Sleepiness and Performance among Oil Rig Onshore Shift Workers in Thailand

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ABSTRACT

Shift work is associated with negative impact on workers’ performance, safety and health due to circadian rhythms disturbance and sleep deficit. The purpose of this study was to assess performance and sleepiness among Thai oil rig onshore shift workers. Healthy Thai onshore shift workers who work on a 12-hour swing shift in an oil and gas company in Thailand participated in this study. The work cycle started from one week of night shifts followed by one week of day shifts. All participants were asked to rate their sleepiness using the Epworth Sleepiness Scale (ESS) questionnaire at the first visit. Furthermore, the participants performed the finger tapping (FT) test in an android application at the pre- and post-shift at the beginning and end of “Night” and “Day” shift period. For the FT test, each participant was instructed to use the index finger to tap on a response button as fast as possible within a 10-second time interval. The total of 38 male-shift workers with a mean age of 36.1±7.87 years participated in this study. The results showed that the mean ESS score was 8.84±4.03 and 63.2% of the participants had an ESS score in the normal range (ESS = 0-10), 31.6% had mild to moderate degree of sleepiness (ESS = 11-15), and 5.3% had severe degree of sleepiness (ESS > 16). For the “Night” shift period, the mean left FT rates on “Night 1” and “Night 7” of the pre-shift were 60.32±6.21 times/10 seconds and 61.39±7.43 times/10 seconds, respectively and of the post-shift were 56.24±5.43 times/10 seconds and 58.76±6.93 times/10 seconds, respectively. The mean right FT rates on “Night 1” and “Night 7” of the pre-shift were 65.11±6.49 times/10 seconds and 65.79±7.82 times/10 seconds, respectively and of the post-shift were 61.08±7.23 times and 63.5±7.44 times/10 seconds, respectively. The results showed that, for the “Night” shift period, the mean left and right FT rates of the post-shift were significantly less than those of the pre-shift ($p < 0.05$). For the “Day” shift period, the mean left FT rates on “Day 1” and “Day 8” of the pre-shift were 60.08±6.98 times/10 seconds and 61.03±6.73 times/10 seconds, respectively and of the post-shift were 62±6.54 times/10 seconds and 61.76±6.87 times/10 seconds, respectively. The mean of right FT rates on “Day 1” and “Day 8” of the pre-shift were 64.74±7.94 times/10 seconds and 65.97±7.82 times/10 seconds, respectively and of the post-shift were 65.68±10.35 times/10 seconds and 67.66±8.06 times/10 seconds, respectively. The results showed that in general, for the “Day” shift period, the mean left and right FT rates of the post-shift were significantly greater than those of the pre-shift ($p < 0.05$). The onshore shift workers revealed poorer performance during the “Night” shift period than the “Day” shift period which might be due to the perturbation of circadian rhythms and sleep loss. It might lead to poor quality of life and higher risk of accident in shift workers. Thus, work scheduling and effective assessment of performance and sleepiness should be of concern to the organization.

Keywords: Sleepiness, Shift workers, Finger tapping test, Epworth sleepiness scale

1. Introduction

The shift workers, especially those who work night shifts, commonly encounter with sleep problems in terms of poor sleep quality and short sleep length (Åkerstedt & Wright, 2009; Boivin & Boudreau, 2014). Several studies suggested that disturbance of circadian rhythm is an important factor affecting the performance of the shift workers (Costa, 2003; Gumenyuk et al., 2014; Hildebrandt & Stratmann, 1979). Other factors associated with performance impairment of the shift workers include such factors as individual factors, social factors and working condition factors. However, due to multidimensional nature of fatigue, there is still inconclusive evidence for the factors that have direct effect on the performance of the shift workers (Costa, 2003). A study revealed that performance impairment of the workers on swing shift was due to excessive sleep loss (Waage et al., 2012).
Even though previous studies (Bohle & Tilley, 1989; Boivin & Boudreau, 2014) reported the negative impact of night shift work, shift work system is still vital in industries due to economic competition. A 12-hour shift is common among oil and gas companies in Thailand. However, it could have negative effects on workers’ health, relationships with family and co-workers, performance and rate of injury (Akechi et al., 1999; Costa, 2003; Swaen et al., 2003). Waage and colleagues (2012) assessed the sleepiness and performance among the oil and gas shift workers in Norway during the 2-week shift work period. They found that the performance of the workers during night shifts tended to be poorer at the post-shift compared to the pre-shift. On the other hand, they found significant improvement of workers’ performance on the last day of the working period. Other studies (Breithaupt et al., 1978; Volná & Šonka, 2010) also reported poor performance among night shifts workers due to sleep deficit. Thus, it is necessary to evaluate sleepiness and performance among shift workers to promote health and safety of the workers.

However, to date no study has investigated sleepiness and performance among oil rig shift workers in Thailand. Accordingly, the aim of this study was to evaluate sleepiness and performance among Thai oil rig onshore shift workers.

2. Method

The observational study design was conducted among oil rig onshore shift workers who worked on a 12-hour swing shift in an oil and gas company in Thailand during September to October 2016. This study was approved by Mahidol University Institutional Review Board.

2.1 Demographic questionnaire

The demographic questionnaire was used to collect information about age, weight, height, job position and work experience. The participants were asked to fill in the questionnaire at the first visit.

2.2 Epworth Sleepiness Scale (ESS) questionnaire (Thai version)

At the first visit, each participant was asked to rate the chance of dozing or sleeping in 8 situations with rating scales range from 0-3 (0 = would never doze or sleep, 1 = slight chance of dozing or sleeping, 2 = moderate chance of dozing or sleeping, 3 = high chance of dozing or sleeping). The total scores greater than 10 is considered as abnormal condition (Johns, 1991). This study used ESS in Thai version. The internal consistency and test-retest reliability were high (Cronbach’s alpha = 0.87; ICC = 0.79) (Banhiran et al., 2011).

2.3 Finger tapping (FT) test

The finger tapping (FT) test was used to evaluate motor performance and sleep onset which is represented by the FT performance. The participants performed the FT test for left and right hand in an android application at the pre- and post-shift on Night 1, Night 7, Day 1 and Day 8 within 2 hours before and after shift. Statistical analyses were performed by using SPSS version 21. Demographic characteristics were analyzed by descriptive statistics. Kolmogorov Smirnov Goodness–of–fit test was used to test for normality of the data. Wilcoxon Signed Rank Test was used to compare the FT rates at the pre- and post-shift. The alpha was set at 0.05.

3. Results

3.1 Demographics information

The total of 38 male-shift workers with a mean age of 36.1±7.87 years participated in this study. Of all participants, 13.2% were workers younger than 30 years old, 71.1% were between 30-40 years old, and 15.8% were over 40 years old. Regarding the job positions of the participants, the results showed that 7.9% were production supervisor, 15.8% were production team leader, 50% were production operators, 7.9% were lab technician, 5.3% were depot operators, 7.9% were operator telecommunication service, and 5.3% were power plant operation and maintenance. The mean of worker’s experience in shift work was 8.6±7 years. With regard to work experience in shift work, of the total participants, 13.2% had experience less than 3 years, 71.1% had experience between 4-10 years, 5.3% had experience between 11-20 years, and 10.5% had experience more than 21 years.
3.2 Epworth Sleepiness Scale (ESS)

The result showed that mean ESS score was 8.84±4.03. Of all participants, 63.20% had ESS score in the normal range (ESS = 0-10), 31.60% had mild to moderate degree of daytime sleepiness (ESS = 11-15), 5.30% had severe degree of daytime sleepiness (ESS > 16). The results indicated that 36.9% of all shift workers had excessive daytime sleepiness (Figure 1).

![Figure 1 Percentage of participants classified by level of daytime sleepiness based on ESS score (n=38)](image)

3.3 Finger Tapping (FT) test

For the “Night” shift period, the mean left FT rates on “Night 1” and “Night 7” of the pre-shift were 60.32±6.21 times/10 seconds and 61.39±7.43 times/10 seconds, respectively and of the post-shift were 56.24±5.43 times/10 seconds and 58.76±6.93 times/10 seconds, respectively (Figure 2). In addition, the mean right FT rates on “Night 1” and “Night 7” of the pre-shift were 65.11±6.49 times/10 seconds and 65.79±7.82 times/10 seconds, respectively and of the post-shift were 61.08±7.23 times/10 seconds and 63.50±7.44 times/10 seconds, respectively (Figure 3).

The results showed that, for the “Night” shift period, the mean left and right FT rates of the post-shift were significantly less than those of the pre-shifts (p < 0.05). This result is in accordance with a previous study (Taylor & McFatter, 2003) which reported less FT rates at the end of the “Night” shifts due to sleepiness. The decline in performance after “Night” shifts indicated that “Night” shift work affects the circadian rhythm.

For the “Day” shift period, the mean left FT rates on “Day 1” and “Day 8” of the pre-shift were 60.08±6.98 times/10 seconds and 61.03±6.73 times/10 seconds, respectively and of the post-shift were 62±6.54 times/10 seconds and 61.76±6.87 times/10 seconds, respectively (Figure 2). Moreover, the mean of right FT rates on “Day 1” and “Day 8” of the pre-shift were 64.74±7.94 times/10 seconds and 65.97±7.82 times/10 seconds, respectively and the post-shift were 65.68±10.35 times/10 seconds and 67.66±8.06 times/10 seconds, respectively (Figure 3).

![Figure 2 Left FT rates at the pre- and post-shift at the beginning and end of “Night” and “Day” shift period (n=38)](image)

![Figure 3 Right FT rates at the pre- and post-shift at the beginning and end of “Night” and “Day” shift period (n=38)](image)

The results showed that in general, for the “Day” shift period, the mean left and right FT rates of the post-shift were significantly greater than those of the pre-shift (p < 0.05).
During the “Day” shift, motor speed at the post-shift was improved. This finding is in contrast with a previous study by Maizlish and colleagues (1987) which found that “Day” shift showed significantly decreased in FT rates at the post-shift. In addition, our results showed that the best performance of the workers was at the end of “Day” shifts. This result is consistent with a previous study which reported that the psychomotor performance of the shift workers was the best at the last day of working shift (Waage et al., 2012). Thus, motivation might affect the shift work performance.

4. Conclusion

The oil rig onshore shift workers showed poorer performance during the “Night” shift period than the “Day” shift period which might be due to the perturbation of circadian rhythms and sleep loss. It might lead to poor quality of life and higher risk of accident in shift workers. Thus, work scheduling and effective assessment of performance and sleepiness should be of concern to the organization.

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