The effects of occupational chemical exposure to respiratory health among hairdresser in Pakistan

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ABSTRACT

The Working environment of hair saloons is a continuous threat to the respiratory health of hairdressers. Therefore, we assessed the status of the respiratory symptoms and pulmonary functions of hairdressers in the present study. Subjects comprised 90 female hairdressers and 90 matched controls. Symptoms were recorded through an adapted questionnaire. Anthropometric data such as age and BMI was noted. Pulmonary function tests were performed through a portable spirometer device. Work-related risk factors such as exposure duration, work intensity, work area size, and ventilation were recorded in hair saloons. Mann-Whitney test and Spearman correlation were run to find any association between pulmonary functions and work-related risk factors. The criterion for statistical significance was a two-tailed P value of ≤ 0.05. Among hairdressers, shortness of breath was 32%, pharynx irritation 31%, rhinal irritation 29%, cough 28%, ocular irritation 21%, wheezing 12%, and phlegm production 9% were higher than compared to the control group. FEV1% (p =.000) and FVC% (p =.000) were reduced in hairdressers compared to controls. Work duration and work intensity declined the pulmonary functions, while ventilation showed a positive correlation. Precautionary measures adopted by hairdressers were insufficient. Implementations of safety methods, including appropriate ventilation system, are recommended.

Key words: Pulmonary function tests, hairdressers, spirometry, lung, risk factors, respiratory health

INTRODUCTION

Exposure to chemicals in saloons is responsible for decline in pulmonary functions. Chemical hazards in hairdressing environment carry the risk of decreased pulmonary functions. Among hairdressers it may reduce pulmonary functions such as FEV1, FVC and FEV1/FVC (Gupta, Thapa, Gupta, & Sharma, 2022). Repeated chemical exposure brings symptoms (Ameille et al., 2003; Malo & Chan-Yeung, 2001). These respiratory symptoms are common among hairdressers at work (Hiller, Greiner, & Drexler, 2022). Hairdressers are exposed to the work-related air pollutants which are responsible for the airway disorders like occupational asthma, bronchitis, rhinitis, cough, and phlegm (Brisman et al., 2003; Larstad & Olin 2018; Moscato & Galdi, 2006; Nemer, Kristensen, Nijem, Bjertness, & Skogstad, 2013; Nemer et al., 2015; Onowhakpor, Aigbovorhiuwa, & Okojie, 2018; Quiros-Alcala, Pollack, Tchangalova, DeSantiago, & Kavi, 2019; Skoufi et al., 2013).

Different activities like hair spray, hair straightening, hair dye, bleaching etc. release irritants and sensitizing chemicals such as ammonium compounds, hydrogen peroxide, alcohol, formaldehyde, Polyvinylpyrrolidone, p-benzenediamine, toluene, ether, and henna etc. (Akpinar-Elci, Cimrin, & Elci, 2002; Hasan & Srivastava, 2019; Mendes et al., 2011; Nilsson et al., 2016; Tsigonia et al., 2010). These chemicals impair the lungs and provoke respiratory symptoms (Hasan & Srivastava, 2019).

In Pakistan, there are many unregistered saloons even working in small houses and flats. Therefore, no official data related to their strength is available. However, according to rough estimates, about 27% of saloons (second largest figure) are established in Lahore city only (State Bank of Pakistan [SBP], 2019). Therefore, the study's primary objective was to evaluate the female hairdressers' self-reported respiratory symptoms and pulmonary functional status and compare it with the matched control population, which was unexposed to the working conditions of hairdressing. The secondary objective was to assess the impact of work-related risk factors on the pulmonary functions of the hairdressers. In the present study, alternative hypothesis was predicted that there will be an effect of occupational chemical exposure to respiratory health among hairdresser.

MATERIAL AND METHODS

A case-control study was designed in the city of Lahore with 90 female hairdressers and 90 matched controls. Collection of workers data was discontinued after attaining saturation (Guest, Namey, & Chen, 2020). Subjects with a previous diagnosis of asthma or other chronic respiratory conditions, smokers, and job duration less than three years were excluded from the study. The participants of the control group were office going having no exposure to the hairdressing environment. Controls were matched with the hairdressers in age, gender, ethnicity and BMI. Written consent of participation was taken from all subjects.

In the present study, dependent variables included were all self-reported respiratory symptoms and pulmonary function tests. However, independent variables included were all work-related risk factors, age and BMI as well.

A questionnaire was adopted from Skoufi et al. (2013) to collect data of self-reported respiratory symptoms and allergies such as cough, phlegm, shortness of breath, wheezing, ocular irritation, rhinal irritation, and pharynx irritation. It is relatively a simple way to collect data from many people quickly and at low cost. In addition, anthropometric characteristics such as age in years (yrs) and BMI (kg/m^2) were also recorded on the same questionnaire.

The pulmonary functional status of all the participants was assessed through a portable spirometer device (Spirotron MDX, USA). Maximum volume and flow range of the device is 10L and 1-16L/s, respectively. However, volume accuracy is ±3% or 0.05L (whichever is greater) and flow accuracy is ±10% or 0.3L (whichever is greater). Three readings of pulmonary function tests (PFTs) were taken as per the British Thoracic Society guidelines (British Thoracic Society [BTS], 2005) and considered the highest value. Spirometry was performed in a sitting position with a nose clip to avoid any leakage. PFTs included forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and the ratio of FEV1/FVC. Results were appeared in the device as flow rate- volume chart, volume time chart display and trend chart display. While all results were interpreted as per British Thoracic Society guidelines (British Thoracic Society [BTS], 2005). All values were taken in percentages.

Physical work-related risk factors such as exposure duration, work intensity, work area size (m^2), and ventilation were also examined at the workplaces. Exposure duration was calculated according to Hashemi, Boskabady, and Nazari (2010) and categorized into low exposure (<= 12889 days) and high exposure (>12889 days). Similarly, work intensity was calculated based on the numbers of applications of hair dyes, bleaching and hair straightening per week (Skoufi et al., 2013). It was also categorized into low work intensity (≤ 32 times per weeks) and high work intensity (>32 times per weeks) groups. Finally, work area size was calculated based on the working area per person in m^2. Moreover, the presence of ventilation was also noted in all studied sites. The study was approved by ethical board of Punjab University, Lahore, Pakistan (Serial# 1880).

All statistical analysis was performed through SPSS (version 25). Normality distribution test was run for continuous variables before running statistical tests. Anthropometric characteristics and pulmonary functions were reported in mean ± SD, and differences of mean values between hairdressers and controls assessed through the Mann-Whitney test. This non-parametric test was performed since data was not normally distributed. Spearman correlation test was run to find any association between pulmonary functions and work-related risk factors. The criterion for statistical significance was a two-tailed P value of ≤ 0.05.

RESULTS

There were ninety female hairdressers and ninety female office workers as a control group in the present study. There were no significant differences in age and BMI (Table 1). The prevalence of respiratory symptoms and allergies was: cough 28%, phlegm production 9%, shortness of breath 32%, wheezing 12%, ocular irritation 21%, rhinal irritation 29% and pharynx irritation 31%, which were higher among hairdressers (after work) as compared to hairdressers (before work) and controls (Figure 1). Among hairdressers, 20% used mask only, 39% gloves and 19% both mask and gloves.

Pulmonary functions such as FEV1 (P =.000) and FVC (P =.000) were significant lowered among hairdressers than controls. However, FEV1/FVC (P =.051) did not show any mean differences between hairdressers and controls (Table 2).

Work-related risk factors of respiratory illnesses in Hairdressers were analyzed (Table 3). A Spearman's correlation test was conducted to investigate the association between pulmonary functions and work-related risk factors (Table 4). It was found that there was a correlation between FEV1, FVC, work intensity, exposure duration, and work area size with statistical significance (P =.000). Ventilation was associated with pulmonary function performance. The presence of ventilation in hair saloons improves the spirometry measurements in hairdressers compared to others without ventilation (Table 5).

DISCUSSION

In the present study, the impact of the hairdresser's occupation on the respiratory health of the workers was assessed. The complaints of respiratory symptoms were higher in hairdressers as compared to the controls. Hairdressers reported symptoms to stop when away from work. Few workers had left the job because of respiratory problems. The findings are consistent with Hashemi, Boskabady, and Nazari (2010). They assessed the impact of the working environment of hair saloons on the lung function performances of the hairdressers in the city of Mashhad, Iran. They concluded hairdressers had higher complaints just after the work exposure as compared to the controls. Other researchers also reported similar findings in hairdressers (Heibati et al., 2021; Nemer et al., 2015; Piapan, Baldo, & Filon, 2019). Macan et al. (2022) concluded after reviewing forty-two articles, there was 20 times higher risk of wheezing and breathlessness among hairdressers than control group.

Hairdressers showed lower spirometric values in the working environment as compared to the controls. FEV1 and FVC were significantly lowered in hairdressers except for FEV1/FVC when compared to the controls. These results may be because of the occupational exposures which lead to decline in pulmonary functions in hairdressers. Similar findings were reported among hairdressers by different researchers (Hasan & Srivastava, 2019; Muniyappanavar & Banner, 2017; Nemer, Kristensen, Nijem, Bjertness, & Skogstad, 2013) and noted that pulmonary functions were declined in hairdressers as compared to controls even after adjusting the confounding factors.

Declined pulmonary functions of hairdressers were associated with the work-related risk factors. Work intensity and exposure duration showed negative correlations with FEV1 and FVC. Akpinar-Elci, Cimrin, and Elci (2002) reported that asthma increases with work intensity. Asthmatics have lower lung functions than non-asthmatics (Dijkstra et al., 2006). Heibati et al. (2021) declared that the risk of reduced lung function was less with the exposure of fewer than six years, but after that, it increased. Similarly, Nemer et al. (2015) declared that, in hairdressers, after four years of exposure, FEV1 decline strongly as compared to less than four years. The work area size and natural ventilation improve the spirometric measurements in hairdressers. Our findings agree with Skoufi et al. (2013), who reported that lung functions improve with the ventilation and size of the work area.

CONCLUSION

It is concluded that hairdressers show higher respiratory symptoms but lower spirometric values than controls, which do not have a saloon working environment. So alternative hypothesis was accepted. Different risk factors in this working environment including work intensity, exposure level, work area size, and ventilation may also contribute to declining the pulmonary functions of the hairdressers. Proper ventilation, low exposure level, reduced work intensity and work duration are recommended to reduce hazards at work.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Figure

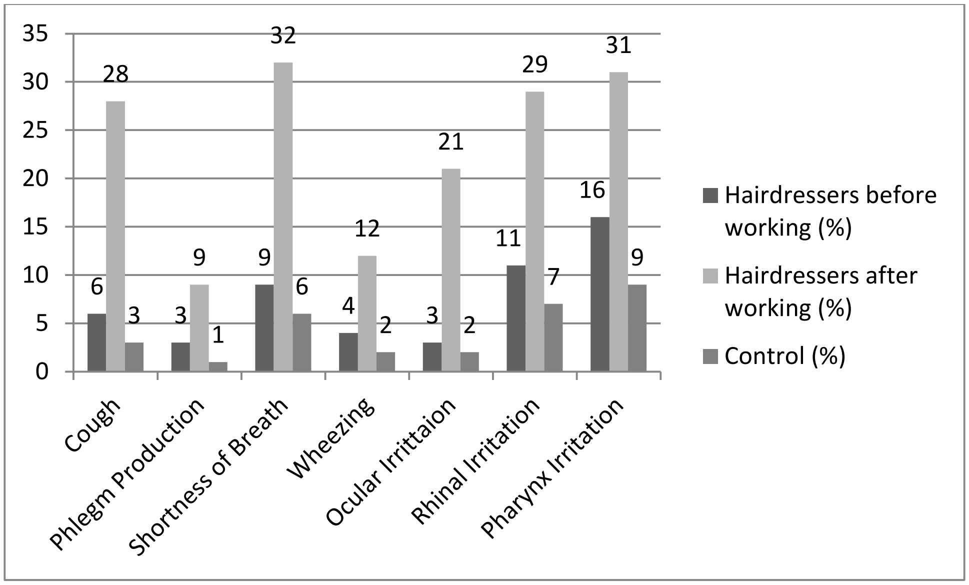

Figure 1: Percentage comparison of Respiratory Symptoms and Allergies between Hairdressers and Controls

Table

Table 1: ***Anthropometric data of hairdressers and controls****		
	Hairdressers	Controls
Subjects (All females, n)	90	90
Age (mean ± SD, yr)	36.44± 8	36.02± 7
BMI (mean ± SD, kg/m^2)	23.4± 2.33	23.8± 2.10
*Matched demographic data of hairdressers and controls		

Table 2: ***Tests of Normality***						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
BMI (kg/m^2)	.120	90	.003	.940	90	.000
FEV1	.100	140	.002	.967	140	.002
FVC	.160	140	.000	.923	140	.000
FEV1/FVC	.119	140	.000	.967	140	.016
a. Lilliefors Significance Correction						

Table 3: ***Mean difference of pulmonary function between hairdressers and control group***

	Mean ± SD of percentage predicted		*P**
	Hairdressers	Controls	
FEV1	82 ± 8	87 ± 6	.000
FVC	91 ± 8	96 ± 7	.000
FEV1/FVC	90 ± 4	92 ± 3	.051

* Determined through Mann-Whitney test, p-value is statistically significant = ≤ 0.05.

Table 4: ***Work-related risk factors of Respiratory illnesses in Hairdressers***

Work Intensity	n	%
Low Intensity	47	52
High Intensity	43	48
Exposure Level		
Low Exposure	55	61
High Exposure	35	39
Work Area Size (m^2)		
≤ 23	40	44
> 23	50	56
Ventilation		
Yes	55	61
No	35	39

Table 5: ***Correlation between work-related risk factors and Lung functions in Hairdressers***

	Work Intensity		Exposure Level		Work Area Size	
Variables	*ρ*	*p*-value	*ρ*	*p*-value	*ρ*	*p*-value
FEV1% pred	-.749**	.000	-.793**	.000	.467**	.000
FVC% pred	-.743**	.000	-.841**	.000	.512**	.000

**P= ≤0.05

Spearman rank correlation coefficient (*ρ)*

Table 6: **Comparison of lung function values of hairdressers working with and without ventilation**

Variables	Ventilation	Without ventilation	*P* value
FEV1 %	87.07± 5.02	74.17± 4.14	.000
FVC %	95.73± 5.74	83.23± 3.29	.000