

Effect of Alternate nostril breathing on simple and choice visual reaction time among rotating shift workers

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Abstract

Introduction: Shift work among the hospital staff is considered necessary to ensure continuity of patient care. Night shifts in particular are the most frequent reasons for circadian rhythm disruption and subsequent psychological and physiological disturbances. These workers suffer from persistent fatigue, decreased muscle strength, declined cognition and mental alertness. Reaction time is an indicator of mental alertness. Alternate nostril breathing (ANB) for about 15 minutes was known to affect the mental alertness. **Objectives:** The aim is to assess the effect of alternate nostril breathing on visual reaction time (VRT) among the rotating shift workers in the tertiary care hospital. **Materials and methods:** After getting institutional ethical committee clearance and informed consent from all the participants, simple and choice visual reaction time was recorded before and after 15 minutes of alternate nostril breathing using Deary –Liewald Reaction time tester. 60 volunteers of both sex of age 25-40 years with normal BMI who did rotating night shifts and 60 subjects of age, sex and BMI matched who were not on shift duty were selected as study and control groups respectively based on inclusion and exclusion criteria. **Results and discussion:** Rotating shift workers were found to have significantly increased stress level and reaction time ($P < 0.05$) compared to non-shift workers. Reaction time was found to be significantly decreased ($P < 0.05$) after alternate nostril breathing among both shift and non-shift workers. **Conclusion:** ANB can be practiced regularly by the shift workers, to maintain their sound health and to improve their performance in the night duty.

Key words: alternate nostril breathing, cognition, non-shift workers, rotating shift workers, visual reaction time

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Introduction

Shift work among the hospital staff is considered necessary to ensure continuity of patient care.¹

Night shifts lead to circadian rhythm disruption and subsequent psychological and physiological disturbances.² Further there seems to be a reduction in the job performance that could

endanger the life of the patients.³ They suffer from persistent fatigue, decreased muscle strength, declined cognition and mental alertness.^{4,5} These workers were found to have abnormally elevated nor-epinephrine levels generally considered as a stress marker.⁶ Stress could alter the reaction time.⁷ Reaction time is the indicator of mental alertness. It is a simple and non-invasive test for assessing the sensory motor performance.⁸ Pranayama techniques are gaining importance and accepted by the public as well as scientific community.⁹ Alternate nostril breathing (ANB) is an integral part of Pranayama. ANB is a simple technique which on acute exposure for about 15 minutes was known to alter blood pressure, heart rate, respiratory rate, PEFR, muscle strength, fatigue, stress level and cognition.^{10,11,12,13} Thus the aim of this study is to determine the stress level, mental alertness and the immediate effect of alternate nostril breathing on visual reaction time among the rotating shift workers and non-shift workers.

Materials and Methods

This is a cross sectional study done in the Department of Physiology, Sri Venkateshwaraa Medical College Hospital and Research Center, Ariyur, Pondicherry, after getting ethical committee clearance. Informed consent was obtained from all the participants consisting of 60 volunteers of both the genders of age 25-40 yrs who did rotating night shifts (1 week of night shift 8 pm to 8 am followed by next week of morning 8 am to 2 pm or 2 pm to 8 pm shifts in rotation) at least for the past 6 months (study group) and 60 age and sex matched volunteers who did not do night shifts (general shift 8.30 am to 4 pm) for the past 2 years (control group).¹⁴ With the help of open-epi software sample size calculated was about 8 with α error of about 0.05 and β error- 80% with the help of mean \pm SD- 216.4 \pm 13.3 (before ANB) & 213.6 \pm 11.6 (after ANB)¹⁵. However, since our study is done among the shift workers in our hospital all

the willing participants were selected based upon simple random sampling method and the study was conducted for about 3 months from December 2018 to February 2019. Both study and control group are from the same locality about 10 km radius around the college and both the groups have completed their under graduation. Shift and non-shift workers with BMI (18.5-22.9 kg/m²) were included and subjects with history of diabetes, hypertension, hormonal abnormalities like hypo, hyperthyroidism, asthmatics, subjects on chronic medication, history of smoking, known sports person or those who regularly practice yoga and pregnant women were excluded from the study.

Methodology

Stress level was measured using perceived stress scale (PSS).¹⁶ Visual reaction time was tested using Deary-Liewald reaction time tester.¹⁷ After familiarizing with the procedure of ANB and clearing the doubts, ANB was practiced by the participants for 15 minutes under supervision of yoga expert. To test simple reaction time using the software, the subject was made to sit in front of the laptop screen and he was asked to press the enter key whenever X symbol appears on the screen. The time between the appearance of X symbol and the press of enter key was taken as simple reaction time in milliseconds. On selecting CRT option in the software, four boxes appear on the screen and each box was assigned for one key in the key pad. Whenever X appears on any of the given four boxes, the subject was asked to press the key assigned to that box. The time between the appearance of X and pressing of the assigned key gives choice reaction time. After explaining the procedure of the test, the subjects were made to practice once. Both simple and choice reaction was recorded three times (excluding the practice session) and the average reading was taken. The same procedure was repeated after practicing ANB for 15 minutes. Thus, both pretest and post-test were done in same day and the post-test readings

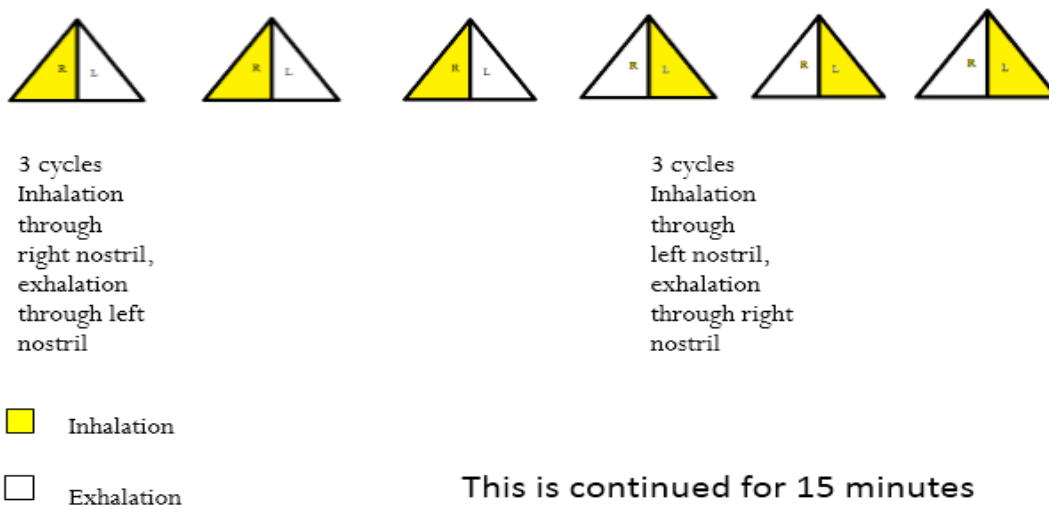
were taken immediately after 15 minutes of ANB. The subject was asked to sit in a calm quiet, airy place in the yoga lab in our department, in an easy and steady posture with head, neck and trunk erect in a straight line with the body still. The subject was asked to bring the right hand up to the nose and use Vishnu mudra i.e. to use the thumb for regulating right nostril breathing and ring finger for regulating left nostril breathing with index and middle finger flexed. ANB consists of 3 cycles of inhalation through right nostril, exhalation through left nostril followed by 3 cycles of exhalation through right nostril and inhalation through left nostril. This is repeated for about 15 minutes as shown in fig.1.¹⁸In the study and control group test were conducted from 11am to 12 pm in the morning. All the test in the study group was

conducted when they were in morning 8 am to 2 pm shift.

Results and discussion

Data were expressed as Mean± SD. Analysis was done using graph pad prism. Paired t test was used to compare simple and choice reaction time before and after ANB among shift and non-shift workers. Unpaired t test was used to compare simple, choice reaction time and stress level between shift and non-shift workers.

Both the shift and non-shift workers were age (p=0.1739) and BMI (p=0.2267) matched. There is no statistical significance between them and hence comparable.



Original fig: 1 Schematic representation of practice of ANB

Table: I Comparison of PSS, SRT and CRT among shift and non-shift workers

	Non-shift workers	shift workers	P value
SRT (milli sec)	363.7±94.56	383.4±101	0.2731
CRT (milli sec)	501.6±67.71	535.5±83.17	0.0158*
PSS	19.83±6.206	22.2±7.69	0.0376*

*P<0.05- statistically significant

SRT- simple reaction time, CRT- choice reaction time, PSS- perceived stress scale

Table: I show that in CRT and PSS there is a significant difference between shift and non-shift workers before ANB. SRT though decreased among non-shift workers but the difference is insignificant.

Table: II Comparison of SRT and CRT before and after ANB among shift workers

	Before ANB	After ANB	P value
SRT (milli sec)	383.4±101	322.7±69.32	<0.0001*
CRT (milli sec)	535.5±83.17	464.4±76.30	<0.0001*

***P<0.05- statistically significant**

SRT- simple reaction time, CRT- choice reaction time, ANB- alternate nostril breathing

Table: II shows that both SRT and CRT decreased significantly after ANB among shift workers

Table: III Comparison of SRT and CRT before and after ANB among non-shift workers

	Before ANB	After ANB	P value
SRT (milli sec)	363.7±94.56	326.7±60.92	0.0079*
CRT (milli sec)	501.6±67.71	444.5±67.30	<0.0001*

***P<0.05- statistically significant**

SRT- simple reaction time, CRT- choice reaction time, ANB- alternate nostril breathing

Table: III shows that both SRT and CRT decreased significantly after ANB among non-shift workers.

Discussion

Table: I show prolonged latency in CRT among the shift workers compared to non-shift workers before practice of ANB. Compared to non-shift workers PSS among the shift workers increased significantly, this might be due to the fact that rotating night shift workers experience less alertness, are less vigilant and more sleepy due to lack of sleep at night and altered circadian rhythm.^{19,20} Reaction time is an indirect measure of processing ability of the central nervous system. It determines the alertness of a person and how quickly the person reacts for the external stimulus.⁸ Stress has inverse relation with cognition. Cognitive emotion related to prefrontal cortex seems to get improved by administration of Prazosin which blocks alpha 1 adrenergic receptors.²¹ Thus altered sleep pattern decrease the psychomotor performance, cause attention lapse and increased the day time sleepiness.²² This might be the reason for prolonged CRT among the shift workers before ANB. Night shifts can lead to attention impairment leading to occupational

errors.²³ Inability to adapt to the rotating shift system might be the reason for slower processing of visual information and changes in cognitive function resulting in prolonged reaction time.^{24,25} Increased electroencephalographic alpha and theta activities was found to be due to altered sleep cycle.²⁶ Spells of attention deficit and increased proneness to traffic accidents were experienced by people working in shift system due to circadian rhythm disturbance.²⁷

Table: II and III showed that both shift and non-shift workers react faster immediately after alternate nostril breathing for 15 minutes. This might be due to faster rate of information processing, improved concentration and ability to ignore unwanted external stimuli following alternate nostril breathing. Increase in performance or ability to react faster might be due to decrease in mental fatigability.²⁸ Non-shift workers were already responding at a faster rate compared to shift workers before ANB, thus the improvement was not as significant as shift workers after ANB. Neural reflex mechanism in

superior nasal meatus during alternate nostril breathing was found to increase the parasympathetic dominance and hence there might be decrease in stress and faster sensory motor performance.⁹ Since stress level was subjectively measured, we did not score the stress level immediately after ANB. In future we would like to extend our work to know the long-term effect of ANB among rotating shift workers.

Conclusion

Altered sleeping pattern among the rotating shift workers might be the reason for increased stress and prolonged latency in the reaction time. Alternate nostril breathing has an immediate effect on reaction time among shift workers and non-shift workers. Hence rotating shift workers can be advised to practice ANB regularly for 15 minutes a day either morning or evening six days a week for the long-term benefit of Pranayama. This can also improve their performance in night duty, since shift system is necessary to provide continuous patient care in tertiary care hospitals.

Limitations

Stress level was not categorized as mild moderate and severe for comparison with reaction time. Both the genders were included and sex wise variation in stress level and reaction time was not done. Auditory reaction time would have had a better impact as shift workers in hospitals are called upon to respond to auditory stimulus than visual stimulus.

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Conflict of interest: Nil

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