

Chemical risk for hairdressers

M.A.BAKE, D.VAISLA, P.SUDMALIS

Institute of Occupational and Environmental Health, 16 Dzirciema str., Riga, LV-1007, Latvia

There is a range of potential health hazards in hairdresser occupational environment, including biological, chemical, physical and ergonomic factors. Relations of hairdressers and customers are developing psycho emotional stress. The hairdressers are contacting with different chemicals (hair dyes, bleaching agents, permanent waves solutions, hair conditioners, hair spray and perfumes (3). Hairdressers may be exposed to a variety of irritative and allergic substances capable of causing skin and airway symptoms and diseases related to work (1, 2, 6, 7, 9, 11, 12, 13).

Few exposure studies exist from hairdressing saloons (3, 4, 8). Ethanol and ammonia are accepted as more characteristic of volatile substances in these investigations, as well as isopropanol and toluene were found in most of air samples.

The data about chemical pollution and health complains of hair dressers are not available in Latvia. The aim of this study was to detect chemical risk factors in different types of the hairdresser workplace and to evaluate the health risk by using questionnaire.

Materials and methods. Personal and stationary measurements were performed at the time of different procedures in 17 enterprises (12 barber shops and 5 hairdressing saloons). Saloons have wider working places and rooms with general ventilation but most of barbershops are located in small rooms without exhaust ventilation. The partners for research were selected by telephone. All received information is confidential. Air samples were taken thrice during the working days – in the morning, afternoon and evening. Personal measurements of volatile organic compounds were performed using charcoal adsorbent tubes connected to the portable pump (SKC or BUCK) according to standard method (ISO). The flow rate was 100 ml/min and sampling time varied 40 – 70 minutes to cover the work cycle. Stationary samples of ammonia were taken at fixed height of 1,5 m above the floor, near the location where bleaching, colouring and waving were prepared. Ammonia was collected into 0.01N sulphur acid with following photometrical detection using Nessler's reagent. Volatile organic compounds were analysed by the gas chromatography (Varian 3800, FID, on capillary column 30 m, 0.325 mm, DB-1 1 μ m, temperature programming 35 $^{\circ}$ C to 70 $^{\circ}$ C - 5 $^{\circ}$ C /min; 71 $^{\circ}$ C to 280 $^{\circ}$ C - 15 $^{\circ}$ C/min, hold 5 min, carrier gas He). 69 air samples were

analysed for organic substances and 18 air samples for ammonia. Microclimatic parameters (temperature, humidity and air movement) were detected with TESTO 400.

The interview included questions about done work (number of hours worked per week, tasks performed, ventilation), information about the risk factors at work, self-appraisal of health, habits. Scandinavian 16 items questionnaire was used also to evaluate impact of solvents on nervous system. The ethics committee of Medical Academy of Latvia approved the study protocol. 80 hairdressers participated in the interview (51 working in barber shops and 29 in hairdressing saloons), 6 persons (7%) refused participation. Average age of surveyed workers was 34.8 ± 13.0 years (from 19 to 69) and length of service 1 - 44 years (on average 12.3 years).

Results. The mean exposure levels of chemical substances are presented in Table 1. The air measurements showed an exposure level (mean concentrations) of ammonia in the range from 0.6 – 3.0 mg/m^3 with highest level by bleaching. Isopropanol and ethanol as leading chemicals were found among the volatile organic compounds and ethylacetate, buthylacetate, toluene and butane also were found. The level of isopropanol varied from 58.3 – 402.5 mg/m^3 with a mean of 109.3 mg/m^3 in saloons and mean of 322.8 mg/m^3 in barbershops. The concentrations of ethanol varied from 5.8 – 102.4 mg/m^3 with a mean of 8.5 mg/m^3 in saloons and with a mean 64.4 mg/m^3 in barbershops. The level of other pollutants varied in less wide range: ethyl acetate 0.5 – 3.1 mg/m^3 , buthylacetate 0.1 – 0.3 mg/m^3 , toluene 0.1 – 1.1 mg/m^3 .

Table 1. Mean concentrations of ammonia and organic solvents in hairdresser workplaces in saloons and barber shops

Chemical substances	Concentration of chemicals in work environment, mg/m^3					
	Hairdressing procedures in Saloons			Hairdressing procedures in Barber shops		
	Waving	Dye, bleaching	Mean $M \pm U$	Waving	Dye, bleaching	Mean $M \pm U$
Ammonia	0.6	1.3	1.0 ± 0.2	0.9	3.0	2.0 ± 0.5
Ethanol	5.8	11.2	8.5 ± 2.1	102.4	26.3	64.4 ± 16.1
Isopropanol	58.3	160.3	109.3 ± 27.3	402.5	243.1	322.8 ± 80.7
Ethylacetate	0.5	2.2	1.4 ± 0.3	3.1	2.2	2.7 ± 0.7
Buthylacetate	0.1	0.2	0.13 ± 0.03	0.3	0.1	0.18 ± 0.05
Toluene	0.8	0.3	0.6 ± 0.1	1.1	0.1	0.6 ± 0.2

The concentration of butane at the time of using the hair spray was $8.7 \pm 2.5 \text{ mg/m}^3$. The work place for manicure was located together with hairdressers in the working room of some barbershops where the concentration of isopropanol was the highest. For manicure, partly to replace acetone, is used isopropanol. The mean concentration of acetone there was $36.6 \pm 9.1 \text{ mg/m}^3$.

Lower exposure level was in the saloons with exhaust ventilation and with broader rooms compared to barber shops without ventilation system. The results of air pollution showed real mean level of exposure as 3 -5 hairdressers simultaneously were performing different procedures. Impossible was to detect concentration of chemicals into air from each procedure separately. The procedure of permanent waving, bleaching, dye comes to end with setting of hair and this is included in all types of air samples too.

The observed work places were without local exhaust ventilation and part of them (21% of barber shops) without general ventilation too. In most cases according to the measurements the air movement in workplaces was lower than 0.1 m/s. Interview showed that 73% of workers from barber shops and 66% from saloons evaluate the existing ventilation system as bad. At the same time 25% and 37% accordingly value lightening at work places insufficient, too. Air temperature and humidity were at recommended values according to the air quality standard for job category Ib, temperature at cold period of year $21 - 23^{\circ}\text{C}$, humidity 60 – 40%.

68% of interviewed were full time workers, 32% - part time workers. Information about the risk factors at work and occupational health and safety for most of them is insufficient: 68% workers from saloons and 86% from barber shops are informed about hazardous factors at work; 41% workers from saloons and 47% from barber shops acknowledge occupational health and safety activities from employees. Surprising that 62% workers from saloons and 76% from barber shops consider their work without hazardous factors. Individual protective means are using 74% of hairdressers (gloves, protective glasses, respirators).

Most of workers evaluate the health status as good (67% from barber shops and 69% from saloons). The analysis of health status showed that most characteristic diseases are osteochondrosis (corresponding 58% and 32%), blood pressure problems (corresponding 30% and 15%), varicose venous (30% and 18%), chronic skin diseases and allergic dermatosis (8% and 25%), chronic nose/throat problems (25% in both groups), allergic conjunctivitis (10% in both groups). Stress as one of the most important health problems point out 40% hairdressers according to self-evaluation and 17% note to irregular menses while worked in this job.

The main complains of hairdressers are irritation of eyes, nose/throat, skin, more frequently the irritation feel workers from barber shops (Figure 1). Correlation coefficient of complains on irritation of skin, nose/throat and eyes with concentration of isopropanol in work environment is

0.729. Equitation for correlation of irritation on eyes $y=0.0594x+5.1691$; on nose $y=0.0111x+20.094$; on throat $y=0.026x+8.886$. The correlation coefficient of some complains on irritation with concentration of ethanol in work environment is 0.617. Workers from barbershops twice more often feel numb. The data obtained by questionnaire on possible impact of solvents on nervous system revealed that group with higher exposure level have more complains on tiredness (37% workers from barber shops again 17% from saloons), suppression (31% - 13%), headache (36% - 14%), dizziness (26% - 16%).

Discussion. Hairdressers are exposed to broad range of chemicals in their work. We have revealed that in work environment, besides of popular pollutants ammonia and ethanol, are spread isopropanol, toluene, butane, ethylacetate and buthylacetate, too. The concentrations of ammonia and ethanol are comparable to determined concentrations in other studies (3, 4, 8). The detected concentrations of isopropanol and toluene in our case are higher then revealed in Norwegian case study at the mixing place of preparations (3). The mean concentrations of chemicals are generally lower than 8 hour occupational exposure limits (OEL) set in Latvian standards (LVS 89:1998): 20 mg/m³ for ammonia, 1000 mg/m³ for ethanol, 350 mg/m³ for isopropanol (short term - 600 mg/m³), ethylacetate and buthylacetate - 200 mg/m³, toluene - 50 mg/m³ (short term 150 mg/m³). Exception was some barber shops where in the working room was located work place for manicure and concentration of isopropanol was above 8 hour time-weighted OEL, but still lower than short term limit. The mean concentration of acetone in these work places was below OEL for acetone (200 mg/m³).

The determined pollutants can irritate skin, eyes, respiratory system, as well as they can induce impact on nervous system (10). However, it should be stressed, that the health effects of gasiform pollutants are uniform. As the result, the risk of the health effects can sum up and increase. The concentrations of determined chemicals showed real mean level of exposure because simultaneously are working 3 -5 hairdressers. So high concentration of pollutants in work environment is determined within lack of appropriate ventilation. It is confirmed with low air movement in workplaces.

The investigation showed that the chemical substances used in hair dressing process have risk potential to cause skin, eyes, nose and throat irritation and tendency of impact on nervous system. The results obtained by questionnaire about complains on irritation and information about health status are comparable with information from other studies that hairdressers have a higher risk of chronic bronchitis, asthma-like symptoms, rhinitis accompanied with irritative eye symptoms than control groups (1, 6, 7, 13).

Conclusions. Hairdressers simultaneously are exposed to different chemical agents. Chemical factor is one of the most important health risk factors for hairdressers. Frequency of health complains on irritation correlate with level of concentration of isopropanol and ethanol in work environment. The efficiency of the ventilation has to be improved in the most of work places of hairdressers to set situation according to legislation in the occupational health and safety in Latvia and to diminish health risk.

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Frequency of complains (%) on irritation of skin, nose, throat and eyes in saloons and barbershops

