

Survey and comparison of sleep quality among fixed and changing shift staff in a steel factory in Tehran, Iran

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Abstract:

Background: Given the hazardous nature of the work in steel factories and that the staff has to deal with hazardous equipment and machines, improper sleep quality and drowsiness among the works tackles performance and boosts rate of job accidents. This study is aimed to survey the quality of sleep and sleepiness status and the pertinent factors among the workers in a rolling mill and a steel production company in Tehran, Iran.

Methods: In a Cross-Sectional study 2011, 180 workers were selected randomly from a rolling mill and a steel production company in Tehran. A questionnaire was designed to collect demographic data and variables of work condition. Pipersborg's sleep quality questionnaire was used to survey quality and problems of Participants' sleep. Epworth Sleepiness questionnaire was used to deals with sleepiness during work, studying, watching TV, or during time spent in public.

Results: Average score of sleep quality for the fixed shift staff and changing shift staff were 7.5 ± 2.82 and 8.49 ± 2.95 respectively. Surveys of sleep quality for the two groups of the participants based on T-test showed a significant difference between the two groups so that the changing shift staff group suffered poorer sleep quality ($p=0.03$). Comparison of average drowsiness scores between the two groups of participants based on Mann-Whitney test showed no significant difference ($p>0.005$). Chi square test showed a significant difference between severity of drowsiness and type of working shift ($p=0.028$ and 0.009).

Conclusion: Staff in revolving shifts suffers poor sleep quality comparing with staff with fixed working shift. Moreover, type of working shift greatly affects severity of drowsiness as staff at different work shift experienced different level of sleepiness. It is essential to survey sleep disorder of the staff in the industry and pay more emphasis on sleep disorder epidemic in other fields of industry.

Keywords: Sleep quality, Sleepiness, Fixed shift staff, Steel production, Occupational health

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1. Introduction

As a complicate biological pattern, sleep is one of the vital cycles of our life in every 24 hours (1). Sleep and wake cycle is one of the biologic cycles which is influenced by physiologic function, day and night and work schedule. Among many, our biological clock plays a dominant role (2). The term "quality of sleep" is common in sleep psychology, though there is no crystal definition for it. Quality of sleep is usually used to point out a set of measures

of sleep such as length of sleep, delay in falling asleep, level of discreteness of sleep, total awake time, sleep performance, and disturbances in some cases (3). On the other hand, sleepiness is a threat to general health along with work accident, work performance, and plenty of personal issues (4). Every day, 12% of the Americans suffer sleepiness (5). There are several reports on increasing rate of the disorder among overnight shift workers (6).

By sleep pattern, the effects of two processes of circadian rhythm (24 hours cycle) and homeostatic (balance) including adequacy of overnight sleep (quantity), mental quality of sleep and sleepiness during the day are under consideration (5). The literature review showed that mortality rate is higher for those with more than 8.5 hours and less than 3.5 hours sleep overnight (7). Ohayon et al. (2004) reported 20-40% of insomnia in West Europe communities, which was more common among women and senior citizen [6]. Another study showed that 50% of men and 31% of women take a nap during the day; 6.9% have problem in falling asleep, and 16.7% wake up early(8).

Sleep disorder is most common among workers with changing shift and overnight shift. Many workers (more than 60%) have confirmed sleep disorders (9). Literature review showed that overnight workers tend to have 2 hours shorter sleep. This means higher probability of over-weariness during the work and more immune disorders consequently (10). Given the hazardous nature of the work in steel factories and that the staff has to deal with hazardous equipment and machines, improper sleep quality and drowsiness among the works surely tackles performance and boosts rate of job accidents. Thus, studies on sleep disorders and drowsiness of the staff may help planning more successful programs for attenuating rate of job accidents and improving physical and mental health of the staff; higher performance in work is also expected. This study was aimed to survey the quality of sleep and sleepiness status and the pertinent factors among the workers in steel factories.

2. Material and Methods

2.1. Study design and population

This Cross-sectional and analytical research was carried out in 2011 year. Participants included workers in a rolling mill and a steel production company in Tehran. They worked in 3 shifts at 6 different units including warehouse, Installation, melt down, Painting, Machineries and Casting. Sample were selected randomly (180 individuals) based on level of confidence of 0.95 and test power of 0.8. Participants were from two fixed shifts (morning shift) and circular shift (night shift) groups.

2.2. Measurement tools and data collection:

For data gathering, questionnaires were filled out by interviewing the participants. Three questionnaires were used:

2.2.1. Demographic and work condition questionnaire

A demographic characteristics and work condition Questionnaire regarding the study of the age, work record, marital status and job were used (table1).

2.2.2. Pipersborg's sleep quality questionnaire

The questionnaire surveys quality and problems of adults' sleep. Pipersborg's sleep quality index is widely used as a measure of sleep quality all around the world. The index measures quality of sleep based on a set of variables such as delay in falling asleep, length of sleep, actual sleep time, use of sleep medicines and disorder of performance during the awake time (3,11). The questionnaire is comprised of 9 questions including four open ended (questions 1 to 4) and 5 questions based Likart's scale (questions 5-9). Question No.1 asks about usual sleep time; No. 2 deals with disorders of falling asleep; No.3 asks usual wake up time; No. 4 is about length of sleep; No.5 asks about disorders in length of sleep; No. 6 asks whether sleep pills are taken; No. 7 deals with drowsiness during the day; No. 9 is about subjective sleep quality. Seven scales constituted the questionnaire: subjective sleep quality, sleep latency, sleep efficiency, sleep disturbances, use of sleep medication, and day time dysfunction. The obtained scores were used to survey quality of sleep. Anbeh's measurement scale dictates 0-4 as good sleep quality and 5 < as poor sleep quality. Validity and reliability of the standard questionnaire have been confirmed severally in other studies. Mokarami et al. reported a reliability of the questionnaire 0.86 based on Cronbach's alpha. Validity of the questionnaire was further confirmed by Alouba et al. for a group of Nigerian students. Alhani et al. and Soleimani et al. as well checked reliability of the questionnaire using Cronbach's test and obtained 0.94 and 0.87 respectively (12-15).

2.2.3. Eporth Sleepiness questionnaire

This is a standard questionnaire of 8 questions, which deals with sleepiness during work, studying, watching TV, or during time spent in public. Based on the measure, the respondent assigned each questions with a point between 0 and 3 (0 = no taking nap; 1 = low possibility of taking nap, 2 = average possibility for taking nap; 3= high

possibility of taking nap). Score between 0 – 5 signals enough sleep or no drowsiness, 6-10 trivial drowsiness; 11-15 average drowsiness, and 16-24 strong drowsiness. In another classification, total score of 10 and higher is deemed as a herald of disorder. Ghazari et al reported reliability of the questionnaire (Cronbach's alpha) 0.73 and this figure in MasoudZadeh et al. was 0.70 (16, 17).

2.3. Statistical analysis

The data were analyzed using SPSS ver. 18 (SPSS Inc., Chicago, Illinois, Unites states of America) Descriptive statistics (frequency and percentage) and deductive statistics (Spearman's correlation test and Chi 2 test) were employed to survey the goals and hypotheses of the study. Moreover, Mann-Whitney and Kruskal–Wallis and variance analysis tests were used to compare the averages

3. Results

Average age of the participants in the study was 32.03 ± 6.01 and average work record was 7.27 ± 5.7 years. Married staff constituted 60% of the group; 50% had below high school diploma degree and 45.6% had the diploma, while the remainder of the group had higher education (table1). The fixed morning shift and overnight circular shift were filled by 63.3% and 36.7% respectively. Body mass of the participants was 25.44 ± 1.78 . Frequency distribution of sleep quality, each element of Pistborg's sleep index, and total point of the index are listed Table 2.

Table 1. Demographic characteristics and work condition of participants

Independent variable	Variable level	Frequency	%
Age (year)	<30	93	51.6
	30-39	64	35.6
	>39	23	12.8
Work record	<5	100	55.5
	5-10	39	21.7
	>10	41	22.8
Marital status	Single	72	40
	Married	108	60
Ward	Warehouse	34	19
	Installation	18	10
	Melt down	29	16
	Painting	20	11
	Machineries	20	11
	Casting	59	33

As represented in Table 2, average score of sleep quality in the study society is 7.86 with standard deviations of 2.9. Moreover, 12.2% and 87.8% have good and bad sleep quality respectively. Average score of sleep quality for the fixed shift staff and changing shift staff were 7.5 ± 2.82 and 8.49 ± 2.95 respectively. Surveys of sleep quality for the two groups of the participants based on T-test showed a significant difference between the two groups so that the changing shift staff group suffered poorer sleep quality ($P=0.03$). Maximum sleep quality score (poorer quality) is for the machinery ward staff and the best quality is for the installation ward staff.

Comparison of sleep quality among the different occupations using single side variance analysis showed a significant difference between quality of sleep in different professions ($p=0.04$). According to Chi Square relation, there is a significant relation between sleep quality and type of work shift ($P<0.005$); though no significant relation was found regarding marital status ($P>0.005$). On average, fixed shift staff went to bed at about 23:30 and for changing shift staff this figure was 23:38. Man-Witty text showed that there is no significant difference in this regard ($P>0.005$).

Average time of preparation for going to bed for fixed shift and changing shift staff were 27'56" (standard deviation 18.78) and 31'27" (standard deviation 19.8) respectively. Once again, Man Witty test showed no significant difference ($P=0.007$). In comparison with changing shift staff, Chi square test showed that falling asleep disorders was 30min shorter among staff in fixed shifts and the difference was significant ($P=.007$).

Table 2. Frequency distribution of sleep quality, the elements of Pitsborg's sleep index, and total average point

Parameter		Frequency	%
Subjective Quality of sleep	Very good	16	8.9
	Almost good	99	55
	Almost bad	56	31.1
	Very bad	6	5
Disorder in falling asleep	Less than 15min during the last month	59	32.8
	16-30min less than once a week	73	40.6
	31-60min one or two time per week	44	24.4
	>60 more than three times per week	4	2.2
Sleep time	More than 7hours.	11	6.1
	6-7hours.	17	9.4
	6-5hours.	150	83.3
	Less than 5hours.	2	1.1
Sleep efficiency	More than 85%	162	90
	74-84%	16	8.9
	65-84%	1	0.6
	Less than 65%	1	0.6
Sleep disturbance	No disturbance	13	7.2
	1-9	139	77.2
	10-18	26	14.4
	19-27	2	1.1
Use of sleep medicine	No medicine taken during the last month	92	51.1
	More than once a week	55	30.6
	One/two times a week	29	16.1
	Three or more times a week	4	2.2
Problem during the day	No problem	20	11.1
	1-2	80	44.4
	3-4	64	35.6
	5-6	16	8.9
Quality of sleep	Good	22	12.2
	Bad	158	87.8

Table3. Prevalence rate of disorders according to Eporth's drowsiness questionnaire

Elements of ESS questionnaire	No napping	Low possibility of napping	Average-high possibility of napping
Studying	125 (69.4%)	46 (25.6%)	9 (5%)
Watching TV	102 (56.7%)	72 (40%)	6 (3.4%)
Sitting in pubic space	56 (31.1%)	107 (59.4%)	17 (9.4%)
In car	37 (20.6%)	104 (57.8%)	39 (21.7%)
Reposing to take a rest	11 (6.1%)	33 (18.4%)	136 (75.5%)
Sitting and talking	157 (87.1%)	19 (10.6%)	4 (2.3%)
Sitting after lunch	38 (21.1%)	95 (52.8%)	47 (26.1%)
In traffic jam	146 (81.1%)	27 (15%)	7 (3.9%)

More than 89% of the staff reported disorders in carrying on daily work which was due to poor sleep quality. Moreover, the results showed that 48.9% of the participants needed sleep medicine (prescribed or not prescribed). Concerning the age, three classes were devised and single side variance analysis was used to survey average score of sleep quality. No significant difference was found between the three age classes ($P>0.005$). Participants with enough sleep, light drowsiness, average drowsiness, and heavy drowsiness constituted 30, 57, 10.6, and 2.4% of the study group respectively.

Table 3 lists prevalence rate of each disorder pointed out in Eporth's drowsiness questionnaire. Comparison of average drowsiness scores between the two groups of participants based on Mann-Whitney test showed no significant difference ($P > 0.005$). Kruskal Wallis tests was used to check difference of drowsiness rate among the age classifications (20-30; 30-40; and >40 years) and no significant difference was confirmed ($P = 0.469$). Chi square test showed a significant difference between severity of drowsiness and type of working shift ($P = 0.028$ and 0.009); though the same was not true regarding marital status and education ($P > 0.005$). Concerning body mass index (BMI), the participants were classified into three groups of 20, 20-25, and $25 <$ years. Variance analysis test concerning drowsiness among the three groups showed no significant difference ($P = 0.78$).

4. Discussion

Our results showed that considerable percentage of the participants suffered from poor sleep quality (87.8%). As listed in Table 2, length of sleep of the participants (83.3%) was varied between 5-6hours. (less than minimum prescribed sleep). Moreover, sleep quality among changing shift staff was worse than that of fixed shift staff. This is inconsistent with Makrami et al.; high rate of sleep disorders of the staff was probably due to early morning start of the shift (5a.m.); add to that many staff had to woke up earlier to attend the work in time (probably 4a.m.) (12). Saremi et al. pointed out the same point. Start of working shift for the participants in the study was at 8a.m. Although many works have confirmed significant relation between higher sleep disorder induced by working shift and age (18), we found no significant relation in this regard. One explanation might be critical age range regarding work shift 40-50, and our participant were not in this rage. Average age of the participant in our study was 32.03, and probably as the staff grew older they were replaced by younger work force. Moreover, variance analysis was used to examine difference of drowsiness among the three age classes (20-30, 30-40, and >40 years) and no significant difference was found ($P = 0.469$). This is not consistent with the results of Harma et al. Their study was conducted in vitro to check effect of age and work shift and showed that participant in younger age experienced more drowsiness and vice versa (19).

The results showed that quality of sleep was not significantly different between married and single participants. Mohammad et al. studied a group of overnight guards in hospitals and showed that the married guard significantly enjoyed better sleep than the singles. In addition, this study is inconsistent with the results by Koslowsky et al. Mokarami et al. and Hojati et al. studied relation between marital status and sleep quality and found no significant difference, which is consistent with our study. (12, 20–22). Regarding work safety and health, Sanjari studied relation between sleeping quality and work accidents and showed that inadequate sleep and chronic weariness are significantly related. Clearly, drowsiness and sleep disorder among workers is critical consideration e that suffer poor sleep quality at night are more probable to have poor work performance during the work and more susceptible to work accidents (23).

5. Conclusion

In summary, our findings showed that the changing shift staff group suffered poorer sleep quality. The results showed that staff in revolving shifts suffers poor sleep quality comparing with staff with fixed working shift. Moreover, type of working shift, as the results demonstrated, affects severity of drowsiness as staff at different work shift experienced different level of sleepiness. Sleep disorders affects mental and physical health not only directly and indirectly, but also tackle performance and quality of the work done by the staff. It is essential, therefore, to survey sleep disorder of the staff in the industry and pay more emphasis on sleep disorder epidemic in other fields of industry. The problem should be dealt with based accurate understanding of the causes and intensity of the disorder in Iranian society to achieve proper intervention relative to specific feature of Iranian society. Taking into account importance of sleep disorder, great deal of emphasis needs to be paid to medical consultation to find sleep disorders and prevent probable work accident. This also improves performance of the staff. In Industries, a changing shift schedule is provided to workers considering the load work and needs. As a type of decision making, the schedule increase workers' social and family problems, and affects their sleep quality and biological setting of their body. It seems that those changing shift schedules according to biological cycles and biological sciences are highly effective in reducing problems associated with changing shift. There are still a lot of things to do locally to be able to assess the quality of sleep and sleepiness status and the pertinent factors among the workers in steel factories. With the available studies, one cannot confidently say that we know enough about the specific effects of changing shift in the staff. There is still a need for more detailed researches to be able to provide empirical evidence of changing shift effects and to be able to make relevant interventions to improve the workers' health and well-being. Currently, the high demand for shift workers in the steel industry and the attractive financial incentives are the major

considerations why workers decide to go on changing shift in the Iran. Additional information resulting from shift work researches can also help workers decide whether changing shift is suited for them.

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Conflict of Interest:

There is no conflict of interest to be declared.

References

1. Williams S. Health psychiatric nursing. St.Louise: Philadelphia: *Mosby*;1993.
2. Lima PF,Medeiros Ald, Araujo JF. Sleep- Wake pattern of medical student: early versus late class starting time. *Braz J Med Biol Res.* 2002;35(11):1373-77.
3. Buysse DJ, Reynolds CF, 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res.* 1989 May;28(2):193–213.
4. Hidalgo MP, De souza CM, Zanette CB, Nunes PV, Associação of daytime sleepiness and the morningness/eveningness dimension in young adult in Brazil, *Psychol Rep.* 2003 oct; 93(2): 427-34 .
5. Dekker NS, Ruggiero JS, Hedges C. Sleep is related to physical function and emotional well-being after cardiac surgery. *Nurs Res.* 2004;53(3):154-62
6. Ohayon MM, Lemoine P. Sleep and insomnia markers in the general population. *Encephale* 2004;30(2):135-140.
7. Kripke DF, Garfinkel L, Wingard DL, Klauber MR, Marler MR. Mortality associated with sleep duration and insomnia. *Arch Gen Psychiatry.* 2002;59:131-6.
8. Ursin R, Bjorvatn B, Hølesten F. Sleep duration, subjective sleep need, and sleep habits of 40 to 45 year olds in the hordland health study. *Sleep.* 2005;28(10):1260-9.
9. Sadeh niat Kh. [Cross sectional effect of sleep abnormality and occupational activity]. *Holistic third congress of sleep abnormality.* 2005; 27.
10. Caldwell JL, Gilreath SR (2001). Work and sleep hours of U.S. army aviation personnel working reverse cycle. *Military Medicine.* 166(2): 159-166.
11. Nutson KL, Rathouz PJ, Yan LL. , Liu K, Lauderdale DS . Stability of the Pittsburgh sleep quality index and the epworth sleepiness questionnaires over 1 year in early middle-aged adults: the CARDIA study. *Sleep.* 2006; 29(11): 1503-6.
12. Mokarami. H, Kakooei. H, Dehdashti .A, Jahani .Y, Ebrahimi. H. Comparison of general health status and sleeping quality of shift workers in a car industry workshop 2008. *Behbood.* 2010;14(3): 237-43.
13. Soleimany MA, Masoodi R, Sadeghi T, Bahrami N, Ghorbani M, Hassanpoor Dehkordi A. General health and its association with sleep quality in two groups of nurses with and without shift working in educational centers of Iran University of Medical Sciences (IUMS). *Shahrekord University of Medical Sciences Journal.* 2008;10(3): 70-5.
14. Aloba. Validity of the Pittsburgh Sleep Quality Index (PSQI) among Nigerian university students. *Sleep Medicine* 8. 2007:266–70.
15. Salehi.K, Alhani. F, et al. Quality of Sleep and Related Factors among Imam Khomeini Hospital Staff Nurses. *Iran Journal of Nursing (IJN).* 2010, 23(63):18-25.
16. Gaffari .F , Zeighami Mohammadi. Sh . Frequency of Daytime Sleepiness in Hypertensive Women. *Scientific Journal of Hamadan Nursing & Midwifery Faculty.* 2011(1):xx-xx
17. Masoudzadeh A, Zanganeh A, Shahbaz nezhad L. Daytime sleepiness in medical students at Mazandaran university of medical sciences, 2003. *Journal of Mazandaran University of Medical Sciences* 2006;16(52):75-80.
18. Saremi M , Khani Jazani R , Tassi P . Comparison of fatigue level, sleep quality and quantity in old and young shift workers . *Pejouhesh.* 2008; 32 (2) :135-9.
19. Härmä MI, Hakola T, Akerstedt T, Laitinen JT. Age and adjustment to night work. *Occupational and Environmental Medicine.* 1994;51(8):568-73.
20. Rahimpour.F,Mohammadi .S,Aghilinejad .M , Attarchi. M,Malek, Dehghan .N . Comparison of Sleep Disorders among Nightshift guard men in Iran University Hospitals Using ESS and PSQI questionnairesin 2009. *Occupational Medicine.* 2011(Issue1).

21. Koslowsky, M. & H. Babkoff. Meta-analysis of the relationship between total sleep deprivation and performance. *Chronobiology Int.* 1992; 9(2): 132-6.
22. Hojjati H, Taheri .N, Heidari. B, Taheri .F. Sleep-quality investigation of bus drivers working in the Gorgan's passenger terminal and its relation with the public health in 2008-2009. *Iran Occupational Health.* 2010;7(2): 20-4.
23. Sanjari.M, Shirazi. F, Heidari. S, Maleki. S, Saalemi. S. Association of Sleep Behaviors and Occupational Injuries in Nurses. *Iran Journal of Nursing.* 2010;22(61): 32-41.