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Sleepiness and Fatigue among Night-Shift Nurses with Three-Hour Nap and Day-Shift Nurses

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Abstract

Background: *Deficiency of sleep among nurses working in shifts, results in sleepiness, fatigue, health, and safety problem, and it also can deteriorate the quality of care provision. The present study aimed to compare sleepiness and fatigue between night-shift nurses who have a 3-h nap and day-shift nurses.*
Methods: *A prospective cohort study was done on 23 night-shift nurses with a 3-h nap and 24 day-shift nurses in Sina Hospital in Tehran (Iran) during 2015–2016. Subjective sleepiness and fatigue before and after their shifts were measured by Stanford Sleepiness Scale (SSS) and Swedish Occupational Fatigue Inventory (SOFI-20), respectively. Statistical analysis including independent t-test, Mann–Whitney test, multivariate analysis of variance, and discriminant analysis were performed to compare the two groups.*
Results: *The difference in means of subjective sleepiness before and after the shifts was significantly greater among night-shift nurses having a 3-h nap (1.43±1.50) than the day-shift nurses (0.37±0.92) (P=0.007). Although after their working shifts, the night-shift nurses (1.40±2.30) were more fatigued than the day-shift ones (0.96±1.46), this was not statistically significant (P=0.81). Moreover, day or night shift working with a 3-h nap was an effective factor (P=0.015) while considering the interrelationship between sleepiness and fatigue in multivariate analysis. Discriminant analysis revealed the dominant role of subjective sleepiness in differentiating the two groups.*
Conclusions: *Despite the 3-h nap, subjective sleepiness was seen more among the night-shift nurses than the day-shift ones; however, the mean difference scores of fatigue did not differ between the two groups. Presumably, getting a 3-h nap during night shift and a heavy work load for day-shift nurses might result in insignificant fatigue between the groups. Furthermore, studies with new strategies for napping among nurses are recommended.*

Keywords: Nap, Night shift, Nurse, Fatigue, Sleepiness.
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Introduction

Sleep deprivation and fatigue, which are prevalent among shift workers, can lead to reduced work performance, errors and accidents, absenteeism, lower quality of life, depression, and somatic and psychiatric diseases.[1]

Nurses working in the night shift, frequently feel sleepiness and fatigue in the morning,[2] which increases the risk of exhaustion and car accidents while commuting home.[3, 4]

Fatigue-related complications such as lost productivity and accidents are estimated to cost $18 billion annually in the United States. More than 100,000 car accidents and 76,000 injuries on the freeways are related to fatigue-related sleepiness.[5]

Night shift workers often report drowsiness disorders. A study by Yong et al. among 6338 USA workers showed that prevalence of insomnia (18.5%), poor sleep quality (30.7%), and short sleep duration (61.8%) were significantly greater among night shift workers.[6] Alternatively, 22% of people who reported daytime sleepiness, used sleeping pills frequently[7] that increased the risk of road accidents.[8]

Furthermore, sleep deprivation has an adverse effect on mood and performance[9] of hospital nurses.[10] Numerous studies have shown that inadequate sleep has a significant association with medical errors,[11] which results in nearly 1.3 million patients getting injured and more than 100,000 deaths in hospitals annually.[12] The nurses usually tend to fall asleep during the night shift; hence, remaining alert on-duty is difficult.[13] Falling asleep at least once a week was reported among 32.4% of the night-shift nurses, 35.3% of the rotated-shift nurses, and 20.7% of the day/evening-shift nurses who worked at nights infrequently.[14] In a study by Scott et al., 66.6% of nurses experienced at least one instance of sleepiness during driving in 4 weeks.[3] Geiger-Brown et al. evaluated sleepiness among 80 nurses during 3 12-h day/night shifts. It was seen that 45% of them experienced maximum sleepiness in one of their shifts, and felt more sleepier after night shift.[15] In another study by Kazemi et al. ,[16] sleepiness of 60 shift workers was evaluated. Results showed that sleepiness trend in night shifts was significantly higher than the day shifts.

Various professions have settled agendas to reduce sleepiness and manage fatigue at the work place.[17] These programs are regularly conducted with an educational module[18] about circadian rhythms, sleep health, shift work and its adverse effects, and various strategies such as use of caffeine and napping,[19] before or during night shifts and breaks; however, inadequate evidence about the effectiveness of these plans is presented.[20] Many studies indicated that napping is the effective strategy for prevented adverse effects of night shift among the nurses;[21,22] however, planning suitable napping plans for shift workers is challengeable.[21] The time and duration of naps were different in several studies.[23] In a study by Howard et al., results showed that 30 and 50 min naps at 4:00 AM improved subjective sleepiness at the end of the shift in comparison with no-nap settings.[24] Another study showed

that subjective sleepiness and fatigue increased between 4:00 and 5:00 am; however, no significant difference was seen between the nap condition and no-nap condition.[25]

Therefore, the purpose of this study was to compare sleepiness and fatigue between the night-shift nurses getting a 3-h nap and day-shift nurses.

Materials and Methods

This prospective cohort study was conducted among nurses of Sina Hospital, Tehran (Iran) in 2015–2016. This study included 24 day-shift and 23 night-shift voluntary female nurses aged 20–40 years with at least one year of work experience. Night-shift nurses worked from 7 PM to 7 AM and had a 3-h nap during their 12-h night shift; they were allowed to choose their nap time. Day-shift nurses worked from 7 AM to 2 PM.

The Ethical Committee of Tehran University of Medical Sciences approved the study protocol. After filling the informed consent form, all the participants were asked to answer some demographic questions including age, marital status, work experience, and sleep duration within the last 24 h.

Moreover, two different questionnaires, before and after the shifts were completed. Stanford Sleepiness Scale (SSS) questionnaire consists of only one item, which was to be answered by choosing one of seven statements representing levels of sleepiness.[26] The degree of sleepiness increased from first (feeling active) to the seventh (no longer fighting sleep) statement. Farvaresh et al. reported the validity and reliability of Farsi version of SSS 0.68 and 0.88, respectively.[27] Swedish Occupational Fatigue Inventory (SOFI-20) contains 20 questions in 5 subscales of physical exertion, physical discomfort, lack of energy, lack of motivation, and sleepiness. Each subscale consists of 4 11-grade questions. The two extreme values of responses were defined as 0 (not at all) to 10 (a very high degree); higher scores indicated more fatigue.[28] The reliability and validity of this questionnaire was evaluated in different languages [29,30] including Farsi.[31,32] Javadpour et al.[31] evaluated the validity of SOFI-20 by confirmatory factor analysis and reported the accuracy of the model. Furthermore, the reliability of SOFI-20 checked by Cronbach's alpha was 0.95.

Descriptive statistics including mean±standard deviation (SD) and relative frequency were used for baseline characteristics of the studied participants. Difference in means of SOFI-20 and SSS scores before and after the shift timings were calculated and the two groups were compared by independent t-test or Mann–Whitney test. Moreover, by considering SOFI-20 and SSS scores as two outcomes, the effect of shift working was accessed by multivariate analysis. Discriminant analysis was done to identify the role of each score in differentiating the type of shift work. All analyses were performed by IBM SPSS Statistics, version 20.0 at significance level of 0.05.

Results

All the participants in this study were females. Age (P=0.05) and marital status (P=0.29) were not significantly different between the night-shift and day-shift nurses. (Table 1)

The difference between the sleepiness and fatigue scores, before and after shift, was calculated. The results of univariate analysis for difference in mean values showed that the night-shift nurses were significantly more sleepy than the day-shift ones (P=0.007); however, fatigue and its subscale were not statistically different between the two groups (P>0.05). (Table 2)

Table 1. Baseline characteristics of participants

Characteristics	Day-shift (N=23)	Night shift (N=24)
Age (years, mean±SD*)	31.42 ± 5.58	28.65 ± 3.91
Marital status N (%)		
- Single	12 (50%)	15 (65.2%)
- Married	12 (50%)	8 (34.8%)
Sleep duration in last 24 h (mean±SD)	6.56±1.75	8.65±2.10
Work experience (years, mean±SD*)	7.78±4.64	4.69±3.10

*SD: standard deviation

Moreover, multivariate analysis of variance (MANOVA) was used to access the interrelationship between sleepiness and fatigue. The results showed that day-shift or night shift with a 3 h nap had a significant effect (Wilks' lambda value=0.826, F=4.621, P=0.015).

Alternatively, discriminant analysis indicated that there was a significant discriminant function. Based on the structure matrix, sleepiness and fatigue had 0.952 and 0.256 correlation with the discriminant function. Although fatigue correlation was not profound, it had a role in differentiating the day- and night-shift nurses, which justified the significant MANOVA results.

Table 2. Sleepiness and fatigue scores between the night-shift nurses having a 3-h nap and the day-shift nurses, before and after the shifts

Variables	Day-shift (N=23)			Night shift with 3-h nap (N=24)			P.V‡
	Before	After	Difference	Before	After	Difference	
Sleepiness	2.00±0.417	2.38±0.92	0.37±0.92	1.65±0.49	3.09±1.59	1.43±1.50	0.007*
Fatigue (total SOFI score)	1.64±1.19	2.60±1.92	0.96±1.46	1.89±1.41	3.29±2.28	1.40±2.30	0.807*
- Physical exertion	1.28±1.18	1.94±1.86	0.67±1.53	1.39±1.58	2.72±2.84	1.33±3.00	0.957*
- Physical discomfort	1.62±1.62	2.52±2.15	0.89±1.67	1.53±1.41	2.79±2.52	1.26±2.45	0.814*
- Lack of energy	1.61±1.72	3.84±2.97	2.23±2.56	2.42±2.17	4.09±2.74	1.66±2.91	0.482†
- Lack of motivation	1.97±1.10	2.32±1.63	0.35±1.28	2.40±1.40	3.21±2.23	0.80±2.53	0.450†
- Sleepiness	1.71±1.73	2.37±1.87	0.67±1.80	1.72±1.87	3.67±2.78	1.96±3.10	0.092†

* Mann–Whitney test, † Independent t-test
‡ P-values were calculated for difference in mean values

Discussion

In this study, sleepiness of the night-shift nurses was significantly more than the day-shift ones, although they had a 3-h nap. Alternatively, the fatigue score was not significantly different. We presume that on-duty napping could not reduce sleepiness considerably; however, it might have an effect on reducing the fatigue. Therefore, taking a 3-h nap during night shift and heavier work load for the day-shift nurses than the night-shift ones might result in insignificant fatigue between the two groups.

Although organizations and institutions have not accepted napping during night shift officially,[33] several studies confirmed the effectiveness of on-duty napping on sleepiness and fatigue. The result of present study is consistent with these studies [16, 21, 33-36]

Borges et al. [33] explored the influence of napping on sleepiness among the night-shift nurses during 12-h working time. Twelve female nurses were considered for two time durations and their levels of sleepiness were measured by Karolinska Sleepiness Scale (KSS). They were allowed to take a nap for 3 h during the first span (00:01–03:00 AM) or the second span (03:01–06:00 AM) of work, optionally. Results showed that taking nap either during the first or the second span decreased sleepiness.

In another study by Geiger-Brown et al.,[34] six nursing units of two hospitals were suggested to take nap during the night-shift and KSS was administered to measure the sleepiness level. The nap effect was measured by a ten-point investigator-developed scale: 0 for “not at all helpful” to 10 for “extremely helpful.” Only one unit was successful to implement the nap strategy. Among 153 participants of this unit, the mean value of KSS score promptly before nap time was 6.1±1.8, and after the nap time the value was reported to be 7.3±2.2; this indicated the effectiveness of the nap strategy.

In a randomized controlled trial by Smith-Coggins et al ,[35] 49 nurses and physicians were studied to evaluate the effect of a 40-min nap at 3 AM on alertness and performance. Sleepiness and fatigue were measured by KSS and Profile of Mood States questionnaires, respectively. After the night shift at 7:30 AM, less fatigue and sleepiness was reported in the napping group (7.4 and 5.36) in comparison with the nonnapping group (10.43 and 6.48).

Furthermore, a randomized controlled trial was conducted to investigate the effect of sleep during working hours among medical interns. Sleepiness measured by KSS was less among interns with protected sleep period in comparison with the normal schedule. Davy et al. [36] indicated that a 1-h self-selected nap improved performance and diminished sleepiness [21]

Limitations of this study include small sample size, which influenced the statistical power of nonsignificant fatigue test. Moreover, there were no night shift nurses without on-duty nap for better comparison. Although several studies mentioned the napping time as an influential factor,[37] we did not consider the timing of night-shift napping during a 12-h work shift in our study. Non-randomization of nurses assigned into day or night shift group could be another limitation.

In summary, despite the 3-h nap, sleepiness in night shift nurses was lesser than the day-shift ones; however, score of fatigue among these groups has not significantly differed after the shifts. This might be considered as an effect of the 3-h nap during night shift and heavier work load of day-shift nurses. Further studies with new strategies for napping with larger participants are recommended.

Conflict of Interest

The authors declared that they have no conflict of interest.

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