

## Comparison of Mind Control Techniques: An Assessment of Reaction Times

Varun Malhotra<sup>1,\*</sup>, Jai Prakash Jha<sup>2</sup>, Rinku Garg<sup>3</sup>, Yogish Tripathi<sup>4</sup>, Om Prakash Jha<sup>5</sup>, Neera Goel<sup>6</sup>

<sup>1,3,4,6</sup>Department of Physiology, <sup>2,5</sup>Department of Biochemistry, Santosh Medical College, Santosh University, Ghaziabad

**\*Corresponding Author:**

Email: malhotravarunr@gmail.com

---

### ABSTRACT

Every activity requires a certain amount of concentration and no effective action may be performed without deep concentration. Businessman or artists or students in school must know the art of focusing all powers of attention on a single point in order to succeed in their respective vocation. We wanted to find the best technique to increase the concentration scientifically. We thus, endeavored to study and compare the reaction times in maneuvers of anuloma viloma pranayama, kapalbhathi pranayama, gayatri chanting and exercise. Reaction time test was taken online before anuloma viloma pranayama, kapalbhathi pranayama, gayatri chanting and exercise and compared after. Reaction times decreased significantly and were least during gayatri mantra. Concentration as seen by a decrease in visual reaction time denotes first a withdrawal of attention from objects of distraction and then focusing all attention upon one thing at a time. Just 30 minutes of physical activity each day offers substantial benefits to your health. Pranayama or devotional music chanting also decreases fatigue keeps the mind alert, and active.

**Key Words:** Pranayama, Gayatri mantra, Exercise, Om sound & Reaction Times

---

### INTRODUCTION

Every activity requires a certain amount of concentration and no effective action may be performed without deep concentration. Businessman or artists or students in school must know the art of focusing all powers of attention on a single point in order to succeed in their respective vocation. Various schools of breath control, meditation, chanting, devotional singing, concentration on the prayer wheel, holy rolling, concentration by diversion and so forth are variants of the real science of Pranayama or switching off of the life force(1). We wanted to find the best technique to increase the concentration scientifically. We thus, endeavored to study and compare the reaction times in maneuvers of anuloma viloma pranayama, kapalbhathi pranayama, gayatri chanting and exercise.

### MATERIAL AND METHODS

**Pranayama:** The Pranayama was performed before meals. The subjects were advised not to hold the breath for uncomfortably long periods, as this causes harmful pressure on the heart, lung, diaphragm and arteries. The subject was seated in a comfortable sitting posture with back straight.(1)

**Anuloma Viloma Pranayama** starts with closing the right nostril with the thumb of the right hand, inhaling through the left nostril, holding the breath, followed by exhalation through the right nostril while closing the left nostril with the index finger and then reversing the process. This forms one round of Anuloma Viloma Pranayama. Reaction times are recorded before and after twelve cycles of anuloma viloma pranayama.(2) Hyperthyroid patients were excluded from the study.

**Kapalbhathi Pranayama** starts with a short inhalation followed by exhalation of air with violent movements of diaphragm and abdominal muscles. The procedure was done for two minutes. Visual reaction time is taken before and after the kapalbhathi pranayama(3).

**Brahmari Pranayam:** The subject was instructed to sit straight with spine erect. The subject was instructed to put the left hand lightly over the tragus of the left ear, and the thumb of the right hand lightly on the tragus of the right ear. Tragus is the fleshy cartilaginous prominence in front of the opening or hole in the ear(4).

They were asked to place the index finger of each hand over the outer corners of closed eyelids, the middle fingers on the side of the nose, near nostrils, fourth fingers above and little fingers below the corners of the mouth.

The subject was asked to chant aum producing or imitating a sound like buzzing bee or wasp while exhaling through nasal cavity keeping mouth closed but keeping the attention at point between eyebrows.

**Exercise:** Subjects were instructed to run on the spot with a springy step but exaggerated motion, for 50 to 60 counts at 2 counts per second, maintaining a constant rhythm. The arms are bent at the elbow and were stationary during the exercise. Reaction times were taken before and after exercise(5).

Subjects who were smokers, alcoholics, who had abnormal vision, were excluded from the study.

**Gayatri Mantra:** Online visual reaction time was measured during listening to Gayatri Mantra was taken. Gayatri mantra means 'We meditate on the worshipable power and glory of him who has created the earth, the nether world and the heavens (i.e. the universe), and

who directs our understanding”. The duration of study was three months. Sound of music kept low (audible). Healthy students with normal hearing and Hindu religion were included in the study. Students who had hearing problems as tested by whispered voice test, complaints of tinnitus, ear pain and students of a different religious faith who did not want to hear the Gayatri mantra were excluded. The mantra was listened early morning. Our hypothesis is that stimulating music, such as Gayatri mantra will shorten the reaction

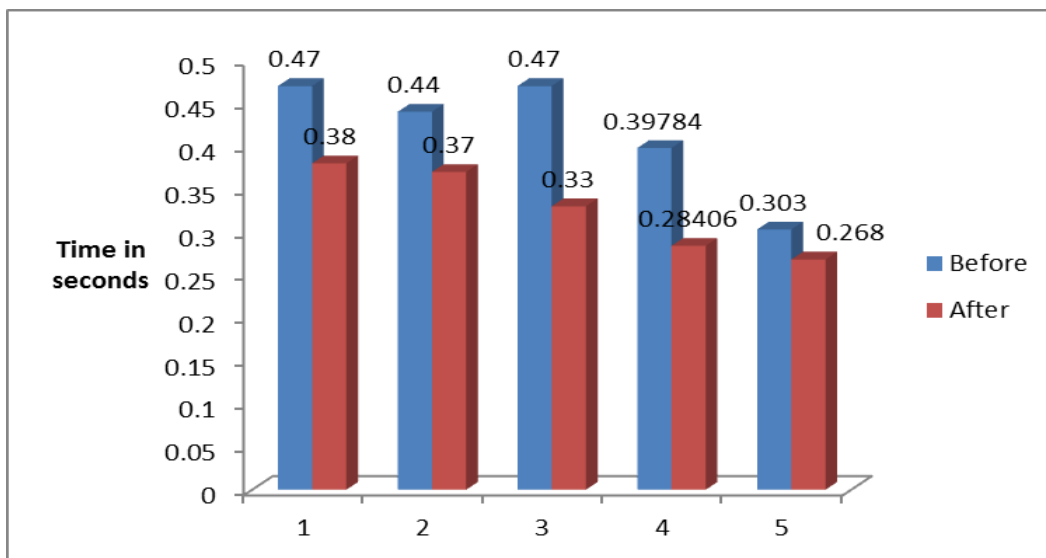
time to visual stimuli, while without music; the reaction time will be longer(6).

**Reaction Time:** Reaction time test was taken online.(7)

It consists of a traffic light signal of red, yellow and green. The subject is instructed to click on a button to begin when ready, to wait for the stoplight to turn green, and click the button when it turns green quickly. The average of five responses in seconds is taken as reading.

**RESULTS**

| Manouvere                     | Reaction Times Before | Reaction Times After | Difference in reaction times | P value |
|-------------------------------|-----------------------|----------------------|------------------------------|---------|
| Anuloma Viloma Pranayama n=66 | 0.47 ± 0.15           | 0.38 ± 0.09          | 0.09                         | 0.001   |
| Kapalbhatti Pranayama n=20    | 0.44 ± 0.2            | 0.37 ± 0.11          | 0.07                         | 0.002   |
| Gayatri Mantra                | 0.47 ± 0.1            | 0.33 ± 0.11          | 0.14                         | 0.001   |
| Brahmari Pranayama n=31       | 0.39784 ± 0.15        | 0.28406 ± 0.09       | 0.113                        | 0.0005  |
| Exercise                      | 0.303 ± 0.06          | 0.268 ± 0.024        | 0.035                        | 0.0106  |



**Fig. 1: Comparison of reaction times**

1. Anuloma Viloma Pranayama
2. Kapalbhatti Pranayama
3. Gayatri mantra
4. Brahmari Pranayama
5. Exercise

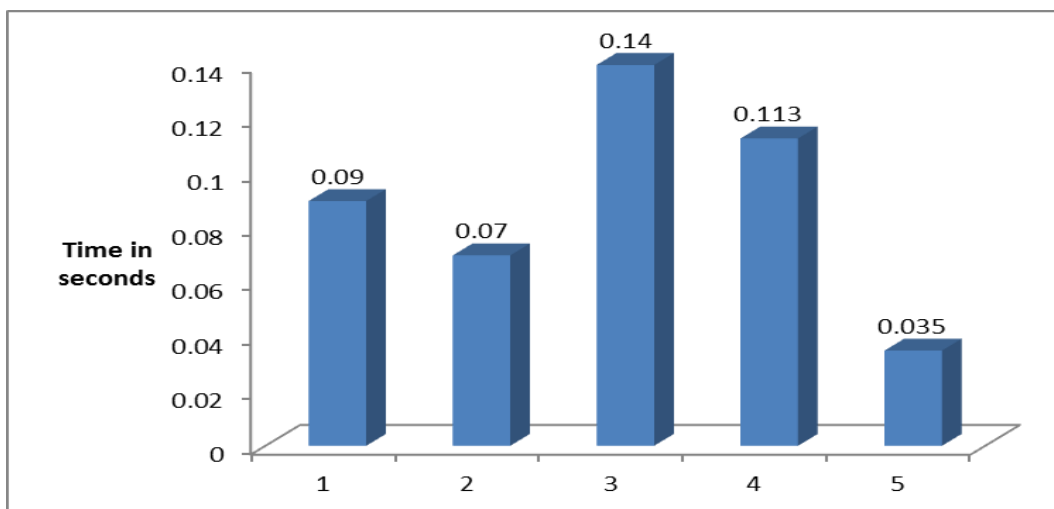


Fig. 2: Comparison of reaction times in Different Maneuvers

1. Anuloma Viloma Pranayama
2. Kapalbhathi Pranayama
3. Gayatri mantra
4. Brahmari Pranayama
5. Exercise

## DISCUSSION

Concentration is focusing the mind through interest and determination on one line of thought(1). Pranayama helps still the mind and achieve perfect concentration. Real concentration is the one-pointed focusing of the mind on a particular thought by means of a definite scientific technique like Anuloma Viloma Pranayama, Kapalbhathi Pranayama or listening to gayatri chant.

Concentration as seen by a decrease in visual reaction time denotes first a withdrawal of attention from objects of distraction and then focusing all attention upon one thing at a time.

**Pranayama and Reaction Times:** By calming the breath during pranayama, control of lifeforce or prana results. This helps to withdraw the currents from the senses, preventing disturbing sensations from the senses, preventing disturbing sensations from reaching the brain, thus calming the mind(1).

The subject then can throw the attention at will on the object of concentration for example the changing light in the online reaction test in our study.

Pranayama charges the body with an increased supply of oxygen through the lungs. This oxygen “burns” or oxidizes the waste impurities, chiefly carbon, in the venous blood. This process of purification is enhanced by an accompanying large increase in expulsion of waste carbon dioxide from the lungs during exhalation. As a consequence, very little of the tissue remains in the blood as waste material. There is less need for the breath, as the flow to the lungs of blood for purification slows down. The heart

and lungs are given extraordinary rest(1,8-11). The inactivity of the muscles and limbs during meditation lessens bodily carbon dioxide production and is conducive to the restful state of heart and lungs. Rest is given to the heart and this helps in increasing longevity(12-14).

Breathing through the right nostril during Alternate Nostril Breathing helps increase the output of adrenaline from the adrenal medulla. Adrenaline causes pupillary dilation and a faster reaction time than Kapalbhathi pranayama.(3)

In Kapalbhathi pranayama the abdominal wall is brought into activity. Excessive muscular activity may be the reason why kapalbhathi may not be as effective as anuloma viloma pranayama to decrease reaction times. Anand et al reported dominance of alpha rhythm in the EEG activity of persons trained in yoga(15).

Yoga relaxes, relieves stress, makes the patients feel good, alert, active and exhilarated by releasing opioids and altering adrenocortical activity that gives pleasurable sensations and keeps the body fit(16). This helps increase concentration that improves reaction times, as noted in our study.

**Gayatri Mantra and Reaction Times:** Sensations are the greatest distractions. Most distractions reach the mind through the medium of the senses. Every minute the attention wants to concentrate upon a problem or a business it meets many distractions caused by sensations of sight, hearing, taste, touch and smell (17-20).

The sensations in turn give rise to thoughts which lure the attention away from the object of concentration(21-23).

Fresh thoughts arising from sensations may rouse associated thoughts. These thoughts are the distractions to the goal of concentration in this case the

green light(1,24). The way to remove sensory distractions is to control the life force by Pranayama.

The way to prevent thoughts from causing distractions would be to replace it with Gayatri Mantra or chanting. This is the scientific way to practice concentration(6).

**Exercise and Reaction Times:** Reaction time study is an important method used for central information processing speed and fast coordinated peripheral movement response. It is an external indicator of the ability of the nervous system to receive process and initiate response to incoming stimuli. Responses that take more time to initiate are assumed to require longer information processing times. Measurement of reaction Time is a common method to evaluate psychomotor fitness(25). They are several factors that influence the reaction time such as age, gender, left handedness vs right, practice, exercise, type of personality, the use of stimulant drugs, hypothyroidism and hyperthyroidism, brain injury and illness(26).

Other studies showed trends in reaction time due to arousal or state of attention. This state of attention also includes muscular tension that can be generated by exercise(27,28). They found that muscular tension allowed the brain to work faster, although muscular tension did not affect movement time.

Though, numerous studies by Welford (1980) showed that reaction time deteriorates when the subject is either too relaxed or too tense(27). We found that immediately after exercise the reaction times were fastest, owing to an alert aroused response similar to fight, flight response due to adrenaline. However, as time passed the individual tends to relax and reaction time deteriorates. The RTs were faster than the basal values but slower than the values obtained immediately after exercise.

Fastest reaction times were observed when the subjects were exercising sufficiently to produce a heart rate of 115 beats per minute(29). One plausible mechanism for this decrease in reaction time is that an increased heart rate due to moderate exercise increases cortical blood flow and enhances cognitive function due to a greater state of arousal (30). Another study reported an improvement in reaction times irrespective of age and gender when subjects regularly exercised for 30 minutes in gymnasium(25).

Exercise training increases mitochondrial content of exercising muscles delaying fatigue(31). Aerobic physical exercise also protects the Central Nervous system against damages caused by reactive oxygen species(32). Exercise also increases blood circulation in the brain that improves neurological functioning(33). This helps increase nutrients like glucose and oxygen, alter levels of neurotransmitters such as serotonin, norepinephrine and dopamine. Frequent exercise results in enhancement of memory,

cardiovascular activity and sustained cognitive aptitude(34).

**General Mechanism of Improving concentration and decreasing Reaction times:** Controlling the life force in the body enables the yogi to switch off the current from the sensory nerve telephones, thus making it impossible for disturbing sensations to reach the brain and distract the attention from goal.

Because of the vital link between breath and life force, many persons think that pranayama-life-force control—consists in holding the breath for long periods. This is untrue. The mortal breath that binds the soul to the body cannot be made to stop by forcibly holding it in the lungs, which is dangerous. Rather by stopping decay (the normal process of cellular breakdown) in the system, and by developing calmness and practicing spiritual exercises such as pranayama, yogis achieve the breathless state in a natural way. It is life force that governs breath, heartbeat, sensory impressions, and motor responses—all the functions of the body. Pranayama means control of that life force, and-hence control over all the functions of the body. Pranayama-techniques of life-force control that calm the heart and breath and remove *sensory distractions* from the mind(40).

**Comparison of Various Techniques:** Reaction times were least while listening to Gayatri mantra chant. The reason may be as in this maneuver the reaction time was tested while the procedure was going on i.e. the chant while in others the test was done after the procedure was completed. Besides the Gayatri would help keep the mind of other distractions and help focus the mind by turning the life force away from the senses. The subject was able to click on the changing light instantly, as a result. In Brahmari also the reaction times are lesser than other techniques. Brahmari is a technique of Pratyahar-or interiorization. The purpose of Brahmari is to prevent the escape of life force through the head openings of eyes, ears, nose and mouth and use the captured life force to chant “aum”.

**Lacunae and Further studies:** It has been shown performing reaction time to an auditory stimulus rather than a visual stimulus eliminated higher variability that can accompany visual stimulus like color of light used and background light. We intend to measure auditory reaction times and the effects of exercise on it.

## REFERENCES

1. Sri Paramhansa Yogananda. God Talks With Arjuna. The Bhagavad Gita Royal Science of God-Realization. The immortal dialogue between soul and spirit. A new translation and commentary 2002, chapter IV Verse 29 p 496-507.
2. Malhotra V, Dhar U, Garg. Anuloma viloma pranayama modifies reaction times and autonomic activity of heart: a pilot study. *Ijcr*. 2012;4(19):146-149.

3. Goel N, Malhotra V, Dhar U. KAPAL BHATI PRANAYAMA MODIFIES VISUAL REACTION TIME. *IJCRR*. (2013), [cited January 28, 2016];5(13):105-109.
4. Kamta Prasad Sahu, Kmal Kishore. The effect of Bhramari Pranayama and Jyoti Dhyana effect on alpha ECG and Hemoglobin of college going students. *Int. Journal of Physical Education, Sports and Health* 2015;1(4):40-44.
5. Varun Malhotra, Neera Goel, Usha Dhar, Yogish Tripathi, Rinku Garg, Exercise and Reaction times. *Journal of Evolution of Medical and Dental Sciences* 2015; Vol. 4 Issue 25, March 26; Page:4277-4281,DOI:10.14260/jemds/2015/618.
6. Varun Malhotra, Rinku Garg, Usha Dhar, Neera Goel, Yogesh Tripathy, Iram Jaan, et al. Mantra, Music and Reaction Times: A Study of Its Applied Aspects. *International Journal of Medical Research and Health Sciences* 2014;3(4):825-828.
7. Online reaction times. <http://getyourownwebsitehere.com/jswb/rttest01.html>
8. OP Tandon, S Singh, V Malhotra. Beneficial Effects of Yoga Asanas in the NIDDM: Biochemical and Electrophysiological Evidence. *Emerging Concepts in Yoga & Lifestyle* p43-53.
9. Anand BK, Chhina GS and Baldev Singh. Some aspects of electroencephatographic studies in yoga'. *Electroencephal and Clin. Neurophysiol*,1961,3:452-456.
10. Udupa KN, Singh RH, Settiwar RM. A comparative study on the effect of some individual Yogic practices in normal persons. *Indian J Med Res* 1975;63:1066-71.
11. Varun Malhotra et al. Surya Anuloma Viloma Pranayama modifies autonomic activity of heart The *Journal of Yoga (JOY)* Vol 8 2009 Spring p1-5(Indexed through EBSCO info services).
12. Varun Malhotra Physiology of Anuloma Viloma Pranayama" *J. R. Educ. Indian Med*, 2008 Oct-Dec p 61-63 ISSN 0970-7700.
13. Varun Malhotra et al "Alternate Nostril Breathing Exercise on Cardiorespiratory Functions Kshitiz Upadhyay Dhungel, *Nepal Med Coll J* 2008;10(1):25-27.
14. Varun Malhotra, Raj Kumar Patil, Monica Malhotra, Kshitiz, Nagamma T, Rahul A, Anshul Singh, Shreekant, Sonam Motani, Atulya Choudhary Chandra Anuloma Viloma Pranayama modifies autonomic activity of the heart" *Bulletin of Association of Physicians of Tamilnadu* 2008, 2(1) p27-28.
15. Anand BK, Chhina GS and Baldev Singh. Some aspects of electroencephatographic studies in yoga. *Electroencephal and Clin. Neurophysiol*, 1961,3:452-456.
16. Jain SC, Talukdar B. Evaluation of yoga therapy programme for patients of bronchial asthma. *Singapore Med J*. 1993 Aug; 34(4):306-8.
17. Mason, R. A. Audiation, cochlear function, and the musical ear of Alfred Tomatis. *Dissertation Abstracts International* 2001; 63:956.
18. G R. Music therapy: Proposed physiological mechanisms and clinical implications. *Clin Nurse Spec* 1997;11:43-50.
19. Hyde IM, Scalapino W. The influence of music upon electrocardiograms and blood pressure. *Am J Physiol*.1918;46:35-38.
20. Bernardi L, Sleight P, Bandinelli G, Cencetti S, Fattorini L, Wdowezyc-Szulc J, et al. Effect of rosary prayer and yoga mantras on autonomic cardiovascular rhythms: comparative study. *BMJ*. 2001;323:1446-49.
21. Wendy E, J Knight, Nikki S. Richard PhD. Relaxing music prevents stress induced increases in subjective anxiety, systolic blood pressure and heart rate in healthy males and females. *Oxford Journals. Journal of Music Therapy*.2001; 38(4):254-72.
22. Burns J, Labbe E, Williams K et al. Perceived and physiological indicators of relaxation; as different as Mozart and Alice in chains. *Appl Psychophysiol Biofeedback*.1999;24:197-02.
23. S Chaffin, M Roy, W Gerin. Music can facilitate blood pressure recovery from stress. *British Journal of Health and Psychology*. 2004;9(3):393-03.
24. Mockel M. Immediate physiological responses of healthy volunteers to different types of music, cardiovascular, hormonal and mental changes. *European Journal of Applied Physiology and Occupational Physiology*.1994;68:451-59.
25. Monika Garg, Hem Lata, Lily Walia, Omesh Goyal. Effect of Aerobic Exercise on Auditory and Visual Reaction Times: A Prospective Study. *Indian J Physiol Pharmacol* 2013;57(2):138-145.
26. Brebner J.T. and Welford A.T. Introduction: a historical background sketch. In A.T. Welford (Ed.) *Reaction Times*. New York Academic Press. 1980;1-23.
27. Welford AT. Choice reaction time: basic concepts. In: Welford AT. 1<sup>st</sup> ed. *Reaction times*. New York: Academic Press;1980:73-128.
28. Nakamoto H, Mori S. Sport-specific decision making in a Go/No Go reaction task: difference among non-athletes and baseball and basketball players. *Percept Mot Skills* 2008;106:163-170.
29. Levitt S, Gutin B. Multiple choice reaction time and movement time during physical exertion. *Res Q* 1971; 42:405-410.
30. Ando S, Kida N and Oda S. Practice effects on reaction time for peripheral and central visual fields. *Perceptual and Motor Skills*. 2002;95:747-751.
31. Joki E, Lexington KY, Anand RL. *Advances in exercise physiology*: New Delhi: S Karger 1974:18-22.
32. Radak Z, Kaneko T, Tahara S. Regular exercise improves cognitive function and decreases oxidative damage in rat brain. *Neurochem Int* 2001;38:17-23.
33. McAuley E, Kramer AF, Colcombe SJ. Cardiovascular fitness and neurocognitive function in older adults: A brief review. *Brain Behav Immun* 2004;18:214-220.
34. Potter D, Keeling D. Effects of moderate exercise and circadian rhythm on human memory. *J Sport Exerc Psychol* 2005;27:117-125.