Original research article

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ACUTE EFFECT OF KAPALBHATI (A YOGIC KRIYA) ON REACTION TIME

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ABSTRACT

Background: Reaction time (RT) is an index of the processing ability of central nervous system. It has been reported that Pranayama training produces a significant decrease in visual reaction time (VRT) and auditory reaction time (ART). The present study was done to determine the effect of Kapalbhati Kriya (In it inhalation is slow and exhalation vigorous) on central neural processing by studying its effect on RT. **Methods:** 22 healthy Medical college students who were practicing yoga for the past 3 months were included for the present study. VRT and ART were recorded before and after 120 rounds (2 min) of Kapalbhati. **Results**: Before Kapalbhati, VRT was 244.56±5.87ms and the ART was 198.81±5.85ms. Immediately after performing 120 strokes of Kapalbhati Kriya, VRT and ART decreased to 227.15±5.85ms and 179.57±6.36ms respectively, the decrease being statistically significant (P<0.01). **Conclusion:** A decrease in reaction time indicates an improved sensory- motor performance and enhanced processing ability of central nervous system. This may be due to greater arousal, faster rate of information processing, improved concentration and/or an ability to ignore extraneous stimuli.

Keywords: Kapalbhati, reaction time, central neural processing

INTRODUCTION:

Hepatitis Ancient yogic text have described a breathing cleansing practice (Kapalbhati Kriya) as stimulating, and slow regulated breathing, Particularly through alternate nostril (nadisuddhi Pranayama) as calming **(1).** These descriptions have been substantiated by scientific studies Kapalbhati was found to cause "autonomic activation." The physiological and psychological benefits of yoga have been demonstrated in several studies **(2, 3, 4, 5)**. These studies have shown that regular practice of yoga leads to improvement in physiological functions and human performance. Benefits have been reported in both peripheral nerve function **(6)** as well as central neuronal processing **(2, 7, 8).** Reaction time (RT) is an indirect index of the processing ability of central nervous system and a simple means of determining sensory- motor association and performance **(9).**

Determination of RT has important implications in sports physiology **(10)** and the performance of an athlete is dependent on the duration of RT. It is an index of cortical arousal **(7)** and a decrease in it indicates an improved sensory – motor performance and an enhanced processing ability

of the central nervous system. Physical conditioning exercises have been shown to shorten visual reaction time (VRT) as well as auditory reaction time (ART) **(11).**

Previous studies on yoga have shown that regular practice of yoga can significantly decrease VRT and ART **(2, 7).** It has also been suggested that RT can be used as a simple and objective method to determine the beneficial effects of yoga training **(2, 7)**

Kapalbhati is a yogic technique in which the breath is actively blasted out with forceful abdominal contractions **(12).**

Agnisar and Bhastrika (yogic techniques that employ similar forceful abdominal contractions) also have been shown to produce central neuronal activation **(13, 14).**

As Kapalbhati Kriya may have a central activating role, we planned this study to determine the effect of Kapalbhati on VRT and ART. The study was conducted on yoga- trained subjects.

METHODS

Twenty two healthy medical students in the age groups of 19-25 (20.5±1.25, SEM) years, who had received training in yoga for three months and were able to perform Kapalbhati Kriya properly, were included for this study. Alcoholics and smokers and subjects with a history of acute and chronic cardiopulmonary disease were excluded from the study. They were briefed about the study protocol and informed consent was obtained. Recording were taken in an air- conditioned Laboratory. RT was measured using a circuit that had a DC source, two tap keys, a magnetic time marker and visual/ auditory signal source arranged in series. Signals obtained by operating the tap keys were recorded on RM 6000 Polygraph (Nihon Kohden Corp., japan) Measurement were taken before and after 120 strokes (2 min) of Kapalbhati by asking the subject to open as quickly as he could, a tap key that was connected alternatively to a light or sound source. Stimulus applied by a completing the circuit was marked by upward deflection of the signal whereas subject's response by breathing the circuit was marked as a downward deflection. RT was calculated as the time between these two deflections. The signals thus obtained were converted into digital format by analog- digital converter (Mi^2, USA) and analyzed with the help of data processing software. With this software the RT was obtained with an accuracy of 1ms. More than ten trials were recorded and mean of three similar observations was taken as a single value for statistical analysis **(2).** The data was analyzed using student's paired 't' test and P values less than 0.05 were consider as indicating significant difference between the compared values.

RESULTS:

The results were expressed as Mean±SEM. Before Kapalbhati, VRT was 244.56±5.87ms and the ART was 198.81±5.85ms. Immediately after

performing 120 strokes of Kapalbhati Kriya, VRT and ART decreased to 227.15±5.85ms and 179.57±6.36ms respectively, the decrease being statistically significant (P<0.01).

DISCUSSION

In this study Pre- Kapalbhati ART was significantly shorter than VRT and this is in agreement with previous reports **(2, 7, 8).** After Kapalbhati also ART was significantly shorter than VRT, although Madanmohan et al **(2)** and Malathi et al **(7)** have reported that yoga training produces a significant reduction in VRT and ART. Hatha yogic practices likes Agnisar, Nauli and Bhastrika have been shown to induce EEG changes around the somatosensory and parietal areas of the cerebral cortex suggesting an effective arousal **(13, 14).** As these practices utilize forceful abdominal contraction similar to Kapalbhatoi and bring about EEG changes through strong stimulation of somatic and splanchnic receptors **(13, 14).** We suggest that Kapalbhati results in shortening of RT through similar mechanisms. The faster reactivity of the subjects after Kapalbhati can also be explained on the basis of generalized alteration in information processing at the primary thalamo-cortical level that has been reported during concentrated mental exercise of pranayama breathing **(8).**

Kapalbhati involves active and rapid expiratory efforts and it is interesting to note that hyperventilation has been found to selectively depress motor cortical inhibition in humans **(15).** This release of motor cortical inhibition may be one of the mechanisms by which Kapalbhati results in shortening of RT.

The present study shows that Kapalbhati produces an immediate reduction in RT. A decrease in RT indicates an improved sensory motor performance, which can be explained on the basis of enhanced processing ability of central nervous system. Kapalbhati may be improving this processing ability by (i) greater arousal and faster rate of information processing (ii) improved concentration power and (iii) ability to ignore or inhibit extraneous stimuli. Greater arousal and faster information processing can be explained on the basis of Kapalbhati induced alteration in afferent inputs from abdominal and thoracic regions, which in turn can modulate the activity at ascending reticular activating system and thalamocortical levels.

This shortening of RT is of applied value in situation requiring faster reactivity such as sports, machine operation, race driving and specialized surgery.

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