

Examining Fatigue and Insomnia Symptoms Among Workers of a Gas Transmission Industry in 2013

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Abstract

Background: Fatigue, which interferes with one's physical and mental operation, resulting in strength reduction and weakness, is considered one of the most important issues in the workplace. In addition, it can cause diseases, occupational accidents, and a reduction in an individual's efficiency. The aforementioned effects can be aggravated by fatigue in shift workers who experience sleep disturbance. The aim of this study was to investigate fatigue and the Insomnia Severity Index (ISI) among workers of a gas transmission industry in 2013.

Methods: This descriptive analytical study was conducted among 300 workers of the aforementioned industry and required data was collected via the face-to-face survey method and questionnaires. Data analysis was done with the following techniques: Mann-Whitney, variance analysis test, independent t-test, Kruskal-Wallis, Spearman's correlation test, and chi square test.

Results: The highest fatigue scores among fixed-dayshift and rotating-shift workers were 6 and 7, respectively, and the fatigue level for both groups was 4. The average of all symptoms associated with fatigue and the total score on the Insomnia Severity Index in rotating-shift workers were higher than for dayshift workers and there was a significant difference between them ($P=0.001$). Lack of concentration, exhaustion, and fatigue during work were the most common symptoms of fatigue among the aforementioned shift workers in this evaluation.

Conclusion: The findings indicated that the level of fatigue and severity of insomnia among workers of this gas transmission industry is very high. Since this can lead to occupational accidents and efficiency reduction, it is necessary to provide workers with opportunities such as short breaks during working hours, rest and exercise during work, paying adequate attention to the workers' human needs, and improving work systems.

Keywords: fatigue, insomnia severity index, fatigue symptoms, shift work

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1. Introduction

Unsuitable working conditions that cause fatigue are considered a problem in gas industries. On the other hand, individual errors caused by fatigue can result in irreparable physical and financial losses. For these reasons it is necessary to pay attention to fatigue-related problems in these industries. Fatigue is considered one of the most important issues in the workplace. Fatigue can be defined as an increasing difficulty in mental and physical activities due to inadequate sleep (1). In another definition, fatigue is complaining continuously during the day due to insomnia (2, 3). Generally, fatigue is defined as a situation resulting in the reduction of body resistance and an

individual's willing to do activities and daily affairs (4). The basis of fatigue in medical chronic diseases is not fully understood. Fatigue is the main cause of complaints and an important reason for disabilities in many of workers' medical problems. Fatigue's pervasive impact can be seen in all aspects of human life (5). Moreover, fatigue is the first sign of a chronic disease that can affect an individual's working ability negatively.

The total annual cost of work force losses and unemployment due to fatigue effects is estimated at about 6.8 billion dollars (6). When someone is tired, it becomes more likely for them to make small errors and to not function normally (7). In a study conducted by the American Transport Safety Association on 107 accidents, it was shown that 57 percent of the accidents were due to fatigue (8). Fatigue interferes in physical, mental, and emotional functions and leads to weakness and a decrease in energy. Generally, fatigue causes people to feel confusion and experience a decrease in physical function, automatic nervous system imbalance, and reduced work efficiency (9). In addition, it can cause diseases and worsen symptoms of illness such as psychosis, cardiovascular problems, obtuseness, weakness, memory loss, muscle pain, amnesia, and imbalance. In studies done by Hossain and Jeam, it is explained that fatigue, which is an inhibitor factor in all works, causes workers to do tasks incorrectly, which consequently leads to a reduction in work efficiency (10, 11). The aim of this study was to examine the symptoms of fatigue and insomnia and their complications and symptoms among workers of a gas transmission company in 2013.

2. Materials and Methods

This cross-section analytical study was conducted at a gas transmission company in 2013. Three hundred participants were selected based on a confidence level of 0.95, a statistical power of 0.8, and an absolute error of 0.25. The participants were from two shifts: fixed (day shift) and rotating (night shift). The data were gathered through the stratified random method and required data was collected by the face-to-face survey method and using a standard questionnaire, which was designed by the Japanese Ministry of Health, Labor, and Welfare and was translated into Persian by Ghasemkhani and colleagues (9, 12). The questionnaire consisted of a) demographic data (age, sex, marital status, educational status, duration of employment, shift and task type, height, weight) as independent variables, b) fatigue symptoms in the previous month as dependent variables, and c) work conditions (overtime work, business trips, rest time and facility amount, physical and mental work-related burdens). For computing the final score which determines fatigue level, sections b) and c) were evaluated separately. By adding up the scores of sections b) and c), a score between 0-7 was computed, which determined the range of fatigue level. With the help of this score, the fatigue level of an individual in a specified range containing 4 different levels was obtained (level 1 indicates a low fatigue level, level 2 shows an approximately high level of fatigue, level 3 shows a high fatigue level, and level 4 indicates a very high level of fatigue). In this study, Cronbach's alpha was used for computing the reliability of the test, which was 0.923 and indicated the validity of the used questionnaire.

The Questionnaire of Insomnia Severity Index was also used in this study. It indicates insomnia rate and consists of seven questions that each have a score of 0-4. Scores of 0-7 in this questionnaire show the normal range (no clinically significant insomnia), 8-14 indicate a sub-threshold insomnia disorder, 15-21 a moderate clinical insomnia disorder, and 22-28 a severe clinical insomnia disorder (13). The reliability of this questionnaire, computed by Cronbach's alpha, was 0.876. In order to analyze the gathered data, the 18th edition of SPSS software was used. For evaluating the aims and hypotheses of the study, descriptive statistics (such as frequency and percentage) and inferential statistics (such as Spearman's Correlation Coefficient and Chi Square Test) were employed. Moreover, the means of the groups were compared using T-test, Mann-Whitney, Kruskal-Wallis Test, and Analysis of Variance (ANNOVA).

3. Results

3.1. Socio-demographic Background

The mean age of participants was 31.61 ± 5.81 and 52.7% of them were under 30 years old. Among the participants, 60.3% were married, and the others were single. On average, workers had 6.72 ± 5.44 years of work experience. Sixty-six-point-seven percent (66.7%) of participants worked during the workday and 33.3% worked the night shift. Out of all participants, 26.3% were of low literacy, 47.7% had a high school diploma, and the others had a high school diploma and above. The mean body mass index of the workers was 26.07 ± 9.68 .

3.2. Fatigue

The results showed that the level of fatigue risk in this company was level 4. There was no significant relationship between fatigue level and educational status. Using the Spearman test, we found no significant relationship between age, duration of employment, and fatigue score ($P > 0.05$). Employing the Kruskal-Wallis Test, it was found that

that the highest levels of fatigue were in jobs related to storehouses, administration, and shipping services, respectively ($P = 0.001$). Chi square test results showed that there was a significant relationship between the effects of fatigue on an individual's life and the level of fatigue risk ($P = 0.01$). There was also a significant relationship between the effects of fatigue on social life and the level of fatigue risk ($P = 0.001$). However, there was no significant relationship between the effects of fatigue on family life and level of fatigue risk in chi square test results ($P > 0.05$). The highest fatigue level in the two shifts and total workers was level 4. Fatigue score and existence of its main symptoms in rotating-shift workers were more than in fixed-shift workers and were statistically significant ($P < 0.05$).

Fatigue scores and existence of its main symptoms in married workers were more than in single workers and were statistically significant ($P < 0.05$). Scores of the Insomnia Severity Index showed that 13.3% of total workers had no clinically significant insomnia, 36% had sub-threshold insomnia, 39.7% had moderate clinical insomnia, and 11% suffered from severe clinical insomnia. According to data gathered from the questionnaire, 52% of participants felt a lot of anxiety about their sleep. In addition, 42.6% of them declared that their sleeping problems had seriously affected the quality of their lives. Spearman's correlation test showed that there was an inverse relationship between the workers' body mass indexes and insomnia severity. That is, a higher body mass index led to a lower Insomnia Severity Index ($P = 0.029$, $r = -0.126$). For analyzing the means of the insomnia severity amount in occupational groups, the variance-analyzing test was used; the results showed that there was a significant difference in the means of insomnia severity amount among occupational groups. The highest severity of insomnia was among the workers of the storehouse section ($P = 0.001$); the highest score also belonged to this group for the fatigue issue. Comparing the means of the Insomnia Severity Index score in the two groups of rotating and fixed shift was done by an independent t-test, which showed that the score mean in the night shift was higher than in the day shift and was significant ($P = 0.01$). A significant relationship between the Insomnia Severity Index and fatigue-related symptoms was found by using Spearman's correlation test (Table 1).

Table 1. Correlation Coefficient between fatigue symptoms and Insomnia Severity Index (ISI)

Fatigue Symptoms	Correlation Coefficient	p-value
Irritable	0.514	0.001
Anxiety	0.531	0.001
Restless	0.555	0.001
Depression	0.402	0.001
Inability to sleep	0.511	0.001
Bad physical condition	0.541	0.001
Lack of concentration	0.474	0.001
Make mistake during working	0.459	0.001
Feeling tired at work	0.453	0.001
Motivated toward the work	0.496	0.001
Exhaustion	0.564	0.001
Exhaustion after sleeping	0.490	0.001
Faster Exhaustion	0.522	0.001

4. Discussion

In this study, the highest frequency of fatigue risk level was level 4, which indicates the existence of a high level of fatigue in this company. In a study conducted by Abbasinia in the Rolling Mills and Steel Production Company, the results showed that the highest fatigue level in the two mentioned shifts and total workers was level 4 (1). Also, in another study conducted by Ghasemkhani, it was revealed that the highest fatigue level in the two investigated shifts and total workers was level 4 again (3).

Comparing the duties based on fatigue level in the present study showed that the highest levels of fatigue were in jobs related to storehouses, administration, and shipping services, respectively. In the study of Abbasinia, it was found that the highest fatigue level was in storekeeping jobs; these results are in accordance with the results of the present study. This factor is related to unsuitable environmental conditions in storehouses, high workload, a lot of physical jobs, and also fewer numbers of manpower compared to high workload (1). In this study, no significant relationship between the fatigue level and educational status was found by using the chi square test, and among age, duration of employment, and fatigue scores by using Spearman's correlation test. In the study of Abbasinia, a

significant relationship was found among fatigue level, educational, and marital status and also among age, duration of employment and fatigue scores (1). In the study conducted by Halvani, the results showed a statistically significant relationship between fatigue duration time and educational status (14) and were in accordance with the study of Grand Jeam (11). The results also showed that fatigue might affect individual and social life. It can be concluded that people want to remove fatigue and this inhibits them from attending social ceremonies.

4.1. Fatigue and Shift Work

The results of this study showed that fatigue level in night shift workers was higher than in day shift workers. This issue proved the hypothesis of the present study, which was the work shift effect in fatigue. As mentioned before, fatigue-related symptoms in night shift workers were more common. This difference in fatigue levels was related to work shift systems, sleep disorders, and circadian cycle dysfunction. The results of the present study are in accordance with the findings of Ghasemkhani and Abbasinia et al., and also the findings of related studies in other countries. In the two mentioned studies, fatigue levels were reported lower in day shift workers than in workers of the night shift (1, 3). However, the results of the present study are not in accordance with the study of Halvani et al. conducted in Yazd Tile Industries. They reported that most workers began to feel fatigued in the early afternoon and that night shift workers felt fatigued less, due to having two jobs among participants who had worked in other places before the shift started (14). In the present study, sleep disorder-related problems were the reason for most fatigue in night shift workers and the means of all fatigue-related symptoms in rotating-shift workers were higher than in fixed-shift workers and were statistically significant - the same as in a study conducted by Ghasemkhani and colleagues (3).

4.2. Fatigue and Material Status

In this study, the mean of all fatigue-related symptoms in married workers was higher than in singles, and was statistically significant. In this assessment, the highest mean belonged to fatigue symptoms in the two investigated shifts, marital status, lack of concentration, exhaustion, and fatigue while on duty. In the study done by Ghasemkhani et al., the highest mean of fatigue symptoms in the two mentioned shifts also belonged to lack of concentration, exhaustion, and fatigue while on duty (3, 9). In addition, in the study conducted by Jafari et al. in their study on examining fatigue among workers of Mashhad Albasco factories, the results showed that the main symptoms of fatigue were lack of concentration (65.2%), anxiety (48.5%), feeling tired in legs (46.3%), and backache (44.2%) (9). Concerning the two aforementioned studies, it can be concluded that the main and most common fatigue symptom was lack of concentration in work.

4.3. Insomnia

The results of this study showed a systematically significant difference in the mean of the Insomnia Severity Index scores of the two investigated groups. The mean of this score in rotating-shift workers was higher than in fixed-shift workers. A strong correlation was seen between fatigue-related symptoms and the Insomnia Severity Index, which indicated that insomnia played a crucial role in all fatigue-related symptoms, and was one of the effective factors that caused these symptoms. In the study of Ghasemkhani et al., there were also differences in the mean of the Insomnia Severity Index scores between the two groups of rotating- and fixed-shift workers, which were statistically significant. In the aforementioned study, the mean of the Insomnia Severity Index scores in rotating-shift workers was higher than in fixed-shift workers [3]. The reason for the high prevalence of sleep disorders in night-shift workers may be that working during the night shift is not in accordance with the body's natural rhythms, such as the circadian cycle and the secretion of sleep-related hormones like melatonin. It has been proven that working during the night shift long-term may not lead to the body's total adaptation. Night-shift workers have to compensate in the daytime for the sleep that they don't get overnight. The quality of the day sleep, due to disturbing factors, is not as high as that of the night sleep. Therefore, as long as sleep quantity remains equal, the quality of sleep in night-shift workers is lower than in day-shift workers.

5. Conclusion

In sum, the results of the present study showed that fatigue level and Insomnia Severity Index scores were at a high level among workers of a gas transmission company. Concerning these results, authorities should upgrade the physical and mental health levels of manpower, and in addition create a fatigue risk management system, which is an international standard for decreasing fatigue risk in workplaces. Managers should provide enough time for workers to rest and pay attention to workers' human needs. Further research can be done on assessing fatigue with regard to physiological and biochemical indicators.

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Conflict of Interest:

There is no conflict of interest to be declared.

Authors' contributions:

All of authors contributed to this project and article equally. All authors read and approved the final manuscript.

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