

# Relationship of Occupational and Non-Occupational Stress with Smoking in Automotive Industry Workers

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**Background:** Tobacco use is the second cause of death and first cause of preventable mortality worldwide. Smoking in the workplace is particularly concerning. Smoking-free workplaces decrease the risk of exposure of non-smoking personnel to cigarette smoke. Recent studies have mostly focused on the effect of daily or non-occupational stressors (in comparison with occupational stress) on prevalence of smoking. Occupational stress is often evaluated in workplaces for smoking cessation or control programs, but the role of non-occupational stressors is often disregarded in this respect.

**Materials and Methods:** This cross-sectional study was conducted in an automobile manufacturing company. The response of automotive industry workers to parts of the validated, reliable, Farsi version of Musculoskeletal Intervention Center (MUSIC)-Norrtalje questionnaire was evaluated. A total of 3,536 factory workers participated in this study. Data were analyzed using SPSS and  $P < 0.05$  was considered statistically significant.

**Results:** The correlation of smoking with demographic factors, occupational stressors and life events was evaluated. The results of logistic regression analysis showed that even after adjusting for the confounding factors, cigarette smoking was significantly correlated with age, sex, level of education, job control and life events ( $P < 0.05$ ).

**Conclusion:** The results showed that of occupational and non-occupational stressors, only job control was correlated with cigarette smoking. Non-occupational stressors had greater effect on cigarette smoking. Consideration of both non-occupational and occupational stressors can enhance the success of smoking control programs. On the other hand, a combination of smoking control and stress (occupational and non-occupational) control programs can be more effective than smoking cessation interventions alone.

**Key words:** Cigarette, Workplace, Occupational stress, Non-occupational stress

## INTRODUCTION

Tobacco use is the second cause of mortality worldwide (1) and the first cause of preventable morbidity and mortality (2). Cigarette smoking caused more than 100 million deaths in the 20<sup>th</sup> century. If not intervened, this figure will reach one billion in the 21<sup>st</sup> century (3).

According to the World Health Organization (WHO), there are 1.3 billion smokers in the world (4). Smoking is the main cause of cancer of the lungs, larynx, pharynx, nasal meatus, nasal sinuses, esophagus, ureter, kidneys, pancreas, stomach, liver, cervix, and myeloid leukemia (5).

Smoking is also linked to many cardiovascular and respiratory diseases (6).

According to the statistics by the Ministry of Health, rate of smoking was 12.3% in 2007 (7). Another study in 2011 demonstrated that 13.7% of Iranians aged 15-64 years were smokers; out of which, 24.3% were males and 2.9% were females. The mean age of smoking initiation was 20 years in males and 24.2 years in females (8). Rezaei et al, in 2011 reported that smoking was initiated mostly in the age of 13 and 14 years (9). Another study in 2012 in the west of Iran indicated that the prevalence of smoking among the Iranian population was 10.2% and prevalence of smoking increased by advanced age (10).

Cigarette smoking in the workplace raises some concerns. Smoking-free workplaces decrease the risk of exposure of nonsmoker personnel to cigarette smoke (11). Occupation and smoking are somehow related. It has been well documented that smoking can seriously compromise the health of personnel and lead to compensation and disability payments, early retirement, and leave of absence (12). Considering the high prevalence of smoking in the workplaces, some studies suggest taking a complete history of smoking status from workers in periodic examinations and refer them to smoking cessation clinics (13, 14).

Studies have discussed a correlation between smoking and occupational stress. Radi et al. demonstrated that risk of smoking was higher in men under high occupational stress and tension, and lower in women with active jobs (15). Azagba and Sharaf indicated that occupational stress was correlated with smoking rate only in light smokers (16). Kouvonen et al. also pointed to the relationship of smoking with occupational stress and concluded that less occupational stress enhances smoking cessation (17).

Recent studies have focused on the effect of non-occupational stressors on smoking in comparison with occupational stress. It has been demonstrated that life events, compared to occupational stress, play a more significant role in likelihood of tobacco consumption (18).

Occupational stress is often taken into account when designing smoking control programs in workplaces, but the role of non-occupational stressors is often disregarded. However, the interaction effect of occupational and non-occupational stressors may somehow balance their individual effect on smoking. No previous study has been conducted in Iran in this regard. Considering the importance of knowledge about the role of non-occupational stressors in designing smoking cessation interventions, this study aimed to assess the role of these factors more comprehensively.

## MATERIALS AND METHODS

This cross-sectional study was conducted by the national research institute of tuberculosis and lung disease (NRITLD) in 2011 in an automobile manufacturing company. The understudy population comprised of the personnel of the factory.

Validated and reliable Farsi version of MUSIC-Norrtalje questionnaire (19) was used for data collection. The questionnaire contained demographic information, questions about history of smoking, psychosocial conditions in the workplace, and life events. Workers were requested to fill out the questionnaire during the informatory sessions anonymously with no time limit.

The shift work in the current study was defined as work with a few hours of night work (sometime other than 7 am. \_ 6 pm.)(20). Work hours more than 44 hours/week were considered as long work hours. To assess the correlation of smoking with understudy parameters, never- or ex-smokers were considered as non-smokers and regular smokers were considered as current smokers.

Questions regarding the psychosocial conditions of workplace in the questionnaire were divided into three domains of job demand, job control and support in the workplace and adapted from the demand, control and support model.

The job demand domain of the questionnaire included questions regarding work load and work pace. The job

control domain included questions regarding independence in work place and compatibility of tasks with skills. The job support domain included questions about the support by the authorities and coworkers in the workplace.

Questions about life events included arguments with spouse, family members or close friends, serious disease or injury of the spouse, family members or close friends, death of spouse, family members or close friends, disease or injury of the worker, separation or divorcing the spouse, marriage, moving, having a child, adopting a child and serious financial problems in the past year.

Each response to questions regarding the psychosocial conditions in the workplace and life events of the MUSIC questionnaire was allocated a specific score and the sum of scores gained by each worker in demand, control, support and life event domains was calculated. Scores acquired in each section were categorized as high score or low score and the correlation of scores in each section with smoking status was investigated.

A total of 3,536 questionnaires (86% response rate) were filled out using convenience sampling. Data were entered in SPSS 15. The correlation of understudy factors with cigarette smoking was analyzed using chi square test. Logistic regression model was applied to assess the effect of confounders on study variables.  $P < 0.05$  was considered statistically significant. This study was in full compliance with the declaration of Helsinki ethical principles in terms of voluntary participation of subjects, obtaining written informed consent, and confidentiality of information. The study protocol was approved by the Ethics Committee of NRITLD, Masih Daneshvari Hospital.

## RESULTS

The mean age of participants was 29.75 years (SD:6.42). Of 3,536 personnel participating in the study, 3,171 (89.7%) were males and 364 (10.3%) were females. In terms of type of occupation, 118 (3.3%) were managers, 680 (19.2%) were technicians, 262 (7.4%) were executive employees, 1,779

(50.3%) were workers and 368 (10.4%) were janitors, kitchen personnel, drivers, etc.; 329 (9.3%) workers did not answer to this question.

In terms of level of education, 5.3% did not have high school diploma and 90.4% had high school diploma or a higher degree; 4.3% did not answer to this question. In terms of smoking status, 1.6% of females and 20.5% of males were current smokers while 0.8% of females and 4.5% of males were ex-smokers. In total, 77.3% ( $n=2,734$ ) were never smokers, 4.1% ( $n=145$ ) were ex-smokers and 18.6% ( $n=657$ ) were current smokers. The mean number of cigarettes smoked daily was 8.2 cigarettes (SD:6.2).

Of 657 current smokers, 48.6% had started smoking in the age range of 10-20 years, 46.9% had started smoking in the age range of 21-30 years, 3.3% had started smoking in the age range of 31-40 years and 1.1% had started smoking in the age range of 41-50 years. Of smokers, 59.3% smoked between 1 to 9 cigarettes daily, 27.6% smoked between 10 to 19 cigarettes daily and 12.9% smoked more than 20 cigarettes daily. Table 1 shows the correlation of smoking with demographic factors. As seen in Table 1, cigarette smoking in the age group of  $\geq 30$  years was significantly higher than that in the age group of  $< 30$  years. Also, prevalence of smoking was higher in males (compared to females), in those with educational level below high school diploma (compared to higher level of education), in married individuals (compared to singles) and in subjects working more than 44 hours/week (compared to those working less than 44 hours/week) ( $P < 0.05$  for all). However, smoking was not correlated with type of occupation or shift work ( $P > 0.05$ ).

Table 2 shows the correlation of smoking with each domain of demand, control and support model for occupational stress in the questionnaire. Prevalence of smoking was significantly correlated with the demand domain of occupational stress that included work load and work pace (OR=1.215, CI:1.010-1.475,  $P=0.049$ ). Subjects with higher workload and work pace smoked higher number of cigarettes. Smoking was also significantly

correlated with job control (OR=1.200, CI=1.009-1.426, P=0.039). Subjects with less job control smoked more cigarettes but job support was not significantly correlated with smoking (OR=1.112, CI=0.898-1.377, P=0.332). A significant association was found between smoking and stress due to life events (OR=1.812, CI=1.413-2.322, P=0.000).

Logistic regression analysis was applied for more accurate assessment of the correlation of smoking with demographic factors, occupational stress and life events (Table 3). The results of this analysis showed that even after adjusting for the confounders, smoking was correlated with age, gender, level of education, job control and life events.

**Table 1.** Correlation of smoking with demographic factors.

Variables	Number (percent)		P value	OR	95% CI
	smoker	Nonsmoker			
<b>Age</b>					
Less than 30	293 (45.6%)	1799 (64%)	-	1	-
Equal to 30 or more	349 (54.4%)	1011 (36%)	0.000	2.120	1.782-2.521
Missing	84 (2.37%)				
<b>Sex</b>					
Female	6 (0.9%)	358 (12.4%)	-	1	-
Male	651 (99.1%)	2521 (87.6%)	0.000	15.408	6.845-34.684
Missing	0 (0%)				
<b>Education</b>					
High school education and Upper	580 (89.6%)	2617 (95.5%)	-	1	-
Lower than high school education	67 (10.4%)	122 (4.5%)	0.000	2.478	1.815-3.383
Missing	150 (4.24%)				
<b>Job</b>					
White collar	78 (12.1%)	326 (11.8%)	-	1	-
Blue collar	569 (87.9%)	2433 (88.2%)	0.865	0.977	0.751-1.272
Missing	130 (3.67%)				
<b>Marriage status</b>					
Unmarried	138 (21.2%)	958 (33.5%)	-	1	-
Married	513 (78.8%)	1900 (66.5%)	0.000	1.874	1.529-2.297
Missing	27 (0.7%)				
<b>Shift work</b>					
No	203 (31%)	969 (33.8%)	-	1	-
Yes	452 (69%)	1902 (66.2%)	0.176	1.134	0.945-1.362
Missing	10 (0.2%)				
<b>Work hours in a week</b>					
Equal to 44 or Less	140 (21.7%)	745 (26.7%)	-	1	-
More than 44	505 (78.3%)	2050 (73.3%)	0.010	1.311	1.068-1.609
Missing	96 (2.7%)				

Table 2. Correlation of smoking with occupational stress and life events.

Variables	Number (percent)		P value	OR	95% CI
	smoker	Nonsmoker			
<b>Job demand</b>					
Low	167 (26.1%)	830 (30.1%)			
High	472 (73.9%)	1931 (69.9%)	0.049	1.215	1.010-1.475
Missing	136 (3.84%)				
<b>Job control</b>					
Low	373 (57.6%)	1479 (53.1%)	-	1	-
High	275 (42.4%)	1308 (46.9%)	0.039	1.200	1.009-1.426
Missing	101 (2.85%)				
<b>Job support</b>					
Low	132 (20.6%)	525 (18.9%)	-	1	-
High	508 (79.4%)	2246 (81.1%)	0.332	1.112	0.898-1.377
Missing	125 (3.5%)				
<b>Life events</b>					
Low	546 (84.4%)	2507 (90.7%)	-	1	-
High	101 (15.6%)	256 (9.3%)	0.000	1.812	1.413-2.322
Missing	126 (3.56%)				

Table 3. Correlation of smoking with demographic factors, occupational stress and event life (logistic regression).

variables	P value	OR	95% CI
Age	0.000	2.148	1.708-2.701
Sex	0.000	17.658	6.447-48.364
Education	0.017	1.544	1.082-2.203
Job	0.906	1.020	0.737-1.410
Marriage status	0.086	1.240	0.970-1.586
Shift work	0.516	1.084	0.849-1.384
Work hours in a week	0.506	1.082	0.858-1.365
Job demand	0.161	1.168	0.940-1.451
Job control	0.026	1.249	1.027-1.518
Job support	0.961	0.994	0.780-1.268
Life events	0.002	1.541	1.166-2.037

## DISCUSSION

This study showed that a high percentage (about one-fifth) of male workers in the understudy automobile manufacturing company were smokers; however, this rate was lower than the general prevalence rate of smoking among Iranian males according to Puścińska et al (8). This difference may be due to the prohibition of smoking in the

workplace and younger mean age of workers in the factory compared to general population. In terms of the age of initiation of smoking in our study, about half the workers had started smoking in the age range of 10-20 years; which is in accord with the highest frequency of the age of smoking initiation reported by Rezaie et al, (9). In terms of the mean number of cigarettes smoked daily, about 60% of

smokers in our study smoked between one to nine cigarettes daily; while, in the study by Kouvonen et al. about 40% of hospital workers smoked between one to nine cigarettes daily and the rate of smoking by the remaining smokers was higher than that (17).

In our study, shift work was significantly correlated with cigarette smoking; but when combined with other variables in regression analysis, no significant association was found in this regard. This finding is in accord with the result of some previous studies (15). The reason may be the effect of other variables that are more effective than occupational and non-occupational stressors as well as work hours.

Moosazadeh et al, in their meta-analysis on cigarette smoking in Iran demonstrated that smoking was correlated with advanced age and male gender (21). The same results were obtained in our study. This correlation was also shown by Jafarabadi et al, in 14-19 year-old Iranians (22). Radi et al, also reported a significant association between smoking and male gender (15).

Broms et al. discussed that in males, marriage was related to higher likelihood of smoking cessation (23). Radi et al. showed that the smoking rate was higher in singles (15); however, our findings were in contrast to those of the mentioned two studies since in our study smoking rate was higher in married workers. This difference may be explained by the fact that most individuals start smoking when they are single and continue smoking after marriage.

In our study, smoking had an inverse relationship with level of education. The results regarding the correlation of smoking with level of education in European countries have been controversial from 1985 to 2000 but Radi et al. and Giskes et al. reported an inverse correlation between smoking and level of education (15, 24).

In our study, smoking was associated with working for more than 44 hours/week, which is attributed to the correlation of stress and tension due to long working hours with cigarette smoking. Radi et al. and Eriksen et al. demonstrated that long working hours were significantly correlated with smoking (15, 25). However, Lallukka et al.

stated otherwise (26). This controversy may be due to the various classifications of work hours in different studies.

Our study showed association of smoking with job demand and job control domains of occupational stress; which is in line with the results of Kouvonen et al, (17). Radi et al. reported that after adjustment for age, level of education, marital status and hostile behavior, high job strain was related to smoking in males. But, in females, job demand and job control had no effect on smoking rate (15). In our study, considering the small number of female smokers, a definite statement cannot be made in this regard.

The inverse correlation of smoking with job control was also confirmed by Otten et al. However, he demonstrated that the combination of high job demand and low job control comprising job strain had no significant association with smoking (27).

Our study confirmed the relationship of smoking with life events. This association has been reported by several studies (28-30). Some studies have even shown the stronger effect of non-occupational stressors on smoking compared to occupational stress (18). This superior effect was also confirmed in the current study. This finding indicates that unfavorable life events are more effective on smoking status compared to occupational stress.

### **Limitations of the study**

This study was conducted on a large group of automotive workers that were mostly young and male. Thus, only the conclusions drawn for males can be reliable. On the other hand, considering the prohibition of smoking in the workplace, many workers may not give accurate answers regarding their smoking status or rate of smoking resulting in underestimation of smoking rate. To overcome this problem, researchers tried to minimize this bias by their continuous physical presence when questionnaires were filled out and ensuring the personnel about the anonymity of the questionnaires and confidentiality of information.

People can respond differently to stressors; for instance, some people may smoke more cigarettes when stressed out while some others may overeat or abuse alcohol (31). Some other individuals may not change their rate of consumption when stressed out but show compensatory behaviors. For example, smokers may not smoke more cigarettes but they may take longer, deeper puffs when stressed out (32). Such compensatory behaviors may be related to stress but were not evaluated in the current study because data in this regard could not be retrieved via the questionnaire used.

### Strength points

Several studies have investigated the effect of occupational stress on smoking (15-17, 27), but not many studies have evaluated the interaction effect of non-occupational and occupational stressors. Evaluation of this interaction effect on smoking was the main strength point of this study.

### CONCLUSION

The results showed that of occupational stressors, only job control had a significant correlation with smoking when occupational stressors were evaluated in combination with non-occupational stressors (indicative of overall stress of an individual). Non-occupational stressors had a greater effect on smoking status compared to occupational stress. In general, taking into account both non-occupational and occupational stressors can greatly enhance the success of smoking control programs. Moreover, combining smoking control and stress (occupational and non-occupational) control programs can be more effective than smoking cessation interventions alone.

Further studies are required to better elucidate the role of stress (both occupational and non-occupational) control strategies in decreasing smoking. Stress management measures for both occupational and non-occupational stressors should be included in smoking control programs.

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