

The Impact of Sleep Quality on Stress Levels in Night Shift Workers and Non-Night Shift Workers: A Cross Sectional Study

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Abstract: *The sleep-wake cycle, which is regulated by the endogenous circadian rhythm, is disrupted by night-shift work. Altered sleep patterns owing to shift work have been associated with irritability, depressed mood, anxiety, and nervousness. The objective of the study was to evaluate the effect of sleep quality on stress in night shift workers and non-night shift workers. A cross-sectional study was conducted in 30 night shift and 30 non-night shift workers of Railway Mail Service and Postal Department, Thrissur, Kerala. Sleep quality was assessed using Pittsburgh Sleep Quality Index and stress was assessed using Perceived Stress Scale. The findings revealed that a majority of night shift workers reported poor sleep quality, with a significant correlation observed between sleep quality and shift work. Furthermore, stress levels were markedly higher among night workers with poor sleep quality. Regression analysis indicated a positive association between impaired sleep quality and elevated stress levels.*

Keywords: night shift, circadian rhythm, sleep quality, stress

1. Introduction

Shift work refers to irregular and abnormal working time arrangements, including all working hours that are outside the normal daytime ones such as rotating night shiftwork¹. The sleep-wake cycle, which is regulated by the endogenous circadian rhythm, is disrupted by night-shift work². Internal biological processes are regulated by a central "clock" in the suprachiasmatic nuclei in the brain and peripheral clocks in virtually all tissues. These clocks dictate the rhythm of many human biological processes, including hormone production.³ Many biological functions in the human body follow this circadian rhythm⁴.

With the rapid development of the social economy, the living and working environment, as well as the working mode of human beings, has undergone tremendous changes. Currently, the night shift schedule is becoming more and more common in various careers, which may cause individual biological rhythm disorders and increase their risk of diseases.⁵ Professions involving night shifts require persons to work and sleep at times that conflict with this rhythm. This may result in circadian rhythm disruption and disturbed sleep, which have been proposed as possible sources of health problems associated with shift work³.

Altered sleep patterns owing to shift work have been associated with irritability, depressed mood, anxiety, and nervousness. Sleeping at odd times of the day together with shift schedules create challenges for maintaining healthy work-life balance in shift workers, as opportunities for family, social, and leisure activities are constrained. This may lead to social isolation and contribute to poor mental health in this occupational group⁶.

2. Materials and Methods

This is a cross sectional study conducted in workers of Railway Mail Service and postal departments of Kerala. The study was approved by Institutional ethics committee. The study comprised 60 participants of which 30 night shift workers and 30 non-night shift workers were included. The sampling technique used was simple random sampling.

Inclusion Criteria

- 1) Healthy subjects of age group - 18 to 60 years
- 2) Those who are working on night shift (on alternate basis) for a period of >1 year or longer.
- 3) Those who are working on day shift for 1 year.

Exclusion Criteria

- 1) Those who took sick leave, maternity leave, or went out for further study within 1 year time period.
- 2) Individuals using medications including painkillers, sleeping pills, antihistamines, anti-depressive drugs and other medicines which interfere with our normal sleeping pattern.

Data Collection

After obtaining scientific and ethical committee approval, informed consent was taken from all workers. Study was conducted in workplace. A proforma was given to the participants for collecting their personal details including name, age, sex, marital status, qualification and occupation. Assessment of sleep quality was done using Pittsburgh sleep quality index (PSQI) questionnaire. The tool comprises seven components of sleep, that is, subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep

disturbance, use of sleep medication and daytime dysfunction. Each component of the questionnaire is rated on a 4-point scale (0–3), which generates a total score ranging between 0 and 21. Stress level assessment was done using Perceived Stress Scale. The Perceived Stress Scale (PSS) is a classic stress assessment instrument.

Statistical Analysis

The data was computerized and analysed statistically using the IBM SPSS program (statistical package for social science) version 22.00, frequencies and percentage were used to reflect quantitative data, mean and standard deviation to summarize quantitative results. Chi square test was calculated for testing the association between data (variables). Association of qualitative data calculated using Spearman rank correlation

3. Results

Table 1: Demographic Profile in Night shift & Day shift workers

Variables		Work shift			
		Night shift		Day shift	
		f	%	f	%
Age Category	21 - 30	5	16.7%	7	23.3%
	31 - 40	15	50.0%	15	50.0%
	41 - 50	6	20.0%	4	13.3%
	51 - 60	4	13.3%	4	13.3%
Sex	Male	14	46.7%	8	26.7%
	Female	16	53.3%	22	73.3%
Marital Status	Married	27	90.0%	26	86.7%
	Single	3	10.0%	4	13.3%
	Divorced	0	0.0%	0	0.0%
Education	Plus Two	7	23.3%	6	20.0%
	Degree	15	50.0%	19	63.3%
	Post-Graduation	8	26.7%	5	16.7%

Table 2: Sleep Quality – Descriptive Statistics

		Sleep quality (PSQI Scores)			
		Mean	SD	Minimum	Maximum
Work shift	Night shift	8.57	2.47	5	14
	Day shift	5	2.83	1	12

Table 2 presents the mean sleep quality among the workers. The mean PSQI scores for night shift workers were 8.57 ± 2.47, while those for day shift workers were 5 ± 2.83. A higher PSQI score indicates poorer sleep quality. Therefore, it is evident that day shift workers exhibit better sleep quality compared to night shift workers.

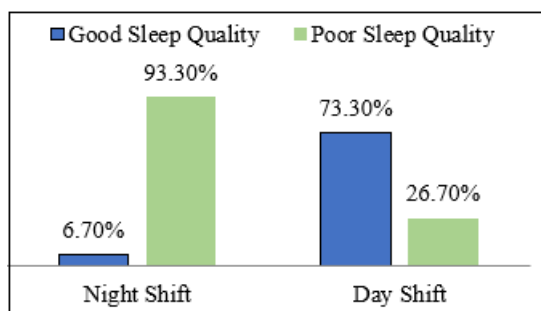


Figure 1: Distribution of sleep quality among night shift and non-night shift workers.

Majority of the workers in the day shift (73.3%) were having good sleep quality. Whereas in the night shift workers, majority (93.3%) had poor sleep quality.

Table 3: Stress – Descriptive Statistics

		PSS SCORE (Stress Scale)			
		Mean	SD	Minimum	Maximum
Work shift	Night shift	21.5	5.77	10	33
	Non-night shift	15.27	3.77	10	23

The above table interprets the mean stress among the workers. Night shift workers have a high mean PSS score of 21.5±5.77 indicating high stress among night shift workers.

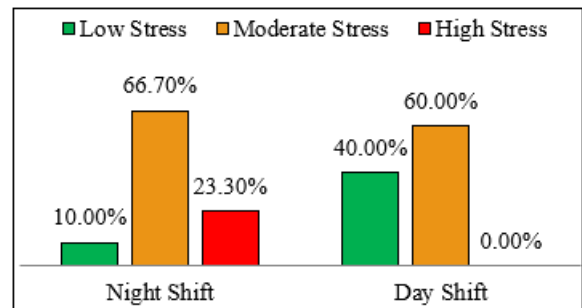


Figure 2: Distribution of Stress among night shift and non-night shift workers

Majority of the workers in the day shift (60%) were having moderate stress. Also, none of them were in high stress and 40% had low stress. Whereas in the night shift workers, majority (66.7%) had moderate stress, moreover, 23.3% had high stress.

Table 4: Correlation between PSQI Score and stress in night shift workers and non- night shift workers

Work shift	n	Pearson Correlation	Significance (p-value)
Night shift	30	0.765	<i>p</i> < 0.001*
Non night shift	30	0.76	<i>p</i> < 0.001*

The correlation coefficient shows a significant positive correlation which shows that there is a positive correlation between PSQI Score and stress among the night shift workers and in non-night shift workers. A high score in the sleep scale indicates more sleep disturbances; the correlation coefficient indicates that as the sleep disturbances are high, there is a high stress. The following scatter diagram also interprets this.

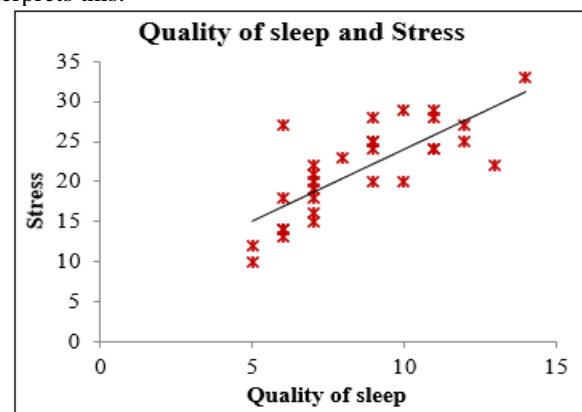


Figure 3: Scatter diagram of sleep quality and stress in night shift workers

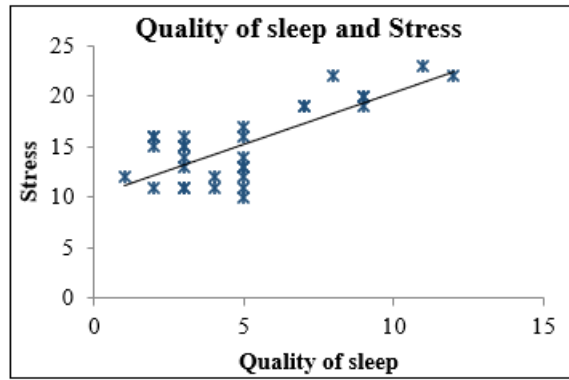


Figure 4: Scatter diagram of sleep quality and stress in non-night shift workers

Table 5: Linear regression analysis to find the influence of sleep quality on stress among the night shift workers

Variables		n	Slope (β - coefficient)	Intercept (Constant)	Significance (p-value)
Independent Sleep quality	Dependent Stress	30	1.78	6.64	p < 0.01*

Regression analysis shows that sleep quality is positively influenced by 1.78 times stress added with a constant of 6.64. But a high score in the sleep quality scale indicates more

sleep disturbances. Hence, as sleep disturbance is increased by 1, it influences 1.78 times stress ($p < 0.01$) in the night shift workers

Table 6: Linear regression analysis to find the influence of sleep quality on stress among non-night shift workers

Variables		n	Slope (β -coefficient)	Intercept (Constant)	Significance (p-value)
Independent Sleep quality	Dependent Stress	30	1.012	10.25	p < 0.001*

Regression analysis shows that sleep quality is positively influenced by 1.012 times stress added with a constant of 10.25. But a high score in the sleep quality scale indicates more sleep disturbances. Hence, as sleep disturbance is increased by 1, it influences 1.012 times stress ($p < 0.001$) in the day shift workers.

investigate the impact of sleep quality on stress within both study groups.

4. Discussion

Sleep is a vital physiological process, disruptions of which affect performance in multiple domains of functioning including cognitive, emotional, metabolic and immunologic.⁷The regulation of sleep is processed by the homeostatic physiology of the circadian rhythm, the sleep/wake cycle. Circadian rhythm is the 24-hour internal clock in our brain that regulates cycles of alertness and sleepiness by responding to day light changes in our environment⁸. As the sun sets in the evening, the brain begins producing melatonin, a hormone that induces sleepiness. Core body temperature also drops contributing to decreased alertness. These changes, driven by circadian rhythms, combine with sleep drive to cause a person to fall asleep at night. In the morning, as exposure to light increases, melatonin production stops and body temperature rises, promoting wakefulness⁹

We observed that the mean PSQI global score for night-shift workers was higher compared to non-night-shift workers, indicating poorer sleep quality (Figure 1). This finding aligns with a cross-sectional study conducted by Lim YC et.al involving 177night shift workers and 317 non-night shift workers in aluminum factories in Malaysia, which similarly reported an association between night shift work and poor sleep quality as well as reduced quality of life ². Additionally, Wahaj Anwar A. Khan et al. found that fifteen paramedics working rotational shifts experienced sleep restriction during night shifts compared to pre-shift, day shift, and days off¹¹

Circadian rhythms are modulated by endogenous (genetic, physiological) as well as environmental (light) and behavioral (activity, feeding) factors. External circadian factors, such as light at the wrong time, induce signs of depression, mediated by intrinsically photosensitive retinal ganglion cells and their projections to hypothalamic, preoptic, and limbic regions, such as the amygdale. Other circadian mechanistic contributors to mood disorders in humans include altered clock gene expression and genetic polymorphisms in clock genes.¹²

During shift work, the organism cannot adapt to the constant change in working hours, so that the shift in the circadian rhythm (sleep-wake cycle) results in restrictions on the duration and quality of sleep and has consequences for health status¹⁰Our study aimed to evaluate the sleep quality and stress levels of both night shift and non-night shift workers who work on alternate basis, as well as to

Sleep disturbances, circadian misalignment and abnormal stress responses may affect mood, and vigilance and in turn the regulation of emotions.¹³ Night shift was also associated with higher levels of stress, fatigue, and sleepiness¹⁴ A number of studies have demonstrated that poor sleep quality and short sleep duration is associated with mood

disturbances and lower subjective well-being². While numerous previous studies have explored the impact of stress on the normal functioning of the body across various populations, this study specifically examines the influence of sleep quality on stress levels among both night shift workers and non-night shift workers. A study conducted by SunminLee et.al. found that greater stress was associated with a higher prevalence of sleep disturbance.¹⁴

According to the results obtained in this study, stress levels are higher among night shift workers, consistent with findings from previous literature (Figure 2). Additionally, there is a statistically significant association between sleep quality and stress levels among the subjects (Table 4). Night shift workers with poor sleep quality exhibited higher stress levels compared to non-shift workers (Tables 5 and 6)

5. Conclusion

Our study examined the correlation between sleep quality and stress levels among individuals working both night shifts and regular daytime shifts. Proper sleep is essential for both physical and mental health. Lack of proper sleep can impair cognitive function, memory, and concentration. The study indicates a strong association between poor sleep quality and stress levels in night shift workers. Therefore, shift schedules should be carefully designed to prioritize adequate rest and minimize circadian rhythm disruptions.

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