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## RESEARCH ARTICLE

### The Prevalence of Hand Eczema and Its Determinants Among Female Hairdressers: A Cross-Sectional Survey

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#### Abstract:

#### Introduction:

Female hairdressers are exposed to various chemicals in their occupation which may lead to skin problems such as hand eczema. This study aimed to determine the one-year prevalence of hand eczema and its risk factors in a sample of Northwest Iranian female hairdressers in 2015.

#### Methods:

This study was a cross-sectional investigation in which 385 female hairdressers and 385 women from general population were selected as case and control, respectively. The prevalence of one-year hand eczema was obtained by Nordic occupationl skin questionnaireusing face-to-face interview. Data were analyzed using descriptive and inferential statistics (chi-square, independent t-test and logistic regression in SPSS software version 19).

#### Results:

The mean and standard deviation of age and work experience of hairdressers were  $33.16 \pm 7.2$  and  $8.72 \pm 5.7$  years, respectively. The prevalence of one-year hand eczema in hairdressers and control group were 27.8% (95%CI=23.22 -32.22) and 13.2% (95%CI=9.02-15.58), respectively. The Odds Ratio (OR) for hand eczema in the hairdressers was 2.52 (95%CI=1.72-3.64), compared to the control group as the reference. Using logistic regression analysis smoking habit [OR=3.44 (95%CI=1.73-6.85)],age less than 30 years [OR=1.76 (95%CI=1.04-2.96)] and working experience less than10 years [OR=3.14 (95%CI=1.63-6.04)]were independent risk factors for reporting one-year prevalence of hand eczema

#### Conclusion:

Female hairdressers were more likely to be at risk of developing hand eczema compared to general population. Smoking habit, younger age, and less work experience were the significant risk factors of hand eczema in hairdressers. Occupational health interventions should consider these factors in the control of hand eczema in hairdressers.

**Keywords:** Female hairdressers, Hand eczema, Skin problems, Nordic occupationl skin questionnaire, Occupational health interventions, Descriptive and inferential statistics.

## 1. INTRODUCTION

The hairdressing industry has grown dramatically in recent years, as there are 70,000 salons in France with around

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160,000 hairdressers [1]. In Sweden, there are about 19,000 hairdressers, of whom approximately 80-90% are women and work in small salons [2]. Hairdressers are exposed to various chemicals, physical, mental stress and to musculoskeletal injuries [1]. Hairdressers work daily with different chemical products including shampoos, hair dyes, hair sprays, straighteners, and bleaches. These products could contain hazardous chemicals. For example, hair dyes contain *p*-phenylenediamine (PPD) and toluene-2, 5-diamine or bleaching products contain persulfates [1, 3]. In addition to chemicals, wet work is one of the main risk factors for developing hand dermatitis in the hairdressers. In other words, frequent washing of hands causes swelling and shrinking of the stratum corneum and can lead to hand eczema [4]. Smoking, more than ten cigarettes per day, is also one of the risk factors for hand eczema in hairdressers [5].

The chemical exposures of hairdressers could result in occupational skin and respiratory diseases such as hand eczema, contact urticaria, asthma, and rhinitis [6]. Previous studies showed that hairdressers are at the highest risk of occupational dermatitis, and it is estimated that 10-20% of hairdressers are affected by skin diseases [7]. Studies have shown that occupational contact dermatitis and hand eczema have a noticeable impact on the individuals' quality of life and may have permanent negative medical, occupational, social and economic consequences [8]. The hand eczema among the hairdressers could lead to change in job, which could not necessarily result in the treatment of hand eczema [8, 9].

Contact dermatitis has the first rank of occupational diseases in most countries. It is believed that the average annual incidence rate is about 0.5 to 1.9 cases per 1000 full-time workers [10]. The incidence of skin diseases has been reported in different occupations. For example, in the North Bavaria (Germany), the annual incidence of occupational skin diseases in mechanics and hairdressers was 3.4 and 24 cases per 1000 workers. In Denmark, the annual incidence for these occupations has been reported 6.6 and 11 cases per 1,000 workers, respectively [11].

In some countries, skin diseases such as hand eczema has been studied in female hairdressers. In the study of Hansen and Søsted, the prevalence of one-year hand eczema in female hairdressers of Copenhagen was 21.7% [12]. Lysdal *et al.* obtained a one-year prevalence of hand eczema by 20.7% in 5239 trained hairdressers in Denmark [13]. In a cross-sectional study in the UK, the prevalence of hand eczema in female hairdressers was 38.6% [14]. In Germany, the odds of developing hand eczema were 4 times higher for female hairdressers compared with the control group (office staff) [15]. Warshaw *et al.* examined existing data regarding Patch tests of 35,842 patients between 1994 and 2010 in North America. Out of 35,842 patients, 432 (1.2%) of them were hairdressers, and majority of them were female hairdressers with the age less than 40 years. They also reported the rate of allergic and contact dermatitis 72.7% and 37% among female hairdressers, respectively [16].

There are limited number of studies reporting the prevalence of hand eczema in Iranian female hairdressers. Therefore, the aim of this study was to estimate the prevalence of one-year hand eczema in a sample of female hairdressers and general population (as a control group) in Urmia city, Northwest Iran by self-report method. Self-reporting of hand eczema is often used in the epidemiologic studies and is an economical method for estimating the prevalence of hand eczema [17].

## 2. METHODS

The present research, a cross-sectional case-control study, was performed in a sample of female hairdressers working in Urmia, Northwest Iran. Inclusion criteria were as follows: 1. Willing to participate in the study, 2. At least one year of work experience, 3. Being resident of Urmia, 4. Being able to read and write, 5. Being mentally healthy. Due to the lack of similar studies in Iran, assuming the Prevalence (P) of 50% for hand eczema, 95% confidence level and error (d) of 5%, the sample size was calculated using the formula for estimating the ratio, and the total sample size for this study became 385 hairdressers. According to the information obtained from the Urmia Health Center, the number of female hairdressing salons in this city was about 650 with an approximate number of 1,300 hairdressers. To select the study samples, Urmia city was divided into three districts based on people social class. One hundred and ninety women's hairdressing salons (as cluster) were selected from districts using cluster random sampling. Then 385 subjects from clusters were recruited and entered to the study as the case group. Against the case group, 385 housewives from general population were selected as control group (one control against one case) from the same regions. The study groups were matched in terms of some demographic variables using the group matching approach during the sampling process.

The study data were collected using Nordic Occupational Skin Questionnaire (NOSQ, 2002). The NOSQ was developed by a group of researchers working in Nordic countries using their work experiences and available

questionnaires [8]. The psychometric properties of this questionnaire were assessed and confirmed in Iranian population in 2005 [18]. This instrument included demographic characteristics and other items for assessing hand eczema and factors influencing it. In the current study, some questions of this questionnaire have been used to assess the prevalence of hand eczema in the participants [13, 19 - 21]. For instance, the following items regarding hand eczema during the last one year were asked to identify eczema in the study samples: "Have you had hand eczema during the last one year?", "Have you had eczema on your forearms during the last one year?", and so on. The exposure to wet work was asked as the frequency of hand washing during the work and at home/outside work. A photographic guide, validated by Coenraads et al., was also used to better understand the eczema of the hand by the hairdressers [22]. To collect data from the study participants, two trained female health professionals completed the questionnaire by interview.

This study was approved by the ethic committee of Urmia University of Medical Sciences and all of the ethical requirements of this committee were met by the research team. Data were analyzed by SPSS software version 19 (SPSS, Chicago, IL, USA). Descriptive statistics methods such as mean and standard deviation and inferential statistics tests such as chi-square and logistic regression were used. Odds Ratios (ORs) and their 95% Confidence Intervals (95% CI) were calculated in both univariate and logistic regression analysis for the risk factors of hand eczema.  $P < 0.05$  was considered significant in all analyses.

### 3. RESULTS

This study was carried out in 385 female hairdressers (as case group) employed in the hairdressing salons of Urmia, Northwest Iran in 2015. Against the case group, 385 housewives were selected as controls from the general population of Urmia. Table 1 presents the demographic characteristics of the group of hairdressers and controls. According to Table 1, there was no statistically significant difference between two groups in terms of age, education, and smoking ( $P > 0.05$ ), and the groups were fully matched.

**Table 1. Demographic characteristics of hairdressers (case) and control groups.**

Variables	The Study Groups		p-value
	Case	Control	
	Mean±SD/N(%)	Mean±SD/N(%)	
Age (years)	33.16 ± 7.2	32.52 ± 7.5	0.08*
Education Level			
Lower than Diploma	239(62.1%)	230(59.8%)	0.50**
Higher than Diploma	146(37.9%)	155(40.2%)	
Smoking			
Yes	45(11.7%)	43(11.2%)	0.82**
No	340(88.3%)	342(88.8%)	
Work Experience	8.72 ± 5.7	-	-

\*Independent t-test, \*\* Chi-square test

As indicated in Table 2, the prevalence of hand eczema in hairdressers and the control group was 27.8% and 13.2%, respectively. Based on Chi-squared test, the prevalence of hand eczema in two groups was statistically different ( $P = 0.001$ ). The Odds Ratio (OR) for hand eczema in hairdressers was 2.52 (95%CI=1.72 - 3.64).

**Table 2. The prevalence of hand eczema in hairdressers and control group**

Groups	Hand Eczema		Results of Chi-Square Test
	Yes	No	
	N(%)	N(%)	
Hairdressers	107(27.8)	278(72.2)	$P=0.001$ OR=2.52(95%CI=1.72-3.64)
Control	51(13.2)	334(86.8)	

Table 3 shows the results of univariate analysis of demographic characteristics and occupational factors in the hairdressers with and without hand eczema. The results revealed that hairdressers under age 30 years [OR=2.4(95%CI=1.52-3.79)], with work experience less than 10 years [OR=3.27(95%CI=2.08-6.67)], and with smoking habit [OR=2.58(95%CI=1.37-4.85)] were likely to report hand eczema.). No significant association was found between reported hand eczema and frequency of hand washing [OR = 0.98(95%CI=0.58-1.68)] and education level [OR = 1.36(95%CI=0.85-2.18)] in hairdressers.

**Table 3.** Univariate analysis of demographic characteristics and occupational factors with hand eczema among hairdressers

Variables	Hand Eczema		Odds Ratio (Confidence Interval of 95%)	p-value of Chi-Square Test
	Yes N(%)	No N(%)		
Age(year)				
≤30	55(39.3)	85(60.7)	2.4(1.52-3.79)	0.001
>30	52(13.2)	193(78.8)	1	
Work Experience(year)				
≤10	91(35.1)	168(64.9)	3.27(2.08-6.67)	0.001
>10	16(12.37)	110(87.3)	1	
Smoking				
Yes	21(46.7)	24(53.3)	2.58(1.37-4.85)	0.003
No	86(25.3)	254(74.7)	1	
Education Level				
Lower than Diploma	72(30.1)	167(69.9)	1.36(0.85-2.18)	0.11
Higher than Diploma	35(24)	11(76)	1	
Hand Washing				
≤10 times in day	24(27.6)	63(72.4)	1	0.96
>10 times in day	83(27.9)	215(72.1)	0.98(0.58-1.68)	

Table 4 shows the results of logistic regression analysis for risk factors for hand eczema in hairdressers. According to Table 4, there was a statistically significant association between report of hand eczema and smoking habit [OR=3.44(95%CI=1.73-6.85)], work experience less than 10 years [OR=3.14(95%CI=1.36-6.04)], and age under 30 years [OR=1.76(95%CI=1.04-2.96)]. More frequent hand washing did not significantly change the report of hand eczema in hairdressers.

**Table 4.** Risk factors associated with hand eczema based on logistic regression analysis (n=385).

Risk factors	Odds Ratio(Confidence Interval of 95%)	p-value of Chi-Square Test
Age(year)		
≤30	1.76(1.04-2.96)	0.03
>30	1	
Work experience(year)		
≤10	3.14(1.36-6.04)	0.001
>10	1	
Smoking		
Yes	3.44(1.73-6.85)	0.001
No	1	

#### 4. DISCUSSION

Hairdressers could be exposed to harmful chemicals found in dyes, bleaches, shampoos and hair conditioners leading to skin problems such as hand eczema. The objectives of this study was to determine the one-year prevalence of hand eczema and its determinants among 385 female hairdressers and equal number of the control group using a self-reporting questionnaire, in Urmia, Northwest Iran. Cases and controls were matched in terms of age, education level, and smoking habit.

On the basis of the study results, the prevalence of hand eczema in hairdressers was 27.8% which was higher than the control group (13.2%). The risk of hand eczema in hairdressers was 2.5-fold compared with that in the controls from general population of the city. The prevalence of hand eczema in the general population of this study was roughly in agreement with the previous studies. For example, in the general population of Northern Europe, the annual prevalence of hand eczema was reported to be 6-11% [5]. The prevalence of one-year hand eczema among young people from general population of Denmark and Sweden has been reported 9-10% [23].

The prevalence of one-year hand eczema in female hairdressers of this study was similar to the findings reported in the previous studies. For example, the one-year prevalence of hand eczema in Copenhagen hairdressers was 21.7% which was underreported to occupational registers [12]. One-year prevalence of 20.7% and 38.6% were, respectively, reported for Denmark [13] and UK [14] female hairdressers. Similar reports are also available for other occupational groups. In motor mechanics [24] and hospital's medical staff [25], the one-year prevalence of hand eczema was 18.4% and 23% respectively. Therefore, according to the results of this study, it seems that female hairdressers could be at risk of hand eczema in comparison with other occupational groups.

Based on the univariate analysis and multiple logistic regression, it was revealed that the age (less than 30 years of age), working experience (less than 10 years), and smoking habit of female hairdressers had significant effects in report of hand eczema. In other words, younger hairdressers who smoke cigarette could be at higher risk of hand eczema than older and more experienced hairdressers who do not smoke cigarette. In line with our findings, other studies have also shown that younger hairdressers were at the higher risk of hand eczema. For instance, younger hairdressers had an odds of 2.95 times higher than older ones in the UK [14]. In Copenhagen, the prevalence of hand eczema had higher rate in the youngest age-group hairdressers, possibly due to the more intense exposures and the healthy worker effect [12]. In the Korean hairdressers, the prevalence of dermatologic symptoms in the subjects <30 years age group (28.1%) was higher than 30-40 (20.1%) and ≥ 40 (12.9%) years age groups [26]. In examining the positive patches of patients with hairdressing jobs, people aged under 40 were composed the 55.6% of the subjects [3]. The intense exposure of younger workers to skin damaging factors has also reported in other working populations. For example, in a study in Iran, it is revealed that the prevalence of hand eczema in younger nursing and midwifery personnel was higher than older personnel [25]. The odds ratio for hand eczema in vehicle technicians (less than 30 years of age), was 3.87 compared to subjects over the age of 30 years [24]. Therefore, it could be concluded that younger hairdressers are prone to expose to risk factors of hand eczema. This could be due to their limited knowledge about risk factors and the use of protective equipment during work. In a survey on trainee hairdressers, it is found that glove use was infrequent and inadequate, particularly during shampooing [27]. The knowledge of skin hazards and the role of wet work was found to be poor among trainee hairdressers [28]. In the present study, the work experience less than 10 years was recognized as a significant factor in the report of eczema in female hairdressers. Thus it could be concluded that hairdressers with lower work experience may have high contact with work conditions or chemicals causing hand eczema when they perform hairdressing tasks. On the other hand, it can be attributed to the leave of the trade by skilled hairdressers with a history of dermatitis or other occupational health problems. It is worth noting that higher prevalence of hand eczema in younger and less experienced hairdressers could be due to the Healthy Worker Effect (HWE). In other words, older hairdressers might change their jobs due to health problems such as skin, respiratory or musculoskeletal disorders. Therefore, hand eczema could be a reason for changing of job in older hairdressers. HWE has been reported in previous studies in hairdressers [12, 19].

According to the results of this study, smoking was found as a risk factor in both univariate ( $OR=2.85$ ) and multivariate ( $OR=3.44$ ) analyses. In some previous studies on general population a positive association has been reported between smoking and hand eczema [29]. In hairdressers, the prevalence of hand eczema in smokers was slightly higher than non-smoker [2]. In contrast, in some studies, cigarette smoking has not considered as a risk factor for hand eczema in general population and hairdressers [20, 30]. In other words, the role of cigarette smoking in the development of skin eczema is still matter of debate.

Based on univariate analysis, education and hand washing were not recognized as a risk factor for hand eczema in hairdressers. In other words, there was no significant difference in the risk of hand eczema in the hairdressers with and without university education, and also with hand washing less than 20 times or more than 20 times a day. Kralj *et al.* found that on average in a 8-hour work shift, hairdressers performed 2 hours and 17 minutes of wet work [31]. According to Uter *et al.*, wet work can be considered as a major risk factor for hand eczema, when it lasts more than 2 hours a day [15]. The reason for the difference in the effect of moisture in this study and previous studies could be attributed to the type of moisture data. In the present study, the duration of hand washing was not included in the data collected and only the frequency of hand washing was recorded that can not provide accurate information on hours of exposure to moisture. Therefore, in order to further investigation about the role of moisture in the development of hand eczema, a more detailed study is needed in which hand washing duration (hours) could be determined by the observation method.

This study had some limitations. First, the results of this study can be generalized only to similar samples and not beyond. Second, a cross-sectional design is not a strong method for understanding cause and effect relationships between variables. It is necessary to assess and identify these associations by applying stronger epidemiological methods. Third, the data of this study were collected using a self-report questionnaire. Participants may have underestimated or overestimated risk factors related to hand eczema, which may have affected the study findings.

## CONCLUSION

The results highlighted that female hairdressers had a higher chance of developing hand eczema compared to general women population. This high risk group should receive adequate occupational protection measures to reduce

and control this skin problem. Among the studied risk factors, smoking was the most important predictors of hand eczema among female hairdressers and should be considered as an important factor in health interventions. According to the results, in hairdressers less than 10 years of work experience and under the age of 30 years, care should be taken to avoid getting hand eczema. Fortunately, in the Iranian Ministry of Health and Medical Education, the Environmental and Occupational Health Center has published a guideline entitled “Occupational Health Guidelines for female Hairdressers” containing occupational hygiene practices related to hairdressing. The occupational health recommendations of this guideline could be helpful in reduction of the skin problems experienced by Iranian female hairdressers.

#### ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

#### HUMAN AND ANIMAL RIGHTS

No animals/humans were used for the studies that are bases of this research.

#### CONSENT FOR PUBLICATION

Not applicable.

#### CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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