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ORIGINAL ARTICLE

The Effects of Environmental Factors on Mucus Membrane, Skin and Upper Respiratory Tract in Office Setting

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ABSTRACT

Background: Occupational and environmental exposure to workplace hazards could effect on employees' various organs including the mucus membranes, skin, and upper respiratory tract. The aim of this study was to determine these effects in office setting during 2014-2015.

Materials and Methods: The current cross-sectional study conducted on office workers in two groups of low and high exposure. The main study instruments were questionnaire for filling with in-depth interview and environmental factors measurement.

Personnel's signs and symptoms were followed for one year. Obtained data were analyzed using SPSS version 16, by *t*-test, and Chi-square tests. *P*–value less than 0.05 was considered statistically significant. The 95% confidence interval (CI) is used to estimate the precision of the odds ratio.

Results: There was no significant difference between the groups; nevertheless, red-eye was more common in office personnel with longer computer use. Red eyes appear in working hours more than free times (*P* =0.001) and odds ratio was 3.50 (1.085-11.292).

Conclusion: Environmental pollutants had more effects on eyes' mucus membranes in comparison to effects of using the computer.

Key Words: Environmental factors, Office personnel, Mucus membranes symptoms, Skin symptoms, Upper respiratory symptoms

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INTRODUCTION

The environmental and occupational factors could affect the human health status, especially in work places. Some of the important factors were humidity, wet and dry climate, air velocity and particulate matter. Some other factors such as duration of computer use, age, gender, and person's past medical history may be risk factors for these disorders [1, 2].

Some studies have performed evaluation of the effects of environmental factors emanated by industries on the workers' health condition. Several instances of occupational respiratory diseases include asthma, chronic bronchitis, and other disorders [3, 4], but few studies were conducted about the offices because of low estimated risks [5]. Some of environmental factors could be harmful in low levels and further studies are required on humidity, wet and dry temperatures, air velocity, and the particulate matter.

The most annoying symptoms affecting the comfortably in the workplace are itchy eyes, red-eyes, eye discomfort, blurred vision, skin dryness, itchy skin, skin rash, itchy throat and nose, nose discomfort, cough, dyspnea and wheezing [5-8]. Although all these signs and symptoms could be found in general diseases with special etiologies, but the important issue is the environmental factors, because they are preventable [9, 10].

High level of air velocity could affect on mucus membranes, skin, and upper respiratory tract. This may cause eye and skin itching and eyes redness, blurred vision, and eye discomfort [1, 2]. Some studies exhibited the effect of humidity on health status. While the mucus membrane and skin disorders could be found in lower levels of humidity, the authors found some special skin and respiratory system ailments in higher level of humidity [2- 6].

Dry and wet temperatures were beneficial for assessment of environmental atmosphere,

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bringing about the mucus and skin symptoms. Using computers for long periods of time could be harmful for eyes and may cause the precocious hyperopia and blurred vision [1, 2]. Eye dryness and redness were demonstrated in long time working with computers.

The influences of gases and particulate matter over respiratory system had been observed in factory workers but not in office personnel [11- 14]. Researchers found that the sick building syndrome and building related illness will occur more in people under exposure of some environmental factors and in a special gender [15- 18].

Some respiratory disorders include hyper-sensitiveity pneumonitis, inhalation injuries, asthma, and upper respiratory tract's infections [19-25]. Various dermal issues in exposure to environmental factors were reported [26, 27]. Using the face masks and gloves for protection in polluted surroundings like factories is recommended [28]. However, engineering controls were the first line procedure for prevention of stated diseases and regular physical exam of at risk people are suggested [29-32]. World health organization (WHO) formulated a scientific plan for deterring these problems [33-35].

The objective of the present study was to evaluate the effects of environmental factors on mucus membrane, skin, and upper respiratory tract in people working in office setting, which led to investigating some of the indoor pollutants.

MATERIALS AND METHODS

This cross-sectional study was conducted on office employees in Khorasan and Tehran provinces in 2014-2015. Study population included clerical workers of 75 administrations. Personnel's signs and symptoms were followed for one year. Simple random sampling is a basic sampling technique where we select a group of subjects [1, 3], with α = 0.05, β = 0.80, P_1=45% and P_2=18% study population were calculated 2000 for each group (low and high risks).

Inclusion criteria consist of office personnel with at least two-year work experience. Exclusion criteria consist of any past history of mucus membrane, skin and upper respiratory tract disorders before entering their present business. The participants were observed for different attributes such as age, gender, and other related diseases.

Questionnaire design

The study was performed by an interview using a questionnaire and measurement of environmental factors. The validity and reliability of questionnaire were checked with experts' attitudes and a pilot study with 85% correlation coefficient.

This questionnaire included queries regarding itching (eye, skin, throat or nose), red eye, eye discomfort, blurred vision, skin dryness, skin rash, rhinorrhea, nose discomfort, cough, dyspnea, and wheezing.

The questionnaire also included questions about non-occupational and occupational risk factors for related disorders. Non-occu-pational risks involved age, gender, body mass index (BMI), and psychological stress. Occupational risks involved physical or mental stress at work, exposure to chemical and physical factors, shift work, and work duration.

Risk factors measurement

We measured the duration of computer use, dry and wet temperatures, humidity, air velocity (which is measured by flowmeter), and particulate matter. According to minimum and maximum levels and in comparison to the occupational safety and health administration's standards, the risk factors divided in two groups of high and low levels.

Statistical analysis

The obtained data were analyzed using SPSS version 16 (Chicago, IL, USA). The frequency tables, half-values, standard deviation, and *t*-test were used to compare the quantitative variables and Chi-square for qualifying the variables. Significant value was considered about $P<0.05$ and the 95% confidence interval (CI) is used to estimate the precision of the odds ratio.

Ethical consideration

Verbal consent was obtained from the participants. The ethics committee of the university approved the study under the license number 86407.

RESULTS

Overall, four-thousand contributors from various offices with high and low level of environmental risk factors were participated in this study in 2014-2015. The mean high and low levels of computer using duration, humidity, wet and dry temperatures, air velocity, particulate matter were 6.90±3.00 and 0.46±0.91 hours, 51.00±3.46% and 37.56±3.79%, 14.15±0.98 and 11.0±0 °C, 22.77±0.97 and 18.00±1.50 °C, 2.0±0 and 0.19±0.38 m/s, 5.90±0.23 and 2.82±0.16 mg/m^3, respectively($P<0.05$).

In Table 1 the odds ratios of mucus membrane and dermal symptoms in high

Table 1. Odds ratios of mucus membrane and skin symptoms in high environmental exposures. OR(CI)

Factors	Symptoms					
	Duration of work with Computer	Humidity	Wet temperature	Dry temperature	Air velocity	Particulate matter
Itchy eyes	1.00 (0.08-12.55)	2.66 (0.29-23.85)	1.07 (0.93-1.22)	1.62 (0.11-22.98)	1.25 (0.97-1.61)	4.33 (0.42-44.42)
Red eye	3.50 (0.20-58.77)	2.16 (0.14-32.52)	1.06 (0.94-1.21)	3.50 (0.20-58.77)	1.23 (0.97-1.55)	2.16 (0.14-35.52)
Eye discomfort	0.909 (0.06-12.52)	1.50 (0.12-18.36)	0.923 (0.789-1.08)	0.167 (0.01-2.36)	0.909 (0.06-12.52)	0.364 (0.03-3.51)
Blurred vision	0.500 (0.03-6.68)	1.143 (0.126-10.386)	0.886 (0.70-1.12)	1.42 (0.95-2.14)	2.57 (0.19-34.47)	0.292 (0.02-3.48)
Skin dryness	1.100 (0.08-15.15)	0.667 (0.05-8.16)	1.03 (0.926-1.267)	6.00 (0.42-85.24)	1.100 (0.08-15.15)	2.750 (0.284-26.60)
Itchy skin	0.364 (0.018-7.29)	0.800 (0.056-11.50)	1.250 (0.806-1.93)	0.833 (0.647-1.07)	0.800 (0.056-11.50)	0.800 (0.056-11.50)
Skin rash	3.50 (0.17-69.33)	7.50 (0.32-173.28)	0.417 (0.02-8.05)	1.25 (0.917-1.704)	2.400 (0.124-46.391)	0.917 (0.773-1.087)

Table 2. Odds ratios of upper respiratory symptoms in high environmental exposures. OR(CI)

Factors	Symptoms					
	Duration of computer using	Humidity	Wet temperature	Dry temperature	Air velocity	Particulate matter
Itchy throat	1.15 (0.94-1.40)	1.07 (0.93-1.22)	1.65 (0.11-22.98)	1.36 (1.005-1.85)	3.50 (0.17-69.33)	1.00 (0.08-12.55)
Itchy nose	1.06 (0.94-1.21)	1.06 (0.94-1.21)	3.50 (0.20-58.77)	3.50 (0.20-58.77)	7.50 (0.32-173.28)	3.50 (0.20-58.77)
Rhinorrhea	1.20 (0.83-1.71)	1.20 (0.83-1.71)	0.909 (0.06-12.52)	0.909 (0.06-12.52)	0.846 (0.67-1.06)	0.769 (0.57-1.03)
Nose discomfort	1.111 (0.90-1.36)	1.111 (0.90-1.36)	0.500 (0.03-6.68)	0.500 (0.03-6.68)	0.778 (0.54-1.103)	0.667 (0.42-1.05)
Cough	0.883 (0.583-1.192)	0.883 (0.583-1.192)	1.100 (0.08-15.15)	1.100 (0.08-15.15)	0.182 (0.937-1.490)	1.300 (0.965-1.751)
Dyspnea	0.917 (0.773-1.08)	0.917 (0.773-1.08)	0.364 (0.018-7.295)	0.750 (0.541-1.040)	0.833 (0.647-1.073)	0.136 (0.001-2.068)
Wheezing	1.62 (0.11-22.98)	1.143 (0.95-1.37)	0.846 (0.671-1.067)	0.778 (0.54-1.103)	0.182 (0.937-1.490)	0.364 (0.018-7.295)

environmental exposure levels is shown with no significant diversity (P<0.05).

At the end of the study, the aforementioned symptoms were assessed and analyzed again. The frequency of red eyes was more frequent in the office personnel with longer computer use; nevertheless, the reported diversity was not significant (P=0.560). The subjects with longer duration of computer use experienced blurred vision more than the others (P=1.0). There was no significant differences between the groups; however, blurred vision and itchy skin were more frequent in office personnel who were supplied with high level air velocity (P=0.222 and P=0.557, respectively). In Table 2 the odds ratios of high environmental exposure is demonstrated.

According to the relationship between humidity and upper respiratory tract' symptoms including cough and dyspnea, people working in places with high humidity percentages experience more cough and dyspnea (P =0.298, P =0.422).

Itchy skin was more commonplace in old-aged employees; nonetheless, it was not very significant (P =1.0). Red eyes occur more commonly in working hours compared to free time (P=0.001) and odds ratio was 3.50 (1.085-11.292).

DISCUSSION

According to the results, the environmental risk factors were calculated (P<0.05); however, there was no significant discrepancy between two groups of low and high level exposures.

No significant difference was observed between the two groups; however, red eyes were more frequent in office personnel with longer period of time computer use (P=0.560); Besides, red eyes were more common in working hours than in free time (P=0.001) and 95% odds ratio was 3.50 (1.085-11.292). It confirmed the relationship between red eyes

phenomenon and work ambiance or indoor factors.

Blurred vision was found in the subjects using computers for long period of time more than the others; nevertheless, there was no significant disparity (*P*=1.0). Long time working with computer had destructive effects on strength and quality of vision [15, 16]. In the present study, staffs had participated in educational programs for computer and ergonomic factors and they exercised in rest times.

Blurred vision was more prevalent in office personnel supplied with high level of air velocity. Some studies displayed the mucus membrane disorders in exposure to environmental factors [6, 7].

This study indicated that itchy skin can be the result of supplying with high air velocity level. Some studies showed the high air velocity impact on mucus membrane and skin [15, 16]. Other studies showed the skin disorders in exposure to the environmental factors [26, 27]. In the current study, the suitable mean amounts of humidity and air velocity were determined to be 45% and 0.1 m/s, respectively, using ventilation systems. Calculating these values were based on occupational safety and health administration's standards.

Regarding the relationship between humidity and incidence of cough and dyspnea, it was pointed out that people working in places with high level of humidity experience more cough and dyspnea attacks than the others. Humidity could have wrecking effect on asthma and airways hyper-responsiveness [1, 2].

Some studies demonstrated the increment of respiratory disorders in exposure to environmental factors [19, 21]. In the ongoing study, environmental factors were not in vulnerable levels and might not affect on respiratory system. This is worth to mention that the workers had not any past medical history of active respiratory hyper-sensitivity.

People working with computer had mucus membranes and skin manifestations [17, 18]. While the humidity was in normal to high levels in their bureaus, local ventilation was in high level. Although it was not very significant, it is pretended that the effect of local air velocity was more strong than normal humidity.

Itchy skin was more frequent in older personnel; however, there was no significant inequality (*P*=1.0). The odds ratio was 2.0 (0.16-24.06). In this study, most of the participated staffs were youthful. Workplace along with the age, affect the skin itching and dryness [17, 18]. People suffering from itchy and dry skin cited the reduction of symptoms at weekend and off days.

Red eye was more prevalent in working hours than free times. According to the results, eyes redness and irritation could be improved out of the workplace. It was stated that the symptoms will subside after leaving the office [15].

Authors recommended general ventilation set on the standard level [36, 37]. Periodic examination of ventilation systems quality was necessary.

The limitation of this study was the deficit in numbers of measured factors; thus, further studies are required. Environmental conta-minants are more responsible for eyes' mucus membranes than computer usage.

In comparison with the other studies which evaluated the effects of air pollutions caused by industries, there were a few studies for assessment of the offices' risk factors [36, 37]. Ironically, the same results reported in evaluating the effects of indoor and outdoor pollutants on health status [16-18].

Based on this study, author suggested that job analysis, especially risk assessment of chemical exposures and determination of occupational risk factors, is essential.

CONCLUSION

The environmental factors might be hazardous for mucus membranes particularly for the eyes, skin and upper respiratory tract. The environmental pollutants are more challenging for ophthalmic mucus membranes than computer usage.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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