Respiratory Symptoms and Pulmonary Function Test among Salon Employees

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Objective: To evaluate the association between chemical exposure in salons and respiratory symptom development and evaluate pulmonary function tests (PFTs).

Design: A Cross-Sectional Prospective Study.

Setting: King Abdulaziz University Hospital, Jeddah, Saudi Arabia

Method: One hundred sixty employees from 35 randomly selected salons in Jeddah from July 2017 to September 2017 were included in the study. The study consisted of two parts answering a self-administrated questionnaire and measuring PFTs.

Result: One hundred sixty salon employees were included in the study, 91 (57%) reported different respiratory symptoms. Forty-four employees (28%) reported at least one respiratory symptom. However, cough, sputum, wheezing and shortness of breath were reported by only eight (5%) employees. Shortness of breath was the most common symptom reported by 71 (44%) followed by wheezing in 40 (25%). Four main risk factors were identified: (1) having a history of respiratory disease (odds ratio [OR] 6.51); (2) working with make-up (OR 4.3); (3) smoking (OR 3.61); (4) exposure to chemicals at work (OR 2.17).

Conclusion: More than half of salon employees reported respiratory symptoms in workplace. However, no significant impairment in PFTs was found. Improving the working environment and using protective devices will minimize exposure-related respiratory symptoms. Worker safety agencies and policymakers must ensure the suitability of the work environment and enforce the use of protective devices for all employees.

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During the last few decades, public awareness of respiratory disorders has been highlighted due to the rising rate of pollution and the rapid growth of industrialization and smoking[1]. Some professions predispose workers to occupational lung diseases. The World Health Organization defines occupational disease as "any disease contracted primarily as a result of exposure to risk factors arising from work activity"[2]. Occupational diseases constitute a major economic burden on workers and societies because of decreased productivity and increase use of medical services[3]. Globally, occupational chronic respiratory diseases account for 2,631,000 new cases per year[4]. In 2000, occupational exposures correlated with 12% of chronic obstructive pulmonary disease (COPD) deaths and 17% of asthma deaths globally[4].

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Hairdressing is a known cause of adverse health effects on the respiratory system, and it is the second to be affected by this profession. Furthermore, hairdressing is the second most common profession to cause occupational asthma in women in which the majority of hairdressing and nail bar workers are female[5,6]. Hairdressers are exposed to potentially harmful agents used during hair styling and care techniques. In addition, chemical agents, including hair dyes, bleaching, permanent wave, curling, cutting polishes, removers, gels, shellacs, disinfectants, and adhesives, are all substances that may have irritant and sensitizing effects on the airways.

Several studies confirmed the high prevalence of respiratory diseases among hairdressing employees compared with other professions. The main respiratory problems were asthma, chronic bronchitis, rhinitis, cough and phlegm[5,7-10]. In Saudi Arabia, there is a paucity of data regarding occupational lung diseases.

The aim of this study is to evaluate the association between exposure to chemicals in salons and the development of respiratory symptoms and to measure the Pulmonary Function Test (PFT) of salon employees.

METHOD

A cross-sectional study was conducted from July 2016 to September 2016. The phone numbers of all 785 salons in Jeddah were documented then we sought their willingness to participate in the study by allowing us to visit their site and interview their employees. Thirty-five salons from different regions in Jeddah agreed to participate. At each salon, all employees were invited to participate, and only those who provided their voluntary informed consent were interviewed. No incentives were given for their participation.

A total of 160 employees were recruited from 35 randomly selected salons out of 785 officially registered salons. We included all adult females above 18 years of age from all ethnic groups. Pregnant employees and those who refused to participate were excluded. The study consisted of two main parts: (1) answering a self-administrated questionnaire and (2) measuring pulmonary functions.

The questionnaire consisted of 55 questions divided into five domains: (1) Personal characteristics (nine questions); (2) workplace (10 questions); (3) symptoms and diseases (16 questions); (4) smoking (10 questions); and (5) family history (10 questions). The questionnaire focused on symptoms that were thought to be work-related and recorded other relevant details of work history. Work-related symptoms were defined as "those worse at work and improving on rest days." Duration of symptoms focused on any symptoms in the preceding three months.

Spirometry was used to evaluate the pulmonary function of each participant. It differentiates between obstructive and restrictive airway diseases and provides a severity assessment. We used a portable spirometry machine (Spirometer, MIR, Spirolab III) with disposable nose clips and mouthpieces. The test was performed according to the American Thoracic Society spirometry standards for acceptability and reproducibility. Measurements including forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and FEV1/FVC ratio were documented for analysis[11].

Data were analyzed using SPSS version 23.0. Qualitative variables were expressed in frequencies and percentages while quantitative variables were expressed in mean and standard deviation. Categorical variables were compared with the chi-squared test, and significance was considered as $p < 0.05$.

RESULT

Ninety-three employees (58%) were less than 35 years, 128 (80%) were non-Saudis, 69 (43%) were from North Jeddah, 90 (56%) had higher educational levels, and 115 (72%) were non-smokers. One hundred one (63%) had work experience less than 10 years, 115 (72%) worked six days a week or less, and 127 (79%) worked less than 8 hours.

Ninety-one (57%) employees reported having respiratory symptoms. Forty-four (28%) reported at least one respiratory symptom. Shortness of breath was the most common symptom, reported by 71 (44%), see table 2. Wheezing, coughing, and sputum production was reported by 40 (25%), 32 (20%), and 28 (17%) of employees, respectively.

Table 1: Characteristics of Research Participants

Variable	Frequency
Age	
≤ 35 years	99 (61.9%)
> 35 years	61(38.1%)
Nationality	
Saudi	32 (20%)
Non-Saudi	128 (80%)
Residence in Jeddah	
North Jeddah	74 (46.3%)
South Jeddah	47 (29.4%)
East Jeddah	16 (10.0%)
Middle Jeddah	23 (14.3%)
Education	
≤ Intermediate	63 (39.4%)
> High school	97 (60.6%)
Smoking Status	
Yes	36 (22.5%)
No	124 (77.5%)
Working Experience	
Years	
< 10 years	101 (63.1%)
≥ 10 years	59 (36.9%)
Days/week	
≤ 6 days	124 (77.5%)
> 7 days	36 (22.5%)
Hours/day	
≤ 8 hours	136 (85%)
> 8 hours	24 (15%)

Table 2: Prevalence of Respiratory Symptoms (n=160)

Symptoms	N	%
Chronic cough	32	(20%)
Sputum	28	(17.5%)
Wheezy chest	40	(25%)
Shortness of breath	71	(44.4%)
Group of symptoms		
0	69	(43.1%)
1	44	(27.5%)
2	24	(15%)
3	15	(9.4%)
4	8	(5%)

It appears that workers who live in South Jeddah had significantly more symptoms than workers in other regions (P-value=0.019), and more than half of workers in North Jeddah had no symptoms, personal characteristics were not predictors of the development of respiratory symptoms, except for the region of residence in Jeddah, see table 3.

Table 3: Personal Characteristics of Salon Employees in Relation to Symptoms

Data	No symptoms N=69	One symptom N=44	> One symptom N=47	Test of significance
Age group				
< 35	35 (50.7)	29 (65.9)	31 (66)	P=0.084
>35	34 (49.3)	15 (34.1)	16 (43)	
Nationality				
Saudi	13 (18.8)	6 (13.6)	15 (31.9)	P=0.43
Non-Saudi	56 (81.2)	38 (86.4)	32 (68.1)	
Education				
≤ Intermediate	26 (37.7)	15 (34.1)	22 (46.8)	P=0.084
≥ High school	43 (62.3)	29 (65.9)	25 (53.2)	
Marital status				
Single	23 (33.3)	18 (40.9)	19 (40.4)	P=0. 82
Married	38 (55.1)	22 (50)	25 (53.2)	
Divorced	8 (11.6)	4 (9.1)	3 (6.4)	
Jeddah				
North	36 (52.2)	21 (47.4)	17 (36.2)	P=0. 019
South	12 (17.4)	16(36.4)	19 (40.4)	
East	8 (11.6)	1 (2.3)	7 (14.9)	
Middle	13 (18.8)	6 (13.6)	4 (8.5)	

Employees who worked in the makeup section and spent more than 10 hours a day tended to have significantly more respiratory symptoms. However, most employees in the manicure section reported fewer symptoms than those in the makeup section, P-value 0.019. There were no other significant variations in symptoms regarding workplace environment such as room numbers, room size, or type of ventilation, see table 4.

Exposure to chemicals in the workplace, history of respiratory disease, and smoking are all found to be significant predictors

Table 4 : Nature of Work and Working Environment with Respiratory Symptoms

Data	No symptoms N=69	One symptom N=44	> One symptom N=47	Test of significance
Multiple jobs at saloon	15 (21.7)	15 (34.1)	11 (23.4)	P = 0.31
Hairdresser	33 (47.8)	25 (56.8)	24 (51.1)	P = 0.64
Makeup artist	9 (13)	14 (31.8)	15 (31.9)	P = 0.011
Manicure	12 (13)	1 (2.3)	3 (6.4)	P = 0.019
Working hours				
< 10	51 (73.9)	28 (63.9)	19 (40.4)	P = 0.001
> 10	18 (26.1)	16 (36.4)	28 (59.6)	
Working days				
5 or 6	51 (73.9)	34 (77.3)	38 (80.9)	P = 0.68
7 days	18 (26.1)	10 (22.7)	9 (19.6)	
Number of rooms				
≥ 5	51 (73.9)	34 (77.3)	38 (80.9)	P = 0.68
< 5	18 (26.1)	10 (22.7)	9 (19.6)	
Size of room				
> 30	56 (81.2)	35 (79.5)	37 (78.7)	P = 0.68
< 30	13 (18.8)	9 (20.5)	10 (21.3)	
Type of ventilation				
Central air condition	31 (44.9)	17 (38.6)	30 (63.8)	P = 0.129
Window	27(39.1)	18 (40.9)	10 (21.3)	
Fans	0 (0)	0 (0)	1 (2.1)	
Others	11 (15.9)	9 (20.5)	6 (12.8)	

for respiratory symptoms (P<0.001). Furthermore, a family history of lung disease significantly increases the risk for respiratory symptoms (P=0.015), see table 5.

Table 5: High-Risk Factors Associated with Respiratory Symptoms

Data	No symptoms N=69	One symptom N=44	More than one N=47	Test of significance
Personal History of Respiratory disease	3 (4.3)	5 (11.4)	20 (42.6)	P <0.001
Family history of respiratory disease	2 (2.9)	6 (13.6)	9 (19.1)	P = 0.015
Exposure to chemicals	30 (43.5)	7 (15.9)	10 (19.6)	P <0.001
	28 (40.6)	14 (31.8)	23 (45.1)	
	11 (15.9)	23 (52.3)	18 (35.3)	
Smoking	8 (11.6)	7 (15.9)	21 (44.7)	P <0.001

Regarding PFTs, the mean FVC was 85.5% for symptomatic employees, which is lower than the mean FVC among asymptomatic employees (90%) but was not statistically significant (P=0.09). There were no significant differences in FEV1 levels or the FEV1/FVC ratio between the symptomatic and asymptomatic employee, see table 6.

Table 6: Pulmonary Function Test according to Respiratory Symptoms

Spirometric variable	No symptoms N=69 SD ± Mean	Symptoms N=91 SD ± Mean	Test of significance
FEV_1 level	6.15 ± 93.25	11.01 ± 93.5	P = 0.87
FVC level	14.17 ± 90	17.86 ± 85.51	P = 0.09
FEV_1/FVC ratio	13.51 ± 84.3	13.86 ± 81.17	P = 0.168

The most important predictors of respiratory symptoms were having respiratory disease (OR 6.51), working as a makeup artist (OR 4.32), smoking (OR 3.61), and exposure to chemicals at the workplace (OR 2.17). The overall predictability was 70%. Non-significant predictors were the region of Jeddah, working in dye, working at the manicure area, working years, and family medical history, see table 7.

Table 7: Logistic Regression for Significant Predictors of Respiratory Symptoms

Significant predictors	B coefficient	Odds ratio	Significance
Working in Makeup	1.46	4.32	0.002
Personal history of Respiratory disease	1.87	6.51	0.005
Exposure to chemicals	0.914	2.17	0.009
Smoking	1.286	3.61	0.011

DISCUSSION

The study revealed that more than half of the participants (57%) suffered from respiratory symptoms ranging from one to four. Furthermore, we found that the most significant predictors of respiratory symptoms were a history of respiratory disease, working as a makeup artist, smoking, and exposure to chemicals. However, we did not find any significant impairment in the employees' pulmonary function test (PFT).

The prevalence of respiratory symptoms in this study was similar to studies published in Palestine[10]. However, less salon-related symptoms were reported in Turkey, and more symptoms were reported in Norway[12,13]. The differences are likely related to be the study tools, working environments, and degree of exposures to irritant at the workplace. Clearly, all employees demonstrate a high risk of developing respiratory diseases; therefore, prevention such as wearing protective devices like masks and gloves at work will minimize exposure risks.

A previous history of lung disease increased the risk of respiratory complaints among employees; this finding was seen in other studies[12,13]. Persistent exposure to chemicals could clearly trigger more symptoms, especially in patients with atopic history[12,13]. It might be conceivable to screen employees before enrolling them in such high risk-working environments.

Working as a makeup artist was found to be a significant predictor for respiratory symptoms. This finding was likely due to heavy exposure to bleaching chemicals and sprays used to fix makeup and the close contact between employees and customers; this finding was similar to another study[14].

The longer the exposure to chemical agents at the workplace, the more likely that the employees would become symptomatic; consequently, we found that spending more than 10 hours at the salon was a significant predictor for respiratory symptoms. Therefore, there may be a dose-response relationship between the duration and intensity of chemical exposure and the development of respiratory symptoms. Employees who spend more than 10 hours per day working at the salon are more likely to develop respiratory symptoms. A positive dose-response relationship was confirmed in another study[12]. However, in this study, years of working duration did not predict respiratory complaints in contrast to other studies[15,16]. This could be due to employees' reporting bias or healthier employees remain longer in these jobs.

The noxious effects of smoking on the respiratory system are well-known. It has been suggested that at high-risk occupations, smokers are susceptible to IgE-mediated sensitization to high-molecular-weight agents, while non-smokers have a higher risk of asthma due to low-molecular weight agents[17]. As expected, in this study, smokers significantly reported more respiratory symptoms. The smoking effect is likely potentiated by chemical exposure at the workplace; apparently smoking in hairdresser salons is still occasionally practiced despite the prohibition of smoking in closed spaces in Saudi Arabia[18].

The slight reduction in lung functions among symptomatic employees was not significant compared to other studies[19]. In addition, previous long-term longitudinal studies have confirmed the reduction of pulmonary function to be most likely due to persistent exposure and airway inflammation caused by chemicals[15,20]. This was not seen in our study because of the cross-sectional study design, which may not detect abnormalities.

This study has a few limitations. First, the lack of a control group which did not allow us to compare the prevalence of respiratory symptoms with that in the general population. Second, recollection and reporting bias are inherited issues with survey studies. Third, the number of participants was relatively small. However, we have employees from different regions in Jeddah, and our study sample is comparable to similar studies.

CONCLUSION

The study revealed a high prevalence of respiratory symptoms among salon employees. Furthermore, a previous history of respiratory disease, smoking, working as a makeup artist, and direct exposure to chemicals were the most important predictors of symptoms. In order to minimize the risk of respiratory symptoms, strict policies regarding protective devices, possible pre-employment screening, especially for smoking individuals should be adopted. Future studies addressing the magnitude of lung function decline in this population are recommended. In addition, studies addressing the compliance with protective devices to minimize respiratory complaints are recommended.

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and design, acquisition, analysis and interpretation of data; (2) drafting the article and revising it critically for important intellectual content; and (3) final approval of the manuscript version should be published. Yes.

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