Research Square

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Work ability index and occupational Fatigue in the Workers of a Large Automotive company in Iran

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Keywords: Work ability index, Fatigue, Iran, Manufacturing and Industrial Facilities, Occupational Health

Posted Date: April 27th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-20241/v1

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Abstract

Background

Work ability and occupational fatigue are two critical topics in occupational health. We aimed to assess fatigue and the work ability and find their association in the workers of a large Iranian car company.

Methods

In this cross-sectional study, we enrolled the workers of SAIPA Automotive Corporation between April and September 2019. We used the Work Ability Index and SOFI-20 questionnaires to assess the work ability and occupational fatigue in the study population, respectively. Then the correlation between work ability index and its association with fatigue dimensions and general study variables were tested.

Results

From a total of 400 workers, we analyzed the data of 376 workers (mean age = 37.1 ± 5.6 years). The mean WAI was 38.01 ± 7.46. Workers with regular exercise training had higher WAI ($P < 0.001$). Workers in the press shop had a higher WAI as compared with those who worked in the painting shop or trim shop ($P < 0.001$). The work ability index had a moderate indirect correlation with all of the fatigue dimensions. There was a significant association between the work stations ($P = 0.002$) and WAI. As regards the fatigue dimensions, higher physical discomfort, lack of motivation and sleepiness were associated with a lower WAI ($P = 0.048$, $P = 0.012$ and $P < 0.001$ respectively).

Conclusion

In this study, we found a negative association between fatigue dimensions and the workability index.

Introduction

Work ability, defined as the physical and mental ability of a worker to perform and cope with the mental and physical work demands, is an important topic in occupational health [1]. The most useful instrument for assessing is the Work Ability Index (WAI), defined by the Finnish Institute of Occupational Health in 2006 [2]. It can actually measure whether individuals are at risk regarding their health or employability. Consequently, WAI has been proved to be a useful predictor for work absenteeism, occupational stress, work disability, early retirement, and even mortality of the workers [3–7]. Therefore, there was a growing interest in recent years to assess work ability index in occupational settings and use it as a predictor or determinants for occupational health issues.

Fatigue, defined as an experience of tiredness, dislike of present activity, and unwillingness to continue performing the task at hand, is also a common finding in workers, particularly in the industrial workers [8, 9]. It has been reported to be present in 14–22% of the general population [8, 10–12]. In a large study in the Netherlands, 25% of the Dutch workers reported fatigue during their working hours [13]. In occupational fatigue can be both acute or chronic, as well as mental or physical[14]. Fatigue in workers results in decreased ability to perform their tasks at the desired level and can be both mental and physical [15]. Consequently, it can result in mood and behavioral changes and decrease of concentration and attention as well as adverse occupational outcomes and errors, absenteeism, and physical degradation [9, 14, 16]. Therefore, we aimed to assess fatigue and the work ability and find their association in the workers of a large Iranian car company.

Methods

In this cross-sectional study, we enrolled the workers of SAIPA Automotive Corporation in the West of Tehran, Iran. We conducted this study between April and September 2019. The study protocol was reviewed and approved by the research board of the Community Medicine Department at Tehran University of Medical Sciences and the medical ethics committee.

Eligible participants were those who had worked in this factory for at least one year and did not have a history of psychiatric disorder or drug abuse. The workers were informed about the study design and its objectives at their workplace. All the participants signed an informed consent form and were reassured that their data would remain confidential and published anonymously for research purposes only. All of the participants received three questionnaires: socio-demographic data, Work Ability Index (WAI), and SOFI. The workers were asked to complete these questionnaires and return them to the research team within a week.

Socio-demographic data questionnaire

The socio-demographic data questionnaire was developed by the authors from the literature review and task analysis. It included data on age, height, weight, marital status, level of education, smoking habits, years of experience, and regular physical exercise practice.

Work ability index questionnaire

We used the standardized Persian version of the WIA questionnaire to assess the participants' descriptions of their work ability [17, 18]. This questionnaire has seven items, including current work ability, physical and mental work demands, diagnosed diseases, disease-related work disability, absenteeism from work, own work ability prognosis, and psychological resources. Based on the final scores (ranging from 7 to 49), the workers are classified with poor (7–27), moderate (28–36), good (37–43), or excellent (44–49) work ability.

The Swedish Occupational Fatigue Inventory

The Persian version of SOFI-20 was used to assess the occupational fatigue in the participating workers [19]. This instrument consists of five dimensions: lack of energy, physical exertion, physical discomfort, lack of motivation, and sleepiness. Each dimension is defined by the content of four expressions related to physiological, cognitive, motor, and emotional responses. Each item can be answered using a 7-degree Likert system from zero (“not at all”) to six (“to a very high degree”).

Statistical Analysis

Categorical variables were shown as frequency (percentage, while quantitative variables were shown as mean ± standard deviation. The student t-test was used to compare the WAI scores between the subgroups. The normality of the data variables was checked using histograms. We used Pearson’s correlation coefficients to evaluate the relationship between the SOFI dimensions and the final scores of WAI. A leaner regression analysis was utilized to determine the association between WAI and SOFI dimensions, and the results were reported as the regression coefficient and 95% confidence interval. All the statistical analyses were performed using SPSS 21.0. (IBM, USA). The significance level of all the statistical tests was set at $p < 0.05$.

Results

In the current study, from a total of 400 workers, we collected and analyzed the data from 376 workers with complete data. The mean age of the study population was 37.1 ± 5.6 years. The mean WAI was 38.01 ± 7.46. Comparison of WAI between the subgroups of the demographic and personal characteristics showed that those who had regular exercise training had a higher WAI ($P < 0.001$). In addition, those who were working in the pressing shop had a higher WAI as compared with those who worked in the painting or trim shops ($P < 0.001$). These comparisons are summarized in Table-1.

Table-1

Comparison of the work ability index between subgroups of the workers' characteristics

Characteristic	Subgroups (n)	Workability index	P-value*
Age	< 40 (233)	37.7 ± 7.5	0.32
	≥ 40 (143)	38.5 ± 7.4	
BMI	< 25 (140)	38.0 ± 7.8	0.9
	≥ 25 (235)	37.9 ± 7.2	
Smoking	No (315)	38.2 ± 7.4	0.1
	Yes (61)	36.6 ± 7.8	
Level of education	High school diploma and below (n = 239)	37.8 ± 7.5	0.600
	University degree (n = 137)	38.2 ± 7.4	
Marital status	Single (35)	38.3 ± 7.3	0.8
	Married (341)	38.0 ± 7.5	
Work experience	< 15 years (171)	38.1 ± 7.5	0.6
	≥ 15 years (202)	37.8 ± 7.4	
Regular exercise training	No (175)	36.7 ± 7.8	0.001
	Yes (201)	39.1 ± 6.9	
Work station	Painting shop (126)	39.4 ± 7.1	0.001
	Press shop (80)	40.2 ± 5.4	
	Trim shop (170)	35.9 ± 8.0	
BMI; Body mass index.			
* P < 0.05 was the statistical level of significance.			

Descriptive statistics of the fatigue dimensions based on the SOFI-20 questionnaire, including mean and standard deviation, are shown in Table-2. Overall, the highest score was attained for the ‘lack of energy’ while ‘lack of motivation’ had the lowest score.

Table-2

Descriptive data of fatigue dimension scores based on the SOFI questionnaire

Fatigue dimension	Mean ± standard deviation
Lack of energy	3.1 ± 1.7
Physical exertion	2.2 ± 1.5
Physical discomfort	2.5 ± 1.7
Lack of motivation	2.0 ± 1.4
Sleepiness	2.4 ± 1.6

The work ability index had a moderate indirect correlation with all of the fatigue dimensions. However, there was no correlation between WAI and the personal characteristics of the workers (Table-3).

Table-3

Correlation between the work ability index and the main characteristics and fatigue dimensions.

Characteristic	Pearson's correlation	P-value
Age	-0.036	0.489
BMI	0.016	0.75
Work experience	-0.065	0.209
Lack of energy	-0.398	< 0.001
Physical exertion	-0.431	< 0.001
Physical discomfort	-0.483	< 0.001
Lack of motivation	-0.472	< 0.001
Sleepiness	-0.508	< 0.001
BMI: Body mass index.		

In the linear regression analysis, there was a significant association between the work station (P = 0.002) and WAI. As regards the fatigue dimensions, higher physical discomfort, lack of motivation and sleepiness were associated with a lower WAI (P = 0.048, P = 0.012 and P < 0.001 respectively). There was also a negative borderline association between smoking and WAI (P = 0.052), whereas regular exercise training had a borderline association with WAI (P = 0.059) (Table-4).

Table-4

Linear regression results for work ability index ($r^2 \approx 33$).

Characteristic	Regression coefficient	95% confidence interval	P-value
Age	-0.07	-0.19, 0.04	0.209
Smoking	-1.73	-3.48, 0.01	0.052
Regular exercise training	1.25	-0.05, 2.55	0.059
Work station	-1.24	-2.01, -0.46	0.002
Lack of energy	0.48	-0.18, 1.14	0.155
Physical exertion	-0.32	1.04, 0.39	0.37
Physical discomfort	-0.71	-1.42, -0.005	0.048
Lack of motivation	-0.86	-1.53, -0.19	0.012
Sleepiness	-1.22	-1.93, -0.25	0.001

Discussion

In this cross-sectional study, we found that work ability of the workers in a large automotive company was significantly affected by the fatigue dimensions. Also, the work station, smoking, and regular exercise training were associated with WAI.

Work ability is an important issue in occupational health as it can affect the efficiency of the workers, and WAI is used as a standard assessment tool worldwide[20]. It can increase employees' sustainable employability by examining their workability and whether they are at risk. Therefore, it helps them to become more employable and reduce levels of sickness and absence from work.

Several studies have discussed variables affecting work ability in various occupational settings. Socio-demographic and psychosocial factors were related to work ability among 168 cemetery workers, and the main factor was the quality of leadership [21]. In a study in Iran on 280 workers, occupational injuries were the strongest predictors of WAI scores and was a strong association between WAI scores and supervisor support, skill discretion, occupational training, sleep quality, work nature, and educational level [20]. However, none of their determinants was similar to our variables. In another study, the authors evaluated the effect of work-related and sociodemographic factors on work ability among 167 employees of a company [22]. Their results showed that age, sex, smoking, regular exercise activity, and sleep quality were significantly associated with the WAI. From their variables, smoking and regular exercise training were similar to ours and confirmed our findings.

On the other hand, fatigue is also a common condition among workers, and its prevalence can even reach 75% in some specific careers [11]. Various factors have been recognized to influence fatigue in the general population, such as age, sex, physical activity, and socioeconomic status [12]. A study in a car factory in China showed that the workers generally felt more fatigue and less satisfaction than the engineers [23]. Also, work-related factors, such as working environment, duration of work, and monotony, were significantly correlated with fatigue.

Moreover, fatigue can result in a decrease of attention, alertness, and vigilance, prolonged reaction time, distorted judgment, lack of motivation, disturbed memory, reduced field of vision, and drowsiness in the workers [24]. All these together mean a higher rate of injury and events in the workers at their workplace.

Some studies have discussed the association between fatigue and work ability. In a much-related study to ours that investigated the association between fatigue and work ability in cancer survivors, a reduction of five points on general fatigue was associated with an improvement of one point in perceived WAI. Additionally, changes in physical and mental fatigue were significantly inversely associated with a change of perceived work ability [25]. These results were confirmed in a comparable longitudinal study [26]. A similar study on breast cancer patients, there was a significant relationship between self-reported attentional fatigue and perceived work ability. Although these studies are conducted on cancer patients and do not reflect occupational fatigue or work ability, they are valuable clues to show how much fatigue

is related to work ability. In a study on 110 nursing professionals, 43% of the participants had residual fatigue, which was significantly associated with a reduction in work ability [27]. One study showed that fatigue was more frequent in unmarried workers, and they also had higher WAI scores than the other marital status workers [28]. Also, those who had mental work tasks had a lower rate of fatigue and higher WIA scores. Overall, fatigue scores were negatively correlated to the WAI scores, which is similar to our findings.

Our findings highlight the fact that fatigue is a critical occupational health issue in industrial workers that should be monitored regularly in the workers. Upon diagnosis of fatigue in a worker, proper interventions could help to solve the problem and reduce the burden on both the worker himself and the workplace by reducing the harms and adverse events.

Study limitations

This study included workers from a single company, so its results could not necessarily be generalized to other workers with a different job setting. Moreover, this study is affected by the healthy worker effect because not all the studied workers had a major health problem that could affect the work ability index.

Conclusion

In this study on the workers of a large automotive corporation in Iran, we observed that fatigue dimensions and the WAI. This confers occupational fatigue in industrial workers can significantly influence their output and efficiency. Therefore, the use of fatigue monitoring programs at workplaces can help much to reduce fatigue in the workers and improve safety and efficiency. Future studies should focus on the preventive measures for occupational fatigue or treat it in those who already have it.

Abbreviations

SOPHI
Swedish occupational fatigue inventory
WAI
Work ability index

Declarations

Ethics approval and consent to participate

All participants of the study signed the written informed consents. Participation was voluntary and confidentiality was guaranteed through anonymous data gathering. Indeed, this study has been approved by the Ethics Committee at Tehran University of Medical Sciences (IR.TUMS.MEDICINE.REC.1397.284).

CONSENT FOR PUBLICATION

We declare that this manuscript is original, not previously published, and not under concurrent consideration elsewhere.

AVAILABILITY OF DATA AND MATERIALS:

Data is available upon request.

COMPETING INTERESTS:

The authors declare that no conflict of interest exists.

Funding:

This study was funded by Tehran University of Medical Sciences, Tehran, Iran.

AUTHORS CONTRIBUTIONS

SAS conceived and designed the experiments, performed the experiments; contributed reagents, materials, analysis tools & data, drafted and edited the paper

SE conceived and designed the experiments, analysed and interpreted the data, contributed reagents, materials, analysis tools & data and edited the paper

OA conceived and designed the experiments and edited the paper

TB conceived and designed the experiments, performed the experiments; contributed reagents, materials, analysis tools & data, wrote and edited the paper

SRR did the data collection

All the authors read and approved the final version of this manuscript

ACKNOWLEDGMENTS

This study was supported by Tehran University of Medical Sciences and SAIPA automotive corporation, Tehran, Iran.

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