and respiratory symptoms, family and personal history of respiratory and allergic diseases and smoking, and occupational history, including work duration and intensity, were collected by worksite personal interviews using the modified American Thoracic Society questionnaire.[20] We calculated work intensity from the average number of application of chemicals reported per week, including bleaching, dye, and permanent wave applications. According to these numbers, hairdressers were categorized as low (<15), medium (15 to 34), and high (≥35) intensity groups. Work intensity algorithms, including work area size and active ventilation of salons during the work hours, did not change the work intensity assignments; therefore, work area size and ventilation were excluded from the algorithms and were evaluated as single risk factors. Atopy for most common allergens in the region (*Dermatophagoides farinae*, *Dermatophagoides pteronyssinus*, mold mix, and *Phleum protence*) was evaluated by skin-prick test using the Alyosteal prick test, Stallergenes-Pasteur.[21] We measured wheal diameters 15 minutes after application. A wheal of ≥5 mm than the control from any of the four antigens was considered as atopy-positive.[22] Worksite pulmonary function test results (forced expiratory volume in 1 second, forced vital capacity, forced expiratory volume in 1 second/forced vital capacity, and peak expiratory flow) were collected from each hairdresser using methods that adhered to the recommended techniques of the American Thoracic Society.[23]

Hairdressers who reported having any one of the following recurrent symptoms: nonproductive cough, dyspnea, chest tightness, or wheezing were defined as having asthma. If these symptoms existed within the overall working period as a hairdresser and were work-related, we recorded them as occupational asthma.[24] We evaluated risk factors by age- and gender-adjusted unconditional logistic regression models comparing symptomatic and asymptomatic hairdressers. Hairdressers who reported asthmatic symptoms that were not work-related ($n = 13$) were excluded from our analysis. Smoking status did not change the results; therefore, we also excluded smoking from the models. We used SPSS™ statistical software package version 10.1 (SPSS, Inc, Chicago IL).

Results

The median age of our study population was 20.0 years (mean ± SD, 25.2 ± 10.7). Among 184 hairdressers, 71.2% ($n = 131$) were men, 48.9% ($n = 90$) reported current smoking, and 76.1% ($n = 140$) had completed 5 years of elementary education. According to job descriptions, 57.1% ($n = 105$) were master hairdressers, 26.6% ($n = 49$) were fellow hairdressers or helpers, and 16.3% ($n = 30$) were manicurists. The distribution of possible occupa-

TABLE 2
Distribution of Possible Risk Factors of Occupational Asthma in Hairdressers

	n	%
Work intensity (wkly no. of chemical applications)		
Low (<15)	87	47.3
Medium (15–34)	30	16.3
High (≤35)	67	36.4
Work duration (yr)		
<1	10	5.4
1–9	102	55.5
≤10	72	39.1
Work area size (m^2)		
≤100	71	38.6
51–99	51	27.7
≥50	62	33.7
Ventilation		
Yes	145	78.8
No	39	21.2

tional risk factors in hairdressers is presented in Table 2. Almost 40% (n = 72) had been working as a hairdresser for 10 years or more. Only 8.2% (n = 15) reported previous occupations with possible risk factors of asthma, including furniture production, auto mechanic, and painting. A history of pulmonary infections, asthma, allergic rhinoconjunctivitis, and allergic dermatitis was reported in 39.1% (n = 72), whereas 44.6% (n = 82) had a family history of allergy and respiratory diseases. Among hairdressers, 56.5% (n = 104) reported allergic rhinitis, 36.4% (n = 67) allergic conjunctivitis, and 28.8% (n = 53) allergic dermatitis. Only 5.4% (n = 10) who had one or more positive allergen skin test results were assigned as atopy-positive. All of the spirometry tests, including forced expiratory volume in 1 second and forced expiratory volume in 1 second/forced vital capacity, were above 80% of predictive values. According to work-related symptoms among hairdressers—nonproductive cough 8.7% (n = 16), dyspnea 3.8% (n = 7), chest tightness 3.3% (n = 6), wheezing 3.3% (n = 6)—the prevalence of occupational asthma was 14.6% (n = 25). The age, gender, and smoking distribution of those with asthma were not significantly different when compared with those without asthma.

Age- and gender-adjusted risks of occupational asthma by job titles and possible risk factors are presented in Table 3. The risk of occupational asthma was 3.6 times higher among hairdressers in the high work intensity group (95% confidence interval [CI], 1.2 to 10.9), and the trend was statistically significant (χ^2_{trend} = 4.875; P = 0.027). A separate analysis of job titles showed that workers did not differ from one another, except in the high work intensity group: fellow hairdressers in this group had a 15.2-fold risk of occupational asthma (95% CI, 1.1 to 208.3). Comparing job groups with each other confirmed that the risk of occupational asthma was not different among master hairdressers, fellow hairdressers, and manicurists (data not shown). The risk of occupational asthma was almost 3 times higher among hairdressers with symptoms of allergic rhinitis and conjunctivitis (Table 4). Hairdressers with atopy had a 4.5-fold excess risk of occupational asthma (95% CI, 1.2 to 17.2), and the odds ratio increased to 9.5 for master hairdressers (95% CI, 1.4 to 63.0).

Discussion

In this study, the questionnaire-based prevalence of occupational asthma among hairdressers in Turkey was 14.6%, and the most prominent risk factors were work intensity and atopy. The asthma prevalence in our study group was more than twice that in the general population in Turkey.[25] This difference suggested the importance of possible occupational risk factors among hairdressers. The few studies that have evaluated the prevalence of occupational asthma in hairdressers reported an asthma prevalence of 4.5% to 22%.[7,8,26] Chemical agents such as persulfate,[10,13] other bleaching agents, and dyes have been discussed as risk factors of occupational asthma among hairdressers.[9,11,17,27]

The age, gender, and smoking habits of the asthmatic hairdressers were similar to those without asthma symptoms. In general, hairdressers in Turkey are younger than reported in study by Leino et al.[17] Turkish hairdressers tend to start working at very early ages, mostly before adolescence. Approximately half of the study population smoked, similar to the overall smoking rate in Turkey.[28] As in many other closed environments, smoking is permitted in hairdressing salons in Turkey, which may increase the risk of asthma when other workplace chemicals are present.[29–31]

The most important risk factor for occupational asthma among hairdressers was work intensity. Previous studies that reported various chemicals related to occupational asthma did not address work intensity, which may reflect occupational exposure.[8–11,32] Finding a positive dose-response relationship between work intensity and occupational asthma also supports the accuracy of our questionnaire-based occupational asthma diagnosis. To our surprise, work duration (years) was not associated with the risk of occupational asthma, as found by others,[8] which was perhaps a result of healthy worker effect. That is, some hairdressers who developed asthma symptoms might have left that type of work, thus obscuring an association between work duration and asthma.[7,26] In terms of the risk of occupational asthma, we found no difference among occupational subgroups such as master or fellow hairdressers or manicurists. Nevertheless, the excess risk among fellow hairdressers with high work intensity supported the relationship between work intensity and occupational asthma that we observed. Because of similar working conditions, we did not exclude manicurists, who work near hairdressers, sometimes help them if needed, and likely share possible chemical exposure. One can assume that master hairdressers would differ from other workers in terms of risk factors. We observed that these groups worked close to one another in the same work environment and most likely shared similar occupational exposure; our analysis also supported this observation. We also observed atopy as a risk factor for occupational asthma, as reported in earlier studies.[9,18,33] Allergic rhinitis and allergic conjunctivitis were associated with occupational asthma, but not allergic dermatitis, which may be explained by immunopathologic mechanisms.[33–35]

A limitation of this study is the absence from the protocol of objective measurements; some were included in our study design, but financial limitations precluded their being performed. To our knowledge this is one of the largest studies on occupa-

TABLE 3
Risk of Occupational Asthma, by Job Title and Risk Factors*

	All Workers	Master	Fellow	Manicurist
Occupational asthma				
OR	–	1.4	0.7	1.1
95% CI	–	0.5–4.2	0.2–2.2	0.2–5.1
OA/H (*n*)†	–	16/85	5/38	4/23
Risk factors				
Previous occupational exposure				
OR	1.9	0.9	6.0	–
95% CI	0.5–7.8	0.1–7.9	0.6–55.8	–
OA/H (*n*)	3/10	1/6	2/4	–
Personal history of respiratory and allergy problems				
OR	1.3	1.6	2.9	0.3
95% CI	0.6–3.2	0.5–4.7	0.4–19.5	0.1–3.6
OA/H (*n*)	11/54	7/29	3/13	1/12
Family history of respiratory and allergy problems				
OR	1.3	2.4	0.7	0.2
95% CI	0.5–2.9	0.8–7.2	0.1–4.7	0.1–2.9
OA/H (*n*)	12/62	9/30	2/19	1/13
Work intensity (wkly no. of chemical applications)				
Low (<15)				
OR	1.0	1.0	1.0	1.0
95% CI	Reference	Reference	Reference	Reference
OA/H (*n*)	7/73	2/22	2/29	3/22
Medium (15–34)				
OR	2.1	1.8	–	10.9
95% CI	0.5–8.0	0.3–12.1	–	0.4–293.6
OA/H (*n*)	4/23	3/19	–	1/1
High (≤35)				
OR	3.6	2.0	15.2	–
95% CI	1.2–10.9	0.6–15.2	1.1–208.3	–
OA/H	14/50	11/44	3/6	–
Work duration (yr)				
<1				
OR	1.0	–	1.0	–
95% CI	Reference	–	Reference	–
OA/H	2/7	–	2/7	–
1–9				
OR	0.5	1.0	0.3	1.0
95% CI	0.1–2.9	Reference	0.1–2.5	Reference
OA/H	12/82	6/34	3/31	3/17
≤10				
OR	0.8	1.6	–	0.5
95% CI	0.1–6.1	0.4–7.1	–	0.1–11.2
OA/H	11/57	10/51	–	1/6
Work area size (m^2)				
≤100				
OR	1.0	1.0	1.0	1.0
95% CI	Reference	Reference	Reference	Reference
OA/H (*n*)	8/51	5/33	2/10	1/8
51–99				
OR	0.8	0.8	–	0.6
95% CI	0.3–21	0.2–3.1	–	0.1–8.3
OA/H (*n*)	6/40	5/20	–	1/6
≥50				
OR	0.8	1.4	0.9	0.8
95% CI	0.3–2.2	0.4–5.2	0.5–6.7	0.1–25.7
OA/H (*n*)	11/55	6/32	3/14	2/9
No ventilation				
OR	0.7	0.9	–	1.8
95% CI	0.2–2.1	0.2–3.6	–	0.1–25.7
OA/H (*n*)	4/32	3/18	–	1/4

* Hairdressers with non-occupational asthma (n = 13) were excluded from age- and gender-adjusted analysis. OR, odds ratio; CI, confidence interval.

† OA/H, number of hairdressers with occupational asthma/number of healthy hairdressers.

tional asthma in Turkey. The accurate registry data from the Association of Hairdressers, high response rate (89.3%), and standard worksite data collection methods are strengths of this study.

In conclusion, this study identified an important risk of occupational asthma among hairdressers in Turkey that was related to work intensity and atopy. It is possible that reduction of the actual exposures for

TABLE 4
Risk of Occupational Asthma by Job Titles, Atopy, and Allergic Symptoms*

	All Workers	Master	Fellow	Manicurist
Atopy				
OR	4.5	9.5	3.2	–
95% CI	1.2–17.2	1.4–63.0	0.2–47.4	–
OA/H (*n*)†	4/6	3/2	1/3	–
Conjunctivitis				
OR	3.0	3.1	0.9	–
95% CI	1.2–7.5	0.9–9.9	0.1–5.9	–
OA/H (*n*)	15/50	9/26	2/17	4/0
Rhinitis				
OR	2.7	2.6	1.8	11.5
95% CI	1.1–7.3	0.7–10.1	0.3–12.3	0.5–284.3
OA/H (*n*)	19/73	13/51	3/15	3/7
Dermatitis				
OR	1.6	1.4	4.0	1.3
95% CI	0.6–4.0	0.4–4.6	0.5–32.6	0.1–17.2
OA/H (*n*)	9/39	5/21	3/13	1/5

* Hairdressers with nonoccupational asthma ($n = 13$) were excluded from age- and gender-adjusted analysis. OR, odds ratio; CI, confidence interval.

† OA/H, number of hairdressers with occupational asthma/number of healthy hairdressers.

which work intensity was a surrogate in this study would also reduce the risk of work-related asthma. Studies, including longitudinal designed investigations from different countries and occupational groups, will support and help future understanding of the nature of occupational asthma.

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