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Effect of Shift Work on Resting Blood Pressure

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Abstract: Shift work disturbs the circadian rhythm and internal clock. From last thirty years shift work has become more common. This type of working schedule has a greater risk of cardiovascular system. Many cross sectional and cohort studies have identified an association between shift work and an elevated blood pressure that would increase the risk of hypertension. The present study was conducted in the Department of Physiology, at National Institute of Medical Sciences and Research, Jaipur. 120 cases were included in which 60 healthy non shift workers and 60 healthy shift workers. The resting blood pressure was examined. The study was approved by the ethical committee of respective college. All data are expressed as mean± standard deviation.Comparison between groups Male shift worker, Male non shift worker, Female shift worker, Female non shift worker (MSW, MNSW, FSW and FNSW) was performed using the student's t-test (t-test for two independent samples / Two-tailed test). Differences was considered significance at $p<0.05$. Shift workers have higher risk of cardiovascular disease and higher level of stress compared with non-shift workers. Shift work may cause considerable physiological and psychological changes in individuals who are susceptible to circadian rhythm misalignment and sleep wake cycle changes
Keywords: Circadian rhythm, Resting blood pressure, Shift work.

INTRODUCTION

Working time arrangement has always been a primary issue in work place like hospitals as it is the basic requirement and condition to human capacities for 24-hour health working services. Medical assistance and emergency life services requiring continuous human assistance 24-hour a day.

Staying awake at night and trying to sleep during day is not a physiological condition for diurnal creatures such as human, which are hence forced to adjust their psychological and physiological state by a phase shift of daily fluctuation of biological functions which are normally activated during day and depressed during night [1].

There is no specific definition for shift worker, but it understood as, shift workers are people who work non-traditional hours, which may be exclusively at night, or on rotating shifts.

Work performance outside the typical work week (that is during day lighthours Monday to Friday) or beyond an 8hour shift is considered as shiftwork with abnormal starting and ending times. Hence, shift work can be defined as work during non-standard hours [2] or workingduring a non-standard work schedule [3].

Shift work is defined as a job schedule in which working hours are outside of the standard daytime hours [4]. Shift work is considered essential 24-hour care in hospitals and residential facilities in health care system. Rotating and scheduling are the main characteristics of shift work and health workers are largely and traditionally locked into schedules that provides 24-hour care and include night shift work[5].

The circadian rhythm of blood pressure adaptation to shift workers and they are associated with increased cardiovascular morbidity and motility. Biological rhythms are an essential component of homoeostasis, most rhythms are driven by an internal biological clock, Heart rate (HR) and blood pressure (BP) is modulated in a circadian rhythm [5].

The aim of the study was to find out either any effect on blood pressure is exist between shift workers and non-shift workers, so that in future we planned for more betterment way to work that would not create any

changes in normal circadian rhythm, that directly affect different system of our body mainly cardiovascular system, to reduce the risk of hypertension.

MATERIALS AND METHODS

The present study was conducted in the department of Physiology, at National Institute of Medical Science & Research, Jaipur. The study was approved by the ethical committee of NIMS medical College, Jaipur.

120 subjects at age group between 20-32 years were taken from the National Institute of Medical Sciences and Research Hospital, Jaipur. We studied 60 healthy subjects (case) employed as technician in hospital with a weekly three-shift system (male=30; female=30), and 60 healthy subjects (control) employed as internship technician in hospital which worked non-shift (male=30; female=30).

Rotating shift

MSW (Male shift workers) = 30 (Thirty)
FSW (Female shift workers) = 30 (Thirty)

Non-rotating shift (Control group)

MNSW (Male non-shift workers) = 30 (Thirty)
FNSW (Female non-shift workers) = 30 (Thirty)

Health status for all subjects = Healthy

The data related to demographic factors such as age, sex, marital status, position, personal history of illness, family history of illness, number of family member, addiction and occupational history were collected for each participant of the study.

Shift or Rotating shift Schedule

Morning shift = 06:00-13:00 Hrs
Evening shift = 13:00-20:00 Hrs
Night shift = 20:00-06:00 Hrs

Non-shift Schedule (without rotation or day time only)

Non-shift = 09:00-16:00 Hrs

For non-shift schedule, they work day time only

Information on the direction of shift rotation was gathered through the hospital records on work schedules. Currently be working in shift (three shifts system) and has always been a shift worker. The participants worked on a weekly rotating three shift system involving six successive work days followed by one rest day, on each of the morning, evening and night shifts. No division of the shift worker group into sub-groups operating different shift systems was made since shifts rapidly rotated weekly in the order of night, morning and evening and a complete cycle of the system took place every three weeks. The shift rotates anti-clock wise every week.

Inclusion criteria

Subjects should be free from any sign of disease and smoked <15 cigarettes a day.All subjects have similar environment and working condition and having age group between 20-32 years.

No previous history of any one or more chronic disease

- Cardiovascular disease
- Diabetes mellitus
- Hypertension
- Chronic Obstructive Pulmonary Disease (COPD)
- Tuberculosis

Exclusion criteria

Only night shift worker (without rotation or without working in day time) was excluded from this study.

In rotating shift

- Day shift worker which is working less than a week in a month
- Night shift worker which is working less than a week in a month

Non-shift

- Only night shift worker (without rotation or without working in day time)

Statistical analysis

All data are expressed as mean± standard deviation. Comparison between groups Male shift workers, Male non shift workers, Female shift workers, Female non shift workers (MSW, MNSW, FSW and FNSW) were performed using the student's t-test (t-test for two independent samples / Two-tailed test). Differences was considered significance at $p<0.05$.

OBSERVATION AND RESULTS

Table-1: Comparison of Mean ± SD and Unpaired t-test for two independent samples/Two-tailed tests (p value) for resting blood pressure in MSW and MNSW

	MSW (n=30)	MNSW (n=30)	p Value
SBP Resting	123.53 ± 4.92	120.53 ± 4.49	p=0.017
DBP Resting	79.47 ± 4.75	76.87 ± 4.26	p=0.030
MBP Resting	94.16 ± 3.98	91.42 ± 3.63	p=0.007

In male shift workers and male non-shift workers Resting Systolic blood pressure, Resting Diastolic blood pressure and Resting Mean blood pressure were statistically significant (p=0.017, 0.030 and 0.007 respectively). In male shift workers Systolic blood pressure, Diastolic blood pressure and Mean blood pressure in resting condition were found significantly higher than male non shift workers.

Table-2: Comparison of Mean ± SD and Unpaired t-test for two independent samples/Two-tailed tests (p value) for resting blood pressure in FSW and FNSW

	FSW (n=30)	FNSW (n=30)	p Value
SBP Resting	122.00 ± 3.68	120.13 ± 3.48	p=0.048
DBP Resting	78.67 ± 3.94	76.87 ± 2.50	p=0.039
MBP Resting	93.11 ± 3.38	91.29 ± 2.32	p=0.018

In female shift workers Resting Systolic blood pressure, Resting Diastolic blood pressure and Resting Mean blood pressure were found statistically significant (p=0.048, 0.039 and 0.018 respectively) than in comparison with the female non shift workers.

Table-3: Comparison of Mean ± SD and Unpaired t-test for two independent samples/Two-tailed tests (p value) for Resting blood pressure in MSW and FSW

	MSW (n=30)	FSW (n=30)	p Value
SBP Resting	123.53 ± 4.92	122.00 ± 3.68	p=0.177 (non-significant)
DBP Resting	79.47 ± 4.75	78.67 ± 3.94	p=0.481 (non-significant)
MBP Resting	94.16 ± 3.98	93.11 ± 3.38	p=0.277 (non-significant)

There were however, in between male shift workers and female shift workers Resting Systolic blood pressure, Resting Diastolic blood pressure and Resting Mean blood pressure were found statistically non-significant (p=0.177, 0.481 and 0.277 respectively).

Table-4: Comparison of Mean ± SD and Unpaired t-test for two independent samples/Two-tailed tests (p value) for Resting blood pressure in MNSW and FNSW

	MNSW (n=30)	FNSW (n=30)	p Value
SBP Resting	120.53 ± 4.49	120.13 ± 3.48	p=0.701 (non-significant)
DBP Resting	76.87 ± 4.26	76.87 ± 2.50	p=1.000 (non-significant)
MBP Resting	91.42 ± 3.63	91.29 ± 2.32	p=0.866 (non-significant)

In male non-shift workers and female non-shift workers Resting Systolic blood pressure, Resting Diastolic blood pressure and Resting Mean blood pressure were found statistically non-significant (p=0.701, 1.000 and 0.866 respectively).

From the above tables, in shift workers both male and female compared when with non-shift workers (male and female); Systolic blood pressure (MSW=123.53 ± 4.92; FSW=122.00 ± 3.68: MNSW=120.53 ± 4.49; FNSW=120.13 ± 3.48), Diastolic blood pressure (MSW=79.47 ± 4.75; FSW=78.67 ± 3.94: MNSW=76.87 ± 4.26; FNSW=76.87 ± 2.50) and Mean blood pressure (MSW=94.16 ± 3.98; FSW=93.11 ± 3.38: MNSW=91.42 ± 3.63; FNSW=91.29 ± 2.32) were found statistically significant resting condition.

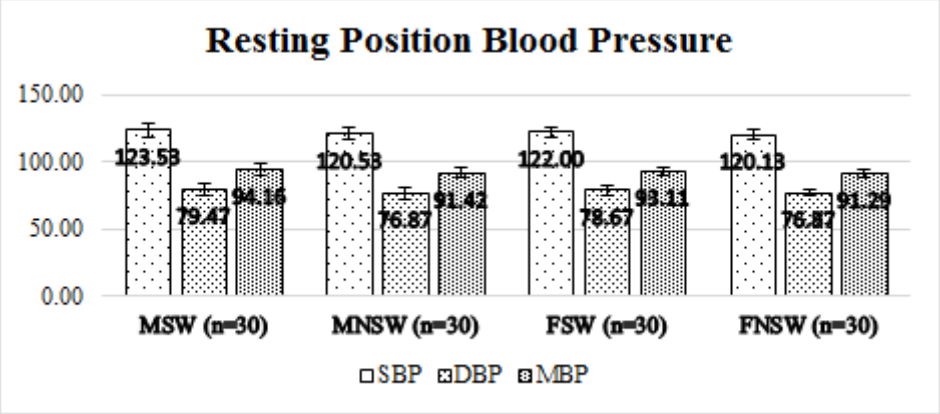

Fig-1: Comparison chart of Resting Blood Pressure in Male shift workers (MSW), Male non-shift workers (MNSW), Female shift workers (FSW) and Female non-shift workers (FNSW)

DISCUSSION

Shift working has become one of the most popular work schedules to effectively utilized the relatively carry out round the clock activities. This study attempted to determine cardiovascular changes in shift and non-shift hospital workers.

The main finding of the present study is that working at shift alters the normal blood pressure and also reduce the fluctuation of blood pressure. In shift workers resting blood pressure found higher compare with non-shift workers in both male and female. Systolic blood pressure and diastolic blood pressure shows more fluctuation in non-shift workers compare than shift workers. Less fluctuation in blood pressure shows autonomic function is less working in shift workers compare with non-shift workers and having more risk of cardiovascular disease in shift working conditions.

The diurnal BP rhythm is mainly determined by the cycle of activities, especially sleep wake activities. It is possible that the association between shift work and cardiovascular disease may be strongly influenced by changes in dietary habits, reduced physical activity and disruption of psychosocial factors. This result is consistent with other studies; shift work has been regarded as a risk for cardiovascular disease [6-8].

But according to Asare*et al.* [4] no significant differences were found between Systolic blood pressure and Diastolic blood pressure for shift and non-shift workers, that is a contrarily to present study.

Excessive stress is detrimental on many levels in humans, and it activates the defense system of the central nervous system. Stress-related physiological responses differ depending on each individual cognitive form, and these physiological responses cause the neuro-endocrine responses and behavioral responses. Sleep is an essential biological process for humans. The regulation of sleep is configured with the circadian process that determines the beginning and ending of sleep, and the homeostatic process that maintains the depth and the amount of sleep Kuem*et al*. [9].

CONCLUSION

A high percentage of health professionals working in a shift working companies, or other organizations, suffer from bad sleep quality, which negatively impacts their social and daily life activities. Many health professionals are not aware of their bad sleep quality. Night workers have worse sleep quality than those working on morning or evenings. So there were many reasons to develop cardiovascular problems, mainly persons suffering from risk of hypertension.

Due to less sample size limit the statistical power of some analysis. In future studies this issue has needed further more studies to improve the quality of life.

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