

“IMMEDIATE EFFECT OF BHRĀMARĪ PRĀNĀYĀMA WITH WALKING ON
TASK PERFORMANCE AMONG SCHOOL STUDENTS USING SIX LETTER
CANCELLATION TEST AND DIGIT LETTER SUBSTITUTION TEST”

Dissertation Submitted by
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Under the guidance of
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Towards the Partial fulfilment of

Masters of Science in Yoga [M Sc (Yoga & Education)]

To



Swami Vivekananda Yoga Anusandhana Samsthana (SVYASA)
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CERTIFICATE

This is to certify that Srinivas Gandikota is submitting this Literary research titled “Nāda Yoga” and Experimental research titled “immediate effect of bhrāmarī prānāyāma with walking on task performance among school students using six letter cancellation test and digit letter substitution test” in partial fulfillment of the requirement for the Master of Science (Yoga and Education) registered with effect from January 12, 2010 by Swami Vivekananda Yoga Anusandhana Samsthana under the division Life sciences and is a record of the work carried out by him in this institute.

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DECLARATION

I, hereby declare that this study was conducted by me at Swami Vivekananda Yoga Anusandhana Samsthana (SVYASA), Bangalore, under the guidance of Dr. Balaram Pradhan, Swami Vivekananda Yoga University, Bangalore. I also declare that the subject matter of my dissertation entitled below has not previously formed the basis of the award of any degree, diploma, associate ship, fellowship or similar titles.

PART – 1

NĀDA YOGA

PART – 2

IMMEDIATE EFFECT OF BHRĀMARĪ PRĀNĀYĀMA WITH WALKING ON TASK PERFORMANCE AMONG SCHOOL STUDENTS USING SIX LETTER CANCELLATION TEST AND DIGIT LETTER SUBSTITUTION TEST”

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Date:

Place: Bengaluru

SRINIVAS GANDIKOTA

IMMEDIATE EFFECT OF BHRĀMARĪ PRĀNĀYĀMA WITH WALKING ON TASK PERFORMANCE AMONG SCHOOL STUDENTS USING SIX LETTER CANCELLATION TEST AND DIGIT LETTER SUBSTITUTION TEST

Abstract

Background

Memory and selective attention are important skills for academic and professional performance. Techniques to improve these skills are not taught either in education or company training courses. Any system which can systematically improve these skills will be of value in schools, universities and work places.

Aim

The aim was to investigate possible improvement in attention, as measured by Digit Letter Substitution Task (DLST) and Six Letter Cancellation Task (SLCT), due to practice of Bhrāmarī prānāyāma along with walking, as compared to walking alone.

Materials and Methods

Subjects consisted of 69 school students included boys = 47(68.12-%) and girls =22(31.9%), in the age range of 10-17 years were participated. They acted as their own controls. They were assessed on DLST and SLCT immediately before and after two sessions (i) Bhrāmarī prānāyāma along with walking on the treadmill at 4 kms/hr (BWT) and (ii) walking on treadmill (WT) with an equal time (10 minutes) period. Fifty percent of participants performed Bhrāmarī prānāyāma along with walking and remaining on the simple walking session on Day-1. The order of the sessions were reversed on Day-2.

Results

Both sessions showed significant improvement in the total and net score of SLCT and DLST. But the magnitude of change was significantly higher in BWT (NSLCT =35.6%, NDLST = =21.67%) compared to WT (SLCT= 2.41%, DLST= 4.85%). It shows the magnitude of change in case of walking along with Bhrāmarī prānāyāma on the treadmill is much more significant compared to that of walking alone on the treadmill.

Conclusion

The combined effect of physical activity along with Bhrāmarī prānāyāma showed better improvement compared to only physical activity.

Key words: Attention, Yoga, Bhrāmarī prānāyāma.

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CHAPTER 1

INTRODUCTION

Yoga is used as part of holistic health practices designed to promote physical, psychological, spiritual health and wellness (Kurtz, 2008). Yoga influenced neurotransmitter function and increases Aminobutyric acid (GABA) level in the brain (White, 2009) , improvement in motor tasks (Subramanya & Telles, 2009); Telles, Raghuraj et al., 2006). The different stages of meditation such as dharana and cancelata, and dharana sessions showed significant improvements in cancellation task (Kumar & Telles, 2009).

Above mentioned study were conducted on adult with highly experienced yoga practitioner. In school students' population studies on Cyclic meditation showed significant improvement in attention as assessed by SLCT and DLST. The change caused by CM was larger than SR (Pradhan & Nagendra, 2010). Digit Letter Substitution Test (DLST) requires visual selectivity and repetitive motor response. It is used to assess selective, focused sustained attention, visual scanning, activation and inhibition of rapid responses. A test of similar design to the DLST has been successfully used in an Indian population, confirming its validity to study immediate effects as DLST as an alternative to Digit Symbol Substitution Test (DSST) (Natu & Agarwal, 2004).

Prāṇāyāma is defined as control of breath and neuro-physiological responses by increasing the activity of Parasympathetic nervous system (Jerath, Edry, Barnes, & Jerath, 2006). Yoga breathing practices enhance the contra lateral hemisphere function which results better performance in cancellation task (Telles, Raghuraj, Maharana, & Nagendra, 2007). Kapalabhati also influence letter cancellation task (Telles, Raghuraj, Arankalle & Naveen, 2008).

Bhrāmarī prāṇāyāma changes the rhythm of breathing by long expiration and short inspiration. Bhramari controls the physiological effect (Vialatte, Bakardjian, Prasad & Cichocki, 2009). The slow pace bhrāmarī prāṇāyāma for 5 minutes, induced parasympathetic dominance on cardiovascular system (Pramanik, Pudasaini & Prajapati R., 2010).

Some studies have been conducted to assess the impact of bhrāmarī prāṇāyāma on improving attention and improving the performance on cancellation task in children.

Physical exercise improves working memory task (Letter Digit Span; LDS) in low performing adolescents (Budde H, et al, 2010), Significant improvements in memory were observed in both the cycling and the stretching/coordination group as compared with the sedentary control group (Hötting K, Reich B, et al, (2011). Walking as a mild form of physical exercise is known as an effective practice for keeping oneself healthy. But till now there is no study which has been conducted to show the effect of bhrāmarī prāṇāyāma along with general walk to evaluate the improvement on performance on both SLCT and DLST. Hence this present study aims at determining the immediate effect of bhrāmarī prāṇāyāma along with walk on performance of both SLCT and DLST among school students.

CHAPTER 2

LITERATURE SURVEY

2.1 CONCEPT OF NĀDA

2.1.1 INTRODUCTION

The etymological meaning of nādaḥ is “flow of consciousness”. It can also be described as the stream of life, consciousness, cosmic rhythmical vibration or the sound current. It is the flow of inner current of sound. Seers say it is the ancient spiritual art and science of inner transformation through sound. It has been a common practice, throughout the universe, to meditate on nādaḥ, irrespective of cast, gender or religion for all spiritual aspirants.

According to the Sanskrit dictionary the root word of Nāda is नद and its meaning is

नद – to roar, shout, cry, howl , make sound or vibrate

नादः – 1. A loud roar, cry, shout, produce sound

Throughout the world use of holy name and its repetition is a general practice for getting peace of mind, to fulfill the cherished object. In India it is being used as a medium , practiced mentally or loudly (doing japa), to de-condition one self from long standing patterns and go beyond the gross consciousness. It has been found that rhythmic repetitions (either loudly or mentally) influence the function of different organs. Mental repetitions create acoustic vibrations, directly affect the central nervous system. Repetitions influence individual’s thoughts, feelings and the depth of perception.

“Nāda Yoga” is the classical term for the Yoga of Sound in the Indian tradition. It is a stream of sacred sound that embraces Haṭha Yoga, the occult linguistics of Tantra, and the spirituality of classical Indian music. By including the nonlinguistic element of music, Nāda Brahman augments the Śabda Brahman of the Vedic tradition, as well as the differentiation of energy in the chakras discovered by the Tāntrikas. While Bhāva Yoga chooses only those frequencies that we classify as music in our earthly appreciation of sound, Nāda yogis incorporate the full spectrum of frequencies — both those that are

audible to the human ear and those that are inaudible — within the field of their yoga practice. This means that all forms of earthly music, the sounds of space, and even the entire electromagnetic spectrum of frequencies are included within this range of perception.

Human hearing lies in the range between sixteen and twenty thousand hertz. “Frequency” refers to the number of wave cycles that occur in one second, giving rise to the experience of high and low tones. Wavelength gets longer as the frequency (or pitch) decreases. Although we may not “hear” all the frequencies that exist in our universe, we are affected by these waves at every moment, and we in turn affect these frequencies by our own sounds and activities.

Indian scriptures describe that there was ākāśa (space or sky) and from there one nāda or śabda (sound) produced and that is “om”. Due to this “om” nāda everything was created. This is the origin of all creation in this universe. Hence it is said that the universe is the projection of sound vibrations. Muslim saints say that the world has evolved from sound and form. The christians also say that in the beginning there was the sound and word was with God and the word was God.

Nāda Yoga does bring together all the key elements and cosmogonies of sacred sound that are explored in those streams, including the devotional element of Bhāva represented in Nāda Yoga by the tradition of Indian classical music. In the first millennium B.C., Nāda yogis focused extensively on the mantra *Om*, which Patañjali’s classic Yoga sūtra teach as:

तस्य वाचकः प्रणवः ॥ प यो सू १-२७ ॥

tasya vācakaḥ praṇavaḥ || PYS 1-27 ||

the “sound that expresses the Divine Absolute,” which should be “repeatedly intoned while absorbing its meaning”.

तज्जपस्तदर्थभावनम् ॥ प यो सू १-२८ ॥

tajjapastadarthabhāvanam || PYS 1-28 ||

The Science of Sound

The cosmology of Nada Yoga presumed that the primary stuff of the universe is vibratory, and therefore sonic in nature. Modern physics supports this understanding, especially via the new field of string theory, which claims that the entire universe may be

made up of infinitesimally small subatomic strands of energy vibrating at different frequencies. The speed at which an object vibrates (as well as its size, however infinitesimal) contributes to its particular sound. Thus, the tones and frequencies that comprise the known universe become the subject of meditation in Nāda Yoga. This science of Nāda Yoga, which also takes into consideration the musical intervals used in music and in the musical recitation of mantras, is brought together with meditation techniques and certain Haṭha Yoga practices that are conducive to sonic exploration.(Don Campbell, 1992)

There are four stages of total manifestation of sound from gross to subtle by which the technique of Nāda yoga develops: (Nāda yoga by Swami Satyananda Saraswati, Swami Satyananda Saraswati, Bihar School Of Yoga, Muger)

- I. वैखरी -*vaikharī*: The sound which can be heard
- II. मध्यमा-*madhyamā* : Soft mental sound with more vibrations
- III. पश्यन्ति-*paśyanti* : Visual sounds which may not be heard
- IV. परा-*parā*: Transcendent sound

1.1 परा नाद (*Parā nāda*): it is called as transcendental sound. It is a sound of great frequency which goes beyond vibration. It is of infinite wavelength. The Upanishads call it ‘Om’. They say its nature is jyoti or light. Ultimately ‘Om’ is silence. In meditation light and silence are the same. Om is anāhata or unstuck sound which is different from normal sound. It has a spontaneous origin. Om is anāhata without any boundary or quality indicating non-tone. It is the inner silence, the root sound or possibility of sound. As per the Pythagoreans, this sound stood for nought or the junction of chi. Parā is the stage before Samadhi

1.2. पश्यन्ति-*paśyanti*: It means that which can be seen, visualized or perceived. It is the mental sound. It is the visualisation of a sound or a melody which is recalled again and again. It is a subconscious sound. This sound is nearer to our mind than the ear.

1.3. मध्यमा-*madhyamā*: In between sound. It is a sound with lower frequencies than the two preceding but higher frequencies than *vaikharī*. It can be a whispering sound with almost no audible effect.

1.4. वैखरी -*vaikharī*: Sound produced by striking two objects. Its frequencies of vibrations are conducted within a specific range. Speech and music belong to this category.

2.1.2 OBJECTIVE

The present review is conducted to compile authentic information on Nāda yoga from classical yogic and spiritual literature.

2.1.3 MATERIALS AND METHODS

2.1.3. A SOURCE MATERIALS

The traditional yogic and spiritual literature was reviewed. The sources for the present literature search include: 1.

2.1.3. B METHODS

The verses and relevant information about different aspects of Nāda yoga, from the above mentioned sources were first systematically compiled and then were sorted according to the defined structure of the sections. The relevant references are cited in the body of the text as well as in the reference section.

2.1. 4 Concept of Nāda according to Scriptures

2.1.4. A. प्रश्नोपनिषद् - *Praśnopaniṣad*

स यो ह वै तद्भगवन् मनुष्येषु प्रायणान्तमोङ्कारमभिध्यायीत कतमं वाव स तेन लोकं जयतीति ॥ ५-१ ॥

Sa yo ha vai tadbhagavan manuṣyeṣu prāyaṇāntamoṅkāramabhidhyāyīta katamaṁ vāva sa tena lokam jayatīti || 5-1||

Shaibya Satyakama asked, " Lord he among men that meditate unto death on OM the syllable, which of the words does he conquer by its puissance?"

तस्मै स होवाच। एतद् वै सत्यकाम परं चापरं च ब्रह्म यदोङ्कारः। तस्माद् विद्वानेतेनैकतरमन्वेति ॥ ५-२ ॥

*tasmai sa hovāca| etad vai satyakāma param cāparam ca brahma yadomkārah| tasmād
vidvānetenaikataramanveti|| 5-2 ||*

Rishi Pippalada answered, "This imperishable Word that is Om, Satyakāma, is the Higher Brahma and also the Lower. Therefore the wise man by making his home in the Word, wins to one of these.

स तद्येकमात्रमभिध्यायीत स तेनैव संवेदितस्तूर्णमेव जगत्यामभिसंपद्यते। तमृचो मनुष्यलोकमुपनयन्ते स तत्र
तपसा ब्रह्मचर्येण श्रद्धया संपन्नो महिमानमनुभवति ॥ ५-३ ॥

*sa tadyekamātramabhidhyāyīta sa tenaiva sarṇveditastūrṇameva
jagatyāmabhisarṇpadyate| tamṛco manuṣyalokamupanayante sa tatra tapasā
brahmacaryeṇa śraddhayā sarṇpanno mahimānamanubhavati ||5-3 ||*

"If he meditates on the one letter of Om the syllable, by that enlightened he attains swiftly in the material universe, and the hymns of the ṛgveda escort him to the world of men; there endowed with askesis and faith and holiness he experiences majesty.

अथ यदि द्विमात्रेण मनसि सम्पद्यते सोऽन्तरिक्षं यजुर्भिरून्नीयते सोमलोकम्। स सोमलोके विभूतिमनुभूय
पुनरावर्तते ॥ ५-४ ॥

*atha yadi dvimātreṇa manasi sampadyate so'ntarikṣarṇ yajurbhirūnnīyate somalokam| sa
somaloke vibhūtimanubhūya punarāvartate|| 5-4 ||*

"Now if by the two letters of the syllable he in the mind attains, to the skies he is exalted and the hymns of the Yajur escort him to the Lunar World. In the heavens of the Moon he feels his soul's majesty; then once more he returns.

यः पुनरेतं त्रिमात्रेणौमित्येतेनैवाक्षरेण परं पुरुषमभिध्यायीत स तेजसि सूर्ये सम्पन्नः। यथ पादोदरस्त्वचा विनिर्मुच्यत एवं ह वै स पाप्मना सूर्ये विनिर्मुक्तः स सामभिरून्नीयते ब्रह्मलोकं स एतस्माज्जीवघनात्परात्परं पुरिशयं पुरुषमीक्षते ॥ तदेतौ श्लोकौ भवतः ॥ ५-५ ॥

yaḥ punaretaṁ trimātreṇaumityetenaiṅvākṣareṇa paraṁ puruṣamabhidhyāyīta sa tejasi sūrye sampannaḥ| yatha pādodarastvacā vinirmucyata evaṁ ha vai sa pāpmanā sūrye vinirmuktaḥ sa sāmabhirūnnīyate brahmalokaṁ sa etasmājjīvaghanātparātparaṁ puriśayaṁ puruṣamīkṣate|| tadetau ślokau bhavataḥ|| 5-5 ||

“But he who by all the three letters meditates by this syllable, even by OM on the Most High Being, he in the Solar world of light and energy is secured in his attainings: as a snake casts off its slough: so he casts off sin, and the hymns of the Samveda escort him to the heaven of the Spirit. He from that Lower who is the density of existence beholds the Higher than the Highest of whom every form is one city. Whereof these are the verses:-

तिस्रो मात्रा मृत्युमत्यः प्रयुक्ता अन्योन्यसक्ता अनविप्रयुक्ताः। क्रियासु बाह्यान्तरमध्यमासु सम्यक्प्रयुक्तासु न कम्पते ज्ञः ॥ ५-६ ॥

tisro mātrā mṛtyumatyaḥ prayuktā anyonyasaktā anaviprayuktāḥ| kriyāsu bāhyāntaramadhyamāsu samyakprayuktāsu na kampate jñaḥ|| 5-6 ||

“Children of death are the letters when they are used as three, the embracing and the inseparable letters: but the wise man is not shaken: for there are three kinds of works, outward deed, inward action and another which is blended of the two, and all these he does rightly without fear and without trembling.

ऋग्भिरेतं यजुर्भिरन्तरिक्षं सामभिर्यत्तत्कवयो वेदयन्ते। तमोँकारेणैवायतनेनान्वेति विद्वान्
यत्तच्छान्तमजरममृतमभयं परं चेति ॥ ५-७ ॥

ṛgbhiretaṁ yajurbhirantarikṣaṁ sāmabhiryattatkavayo vedayante|

*tamoṁkāreṇaivāyatanenānveti vidvāna yattacchāntamajaramamṛtamabhayaṁ paraṁ
ceti|| 5-7 ||*

“ To the earth the ṛgveda leads, to the skies the Yajur, but the Sama to That of which the stages know. Thither the wise man by resting on OM the syllable attains, even to that Supreme Quietude where age is not and fear is cast out by immortality.”

2.1.4. B. माण्डुक्य उपनिषद् - *Māṇḍūkya upaniṣad*

This upanishad speaks in detail about the word and syllables of the first sound in the universe that is OM, It goes on to describe the importance of each syllable and the deeper meaning behind it. Ultimately it tries to describe the Ultimate reality, the Cosmic consciousness through a few shlokas. Hence when we talk about Nada the importance of this upanishad comes to the front.

सोऽयमामाध्यक्षरमोँडकारोऽधिमात्रं पादा मात्रा मात्राश्च पादा अकार उकार मकार इति ॥ ८ ॥

*so'yamāmādhyaṣaramoṁḍakāro'dhimātraṁ pādā mātrā mātrāśca pādā akāra ukāra
makāra iti|| 8 ||*

Now this the Self, as to the imperishable Word, is OM: and as to the letters, His parts are the letters and the letters are His parts, namely, A U M.

जागरितस्थानो वैश्वानरोऽकारः प्रथमा मात्रा आक्षेरादिमत्वाद् वा आप्नोति ह वै सर्वान् कामानादिश्च भवति य एवं वेद ॥ ९ ॥

jāgaritasthāno vaiśvānaro'kāraḥ prathamā mātrā ākṣerādīmatvād vā āpnoti ha vai sarvān kāmānādiśva bhavati ya evaṁ veda || 9 ||

The Waker, Vaishvanara, the Universal male, He is A, the first letter, because of Initiality and Pervasiveness: he that knows Him for such, pervades and attains all his desires: he becomes the source and first.

स्वप्नस्थानस्तैजस उकारो द्वितीया मात्रा उत्कर्षादुभयत्वाद् वा उत्कर्षति ह वै ज्ञानसन्ततिं समानश्च भवति नास्याब्रह्मवित् कुले भवति य एवं वेद ॥ १० ॥

svapnasthānastajasa ukāro dvitīyā mātrā utkarṣādubhaytvād vā utkarṣati ha vai jñānasantatiṁ samānaśca bhavati nāsyābrahmavit kule bhavati ya evaṁ veda || 10 ||

The Dreamer, Taijasa, the Inhabitan in Luminous Mind, He is U, the second letter, because of Advance and Centrality; he that knows Him for such, advances the bounds of his knowledge and rises above difference: nor of his seed is any born that knows not the Eternal.

सुषुप्तस्थानः प्राज्ञो मकारस्तृतीया मात्रा मितेरपीतेर्वा मिनोति ह वा इदं सर्वमपीतिश्च भवति य एवं वेद ॥ ११ ॥

susuptasthānaḥ prājño makārastṛtīyā mātrā miterapītervā minoti ha vā idaṁ sarvamapītiśca bhavati ya evaṁ veda || 11 ||

The Sleeper, Prajna, the Lord of Wisdom, He is M, the third letter, because of Measure and Finality: he that knows Him for such, measures with himself the Universe and becomes the departure into the Eternal.

अमात्रश्चतुर्थोऽव्यवहार्यः प्रपञ्चोपशमः शिवोऽद्वैत् एवमोङ्कार आत्मैव संविशत्यात्मनात्मानं य एवं वेद य एवं वेद ॥

१२ ॥

*amātraścaturtho'vyavahāryaḥ prapañcopaśamaḥ śivo'dvait evamoṅkāra ātmaiva
sarīviśatyātmanātmānaṁ ya evaṁ veda ya evaṁ veda|| 12 ||*

Letterless is the fourth, the Incommunicable, the end of phenomena, the Good, the One than Whom there is no other: thus is OM. He that knows is the Self and enters by his self into the Self, he that knows.

2.1.4 C मुण्डक उपनिषद् - *Muṇḍaka upaniṣad*

Like the other Indian scriptures Muṇḍaka upaniṣad also stresses the importance of uttering, chanting the primordial nāda – the OM –the supreme sound – the divine sound and its importance in one's life.

अरा एव रथनाभौ संहता यत्र नाड्यः

स एषोऽन्तश्चरते बहुधा जायमानः ।

ओमित्येवं ध्यायथ आत्मानं

स्वस्ति वः पाराय तमसः परस्तात् ॥ २-६ ॥

arā eva rathanābhau saṁhatā yatra nāḍyaḥ

sa eṣo'ntaścārate bahudhā jāyamānaḥ

omityevaṁ dhyāyatha ātmānaṁ

svasti vaḥ pārāya tamaśaḥ parastāt|| 2-6 ||

Where the nerves are brought close together like the spokes in the nave of a chariot wheel, this is He that moves within, - there is He manifoldly born. Meditate on the Self as OM and happy be your passage to the other shore beyond the darkness.

2.1.4. D. कठोपनिषत् - *Kaṭhōpaniṣat*

अन्यत्र धर्मादन्यत्राधर्मादन्यत्रास्मात्कृताकृतात्।

अन्यत्र भूताच्च भव्याच्च यत्तत्पश्यसि तद्वद ॥ १-२-१४ ॥

anyatra dharmādanyatrādharmādanyatrāsmātkṛtākṛtāt |

anyatra bhūtācca bhavyācca yattatpaśyasi tadvada || 1-2-14 ||

Nachiketa asks Yama, “ Tell me of That which thou seest otherwhere than in virtue and otherwhere than in unrighteousness, otherwhere than in this created and this uncreated, otherwhere than in that which has been and that which shall be.”

सर्वे वेदा यत्पदमामनन्ति तपंसि सर्वाणि च यद्वदन्ति।

यदिच्छन्तो ब्रह्मचर्यं चरन्ति तत्ते पदं संग्रहेण ब्रवीम्योमित्येतत् ॥ १-२-१५ ॥

sarve vedā yatpdamāmananti tapāṁsi sarvāṇi ca yadvadanti |

yadicchanto brahmacarya caranti tatte padaṁ saṅgrāheṇa bravīmyomityetat||1-2-15 II

Yama replies, “ the seat or goal that all the Vedas glorify and which austerities declare, for the desire of which men practise living, of that will I tell thee in brief compass. OM is that goal, O Nachiketa.

एतद्ध्येवाक्षरं ब्रह्म एतद्ध्येवाक्षरं परम्।

एतद्ध्येवाक्षरं ज्ञात्वा यो यदिच्छति तस्य तत् ॥ १-२-१६ ॥

etaddhyevākṣaraṁ brahma etaddhyevākṣaraṁ param |

etaddhyevākṣaraṁ jñātvā yo yadicchati tasya tat || 1-2-16 ||

“ For this Syllable is Brahman, this Syllable is the Most High; this Syllable if one knows, whatsoever one shall desire, it is his.

एतदालम्बनं श्रेष्ठमेतदालम्बनं परम्।

एतदालम्बनं ज्ञात्वा ब्रह्मलोके महीयते ॥ १-२-१७ ॥

etadālabanaṁ śreṣṭhametadālabanaṁ param |

etadālabanaṁ jñātvā brahmaloke mahīyate || 1-2-17 ||

“ This support is the best, this support is the highest, knowing this support one grows great in the world of the Brahman.

2.1.4. E. घेरण्ड संहिता - Gheraṇḍa saṁhitā

अशक्यतत्वबोधनां मूढानामपि संमतम् ।

प्रोक्तं गोरक्षनाथेन नादोपासनमुच्यते ॥ घे सं ७- ६५ ॥

aśakyatvabodhanāṁ mūḍhānāmapī sarīmatam |

prūktam gorakṣanāthena nādopāsanamucyate||65||

I will describe the concentration nāda as told by Gorakṣanāth which is attainable by even the unlearned who are unable to comprehend Thatness (tatva).

अनिलं मन्दवेगेन भ्रामरीकुम्भकं चरेत्।

मन्दं मन्दं रेचयेद्वायुं भृङ्गनादं ततो भवेत् ॥ घे सं ७- १० ॥

anilam mandavegena bhraamarīkumbhakam caret|

mandam mandam recayedvāyum bhṛṅganādam tato bhavet||ghe sam 7- 10||

अन्तःस्थं भ्रामरीनादं श्रुत्वा तत्र मनो नयेत्।

समाधिर्जायते तत्र चानन्दः सोहमित्यतः ॥ घे। सं ७-११ ॥

antaḥstham bhraamarīnādam śrutvā tatra mano nayet|

samādhirjāyate tatra cānandaḥ sohamityataḥ|| ghe| sam 7-11||

Slowly inhale, during exhalation do the bhramarī prāṇāyāma. While inhaling produce sound like male honey bee and while exhaling produce sound like that of a female honey bee. On these sound concentrate the mind. This is called as nāda-yoga samadhi .

The above stanzas are describing the process for attaining nāda-yoga samadhi . When the practitioner practices antarkumbhaka he/she slowly gets absorbed into nāda and becomes one with it and attains nāda-yoga samadhi .

2.1.4. F. *Haṭha yoga pradīpikā* (हठयोग प्रदीपिक)

नमः शिवाय गुरवे नादबिन्दुकलात्मने।

निरञ्जनपदं याति नित्यं यत्र परयणः ॥ ह यो प्र ४-१ ॥

namaḥ śivāya gurave nādabindukalātmane|

nirañjanapadaṁ yāti nityaṁ yatra parayaṇaḥ ||HYP 4-1 ||

Salutations to Śivā the guru who is of the form of nāda, bindu and kalā.

नासनं सिद्धसदृशं न कुम्भः केवलोपमः।

न खेचरी समा मुद्र न नादसदृशो लयः ॥ ह यो प्र १-४३ ॥

nāsanaṁ siddhasadrūśaṁ na kumbhaḥ kevalopamaḥ|

na khecarī samā mudra na nādasadrūśo layaḥ|| HYP 1-43||

There is no āsana like the siddha, no kumbhaka like kevala, no mudra like khecarī and no laya (absorption of mind) like Nāda.

इन्द्रियाणां मनो नाथो मनोनाथस्तु मारुतः।

मारुतस्य लयो नाथः स लयो नादमाश्रितः ॥ ह यो प्र ४-२९ ॥

indriyāṇāṁ mano nātho manonāthastu mārūtaḥ|

marūtasya layo nāthaḥ sa layo nādamāśritaḥ ||HYP 4-29 ||

The mind is the lord of indriyās (the organs of senses). Prāṇa is the lord of the mind.

Laya (or absorption) is the lord of the prāṇa, and that laya depends on the nādā (the inner sounds).

यथेष्टधारणां वायोरनलस्य प्रदीपनम्।

नादाभिव्यक्तिरारोग्यं जायते नाडिशोधनात् ॥ ह यो प्र २-२० ॥

yatheṣṭhadhāraṇāṃ vāyoranalasya pradīpanam|

nādābhivyaktirārogyaṃ jāyate nāḍīśodhanāt ||HYP 2-20 ||

If the nāḍis are purified, he is able to restrain his breath longer, the gastric fire becomes more active, the nādā (inner sound) is heard and he enjoys perfect health.

महति श्रूयमाणेऽपि मेघभेयादिके ध्वनौ।

यत्र सूक्ष्मात्सूक्ष्मतरं नादमेव परामृशेत् ॥ ह यो प्र ४-८७ ॥

mahati śrūyamāṇe'pi meghabheyaardike dhvanau|

yatra sūkṣmātsūkṣmataraṃ nādameva parāmṛśet||HYP 4-87||

Even when the loud sounds of the clouds and the kettledrum are heard, he should try to fix his attention on the subtler sounds.

मकरन्दं पिबन् भृङ्गौ गन्धं नापेक्षते यथा ।

नादासक्तं तथा चित्तं विषयान्त हि काङ्क्षते ॥ ह यो प्र ४-९० ॥

makarandaṃ pivban bhṛṅgau gandhaṃ nāpekṣate yathaa|

nādāsaktaṃ tathā cittaṃ viṣayānta hi kāṅkṣate|| HYP 4-90||

As a bee, through drinking honey of flowers, cares not for the odor, so the mind absorbed in the nādā does not care for the objects of enjoyments.

नादश्रवणतः क्षिप्रमन्तरङ्गभुजङ्गमः ।

विस्मृत्य सर्वमेकाग्रः कुत्रचित्त्र हि धावति ॥ ह यो प्र ४-९७ ॥

nādaśravaṇataḥ kṣipramantaraṅgabhujaṅgamaḥ|

vismṛitya sarvamekāgraḥ kutracitra hi dhāvati|| HYP 4-97||

The mind is like a serpent within, which on hearing the musical sound, oblivious to all else and absorbed in the one thing, dies not run away.

काष्ठे प्रवर्त्तितो वन्हिः काष्ठेन सह शाम्यते।

नादे प्रवर्त्तितं चित्तं नादेन सह लीयते ॥ ह यो प्र ४-९८ ॥

kāṣṭhe pravarttito vanhiḥ kāṣṭhena saha śāmyate|

nāde pravarttitaṁ cittam nādena saha līyate|| HYP 4-98||

The fire that burns a piece of wood, dies as soon as the wood is burnt up. So the mind concentrated upon nāda gets absorbed with it.

अनाहतस्य शब्दस्य ध्वनिर्य उपलभ्यते।

ध्वनेरन्तर्गतं ज्ञेयम् ज्ञेयंस्तान्तर्गतं मनः।

मनस्तत्र लयं याति तद्विष्णोः परमं पदं ॥ ह यो प्र ४-१०० ॥

anāhatasya śabdasya dhvanirya upalabhyate|

dhvanerantargataṁ jñeyam jñeyaṁstāntargataṁ manaḥ|

manastatra layaṁ yāti tadviṣṇoḥ paramaṁ padaṁ||H.Y.P. 4-100||

One hears the sound of unstruck resonance (anāhata śabda) the quintessence of that sound is the supreme object (consciousness). The mind becomes one with that object of knowledge and it dissolves therein. That is the supreme state of Viṣṇu (sthiti).

सदानादानुसन्धानात्क्षीयन्ते पापसन्चयाः।

निरजने विलीयते निश्चित चित्तमारूता ॥ ह यो प्र ४-१०५ ॥

sadānādānusandhānātkṣīyante pāpasancayāḥ|

nirañane vilīyate niścita cittamārūtā || HYP 4-105||

Bad karma or sin is destroyed through continuous practice of contemplation on nādā. The finite mind and prāṇa dissolve into the stainless (nirañāna).

नादानुसन्धान्समाधिभाजां योगीश्वराणां ह्रुदि वर्धमान्।

आनन्दमेकं वचसामगम्यं जानाति तं श्रीगुरुनाथ एकः ॥ ह यो प्र ४-८१ ॥

nādānusandhānsamādhībhājāṃ yogīśvarāṇāṃ hrudī vardhamān|

ānandamekaṃ vacasāmagamyam jānāti taṃ śrīgurunātha ekaḥ||HYP 4-81||

Great yogis who practice samādhi through the concentration on nādā, experience a joy arising in their hearts that surpasses all description, and which only the ŚrīGurunātha is able to know.

शंखदुन्दुभ्रादं च न श्रूणोति कदाचन।

काष्ठवज्जायते देह उन्मण्यवस्थया ध्रुवं ॥ ह यो प्र ४-१०६ ॥

śaṅkhadundubhnādaṃ ca na śrūṇoti kadācana|

kāṣṭhavajjāyate deha unmaṇyavasthayā dhrūvaṃ|| HYP 4-106||

During Unmani Avastha, the body becomes like a log of wood. The yogi neer hears the (loud) sounds of a conch, or dundhubhi (a large drum).

2.1.4. G TYĀGARAJA

As described by Tyāgaraja (Tyāgaraja vaibhavam,2007) in the composition, Sobhillu Saptaswara, the entire body, including the abdomen (Nābhi), heart (hṛ), neck (Kaṇṭha), mouth (Rasana) and nasal passages (Nāsa), aids in the production of the sound.

The great poet and saint Tyagaraja concludes that the nectar of Nadarasa gives one the blessings of Yoga, Yaga, Tyaga and Bhoga, and helps us to drink deep that Ragarasa and delight, for Nada Svara and Pranava are the very form of Shiva.

Raga sudharasa panamu jesi rajillave manasa

raga yoga tyaga bhoga phala mosange–

Sadasiva mayamagu nada omkara svara vidulu

Jivanmuktulani tyagaraju deliyu.

(Andolika in Telugu language)

2.1.5 Conclusion:

Nāda yoga is a tireless sādhanā through which one gets liberation and is attainable by even the unlearned that are unable to comprehend tattva. The importance of chanting nāda in one's life is it purifies the nādis retains the breath for longer time; gastric fire becomes more active, helps in maintaining a perfect health. Mind concentrated in nāda does not care for the objects of enjoyment, gets absorbed with it and dissolves therein. It helps in keeping the mind by keeping it de-conditioned.

2.2 Review of Scientific Literature

Yoga has been found for improving physical stamina as measured by hand grip strength in healthy children and adults ((Naveen et al., 1997), better lung functions (White, 2009).

Yoga also helps in better performance in sports through stress reduction (Telles et al., 1993, Telles and Desiraju, 1992, Telles et al., 1994). Practice of yoga has shown improvement in sensory perception in volunteers across diverse age group (Telles et al., 1997). A definite improvement was shown to occur in static motor performance or the ability to hold the hand steady (Telles, Hanumanthaiah et al, 1994).

A significant increase in sustained attention scores using Six Letter Cancellation Test (SLCT) after the academic year for the Gurukula Education System group (Rangan et al., 2009). In a study on the effects of Prāṇāyāma on school children (Udupa et al. 2003), has shown a decrease in basal sympathetic tone, an increase in parasympathetic tone and a significant decrease in RPP (index of myocardial oxygen consumption and load on the heart). Studies on yoga based relaxation has shown the physiological signs of reduction in arousal which helps in improving sustained attention for a longer time as the mind being in a state of calmness (Vempati & Telles, 2002).

A study shows the effect of bhrāmarī prāṇāyāma on attention performance on healthy children. One hundred and thirty eight adolescent students in age range of 12 to 15 years participated in the study. This was a randomized self as control within-subjects design. Assessments were done immediately before and after experimental and control sessions of 10 minutes by using Six Letter Cancellation Task (SLCT). Experimental session consisted of *bhrāmarī prāṇāyāma*. The control session was breath awareness (BA). Significantly higher performance after bhrāmarī prāṇāyāma in net SLCT score and significantly lower score following BA was observed. After bhrāmarī prāṇāyāma wrong score reduced significantly while a significant increase was found following BA (Revanth I, Nagendra HR, 2010). Khemka et al, (2009) found (25%) following 20 minutes of Deep Relaxation Technique, mean age= 30.14), Sanjay et al, (2009) found (Om Dharana=13%, mean age=29.1), Sarang et al, 2007) found (CM=25% and SR=13%, mean age=27.4).

One more study assessed the effect of three pranayamas (Surya anuloma viloma, Chandra anuloma viloma and Sukha Pranayama) on Digit Letter Substitution Test (DLST) on 52 healthy volunteers in three groups. The pre values were not significantly different between groups showing that there was matching of groups to begin with. The pre- post values for Chandra anuloma viloma showed significant increase, both pre versus intermediate and pre versus post values for Sukha Pranayama showed highly significant increase indicative, Sukha Pranayama showed significantly higher improvements than Surya anuloma viloma and Chandra anuloma viloma. At post assessment phase all three pranayama group were not significantly different. While pre values of females were higher than males this is noted that males showed greater improvement in all the three pranayama than females in pre-post values. Only in Surya anuloma vilom, males showed a highly significant increase in DLST than the females. (Surabhi Venugopal, Nagendra, 2008)

The study was carried out in Nepal to evaluate the immediate effect of bhrāmarī prāṇāyāma, (Pramanik T, Pudasaini B, Prajapati R., 2010). The result indicated that slow pace bhrāmarī prāṇāyāma for 5 minutes, induced parasympathetic dominance on cardiovascular system.

CHAPTER 3

AIM AND OBJECTIVE

3.1 AIM:

Present study was to compare the attention task performance between walking and walking with bhrāmarī prāṇāyāma in school students.

3.2 OBJECTIVE:

The objective of the study is to understand the immediate effect of yogic practice (bhrāmarī prāṇāyāma) when it is combined with walking.

3.3 RESEARCH QUESTION

1. Does walking along with bhrāmarī prāṇāyāma has an immediate effect on attention in school students?

3.4 HYPOTHESIS

The hypothesis of this study was that the association of bhrāmarī prāṇāyāma along with walk will enhance the students' attention task performance.

3.4.1 Null Hypothesis

Bhrāmarī prāṇāyāma would not influence attention and cognitive functions when it is combined with walking among school students.

3.4.2 Alternative Hypothesis:

Bhrāmarī prāṇāyāma would influence attention and cognitive functions when it is combined with walking among school students.

3.5 SCOPE

The study covered the immediate effect of bhrāmarī prāṇāyāma in ability to focus attention in the students. This understanding of positive effect of bhrāmarī prāṇāyāma would scientifically validate in improving attention. The result of the present study can be applied for optimizing an individual's performance related to higher brain functions which can add value to the quality academic performance.

CHAPTER 4

METHOD

4.1 PARTICIPANTS:

4.1.1 SUBJECTS:

The study was performed on 69 school children (both male and female) in the age group of 10-17 years.

4.1.2 SOURCE

All participants were from one English medium Residential cum day scholar school called Orchid International School, Nashik, Maharashtra, India.

4.1.3 INCLUSION CRITERIA

The healthy students (both male and female) and free from medication (as per the recommendation of the Residential Medical Officer), between the age group of 10-17 years and volunteered to participate in the study were included.

4.1.4 EXCLUSION CRITERIA

The unhealthy students, under medication, and those who are below 10 years were excluded.

4.1.5 INSTITUTIONAL ETHICAL COMMITTEE

Approval of the school Principal was taken (as it was residential cum day scholar school, the maximum students belonged to hostel and the Principal was the direct guardian to the children) before conducting the study.

4.2 DESIGN OF THE STUDY

4.2.1 STUCTURE OF SESSIONS

The participants were divided into two different experimental conditions i.e. such as half of the participants did simple walking on the treadmill on the first day and the experimental session (walking on the treadmill combined with bhrāmarī prāṇāyāma) on the second day. The other half received the experimental session (walking on the treadmill combined with bhrāmarī prāṇāyāma) on the first day and the simple walking on the treadmill the next day.

Both sessions were assessed before and immediately after the task were completed on both days. Each student was briefed about the procedure of the tests (Six letter cancellation test and digit letter substitution test) prior to experimental conditions. A pilot study was conducted to fix the speed of the walking on the treadmill after a few days of continuous observation. It was found that 4kms/hr is the ideal speed.

STUCTURE OF SESSIONS TABLE

Day 1	Pre	WALKING ON THE TREADMILL FOR 10 MINUTES (SPEED -4 Km/Hr)	Post	
	Pre	WALKING ON THE TREADMILL FOR 10 MINUTES along with Bhrāmarī Prānāyāma (SPEED -4 Km/Hr)	Post	
Day 2	Pre	WALKING ON THE TREADMILL FOR 10 MINUTES along with Bhrāmarī Prānāyāma (SPEED -4 Km/Hr)	Post	
	Pre	WALKING ON THE TREADMILL FOR 10 MINUTES (SPEED -4 Km/Hr)	Post	

4.3 ASSESSMENT

4.3.1 SIX LETTER CANCELLATION TASK (SLCT)

The six letter cancellation task is a paper pencil test consists of a test worksheet with specified six target letters to be cancelled and has a working section which consists of letters of the alphabet arranged randomly in 14 rows and 12 columns. The student was asked to cancel as many of the six target letters as possible in the specified time of 90 seconds. They were given the option of choosing their own strategy i.e., cancelling all six letters at a time or selecting any target letter out of the six. They were also given freedom to follow horizontal, vertical or a random path according to their own convenience (Natu & Agarwal, 1997). The six letter cancellation task was used to understand the validity of the task with a similar design regarding the immediate effects (Sarang, et al, 2007).

As this test was administered before and immediately after the intervention parallel worksheets were prepared by changing the sequence of letters in the working section to avoid any test-retest effect (Agarwal, Kalra, et al, 2002). The total number of substitutions and wrong substitutions are scored. The net score was obtained by deducting wrong substitutions from the total substitutions attempted.

4.3.2 DIGIT LETTER SUBSTITUTION TEST (DLST)

The DLST consisted of a worksheet, which has 8 rows and 12 columns and randomly arranged digits in rows and columns. The students are asked to substitute as many target digits as possible in the specified time of 90 seconds. The letter substitution may be undertaken in a horizontal, vertical, or randomized manner by selecting a particular digit. The total number of substitutions and wrong substitutions are scored. The net score was obtained by deducting wrong substitutions from the total substitutions attempted. (Surabhi Venugopal, Nagendra HR, (2008). This test followed the SLCT test for some students and sometimes it was the first test followed by SLCT.

4.4 INTERVENTION

4.4.1. EXPERIMENTAL SESSION (BHRĀMARĪ PRĀNĀYĀMA)

The students were asked to walk on the treadmill at 4 kms/hr. (the speed was fixed) for 10 minutes and at the same time chanting/humming bhrāmarī prāṇāyāma (female honey bee sound) as comfortable as possible.

4.4.2. CONTROL SESSION (WALKING ON THE TREADMILL)

The students were asked to walk on the treadmill at 4kms/hr (the speed was fixed) for 10 minutes without giving any target to focus on.

CHAPTER 5

DATA EXTRACTION AND ANALYSIS

5.1 DATA EXTRACTION

SLCT: The total number of cancellations attempted, and the number wrongly cancelled were counted. Then net score is obtained by deducting the latter from the former (Natu and Agarwal, 1997).

DLST: The total number of substitutions attempted, and the number of wrong substitutions were counted. Then net score was obtained by deducting the latter from the former (Natu and Agarwal, 1997).

The answer sheets were coded and scoring was done by the researcher who was not involved in the study. It was cross checked by another researcher. Then entry was done in computer checking was done.

5.2 DATA ANALYSIS

The raw data obtained for each subject in each recording session were tabulated separately. Statistical analysis was done using SPSS (Version 10.0) in following steps:

5.3 EFFECT OF NORMAL WALK ALONG WITH BHRĀMARĪ PRĀNĀYĀMA ON SLCT AND DLST

The group mean and standard deviation were calculated and data were tested for variance and normal distribution by F-test and Kolmogorov-Smirnov test respectively. For the normally distributed data, repeated measures analyses of variance (RMANOVA) were performed with two 'Within subjects' factors, i.e., Factor 1: Sessions: walk and walk along with bhrāmarī prāṇāyāma and Factor 2: States; 'Pre' and 'Post'. These repeated measures ANOVA were carried out for each variable separately.

Subsequently, post-hoc tests with Bonferroni adjustment were performed to compare the data of the 'Post' periods with those of the respective 'Pre' period and also the different states were compared between sessions.

5.3.1 Six letter cancellation test

There were significant differences in between Sessions (walk vs walk along with bhrāmarī prāṇāyāma) in (i) Total score [$F(1, 68) = 167.65, p < 0.001$]; (ii) Net score (i) Total score [$F(1, 68) = 171.77, p < 0.001$].

There were significant differences in between states (pre vs post) in (i) Total score [$F(1, 68) = 251.89, p < 0.001$]; (ii) Net score (i) Total score [$F(1, 68) = 248.17, p < 0.001$].

There was significant interaction between sessions and states in (i) Total score [$F(1, 68) = 240.33, p < 0.001$]; (ii) Net score [$F(1, 68) = 232.91, p < 0.001$].

Post-hoc test with Bonferroni adjustment showed a significant increase in (i) Total score ($p < 0.001$) and (ii) net score ($p < 0.001$) immediately after both walk and walk along with bhrāmarī prāṇāyāma compared to the respective pre scores. The group average values \pm S.D. are given in **Table 5.3.1.A**.

Table 5.3.1.A Total score, net score and score for wrong cancellation in a six-letter cancellation task pre and post walking along with bhrāmarī prāṇāyāma and normal walking sessions; values are group mean ± SD.

Variables		Between Groups				
		PRE	POST	% Chg	p values	p values
Total Score	WBhr	31.04 ±9.75	42.09± 11.11***	35.6	0.001	0.028
	Walk	27.01± 8.26	27.68± 8.34***	2.48	0.001	
Wrong Score	WBhr	0.06± 0.24	0.07±0.31	16.66	1.543	0.241
	Walk	0.12± 0.44	0.07±0.31	-0.05	1.317	
Net Score	WBhr	30.99± 9.74	41.96± 11.03***	35.48	0.001	0.061
	Walk	26.93± 8.22	1.58± 8.31***	2.41	0.001	

Abbreviations: ES = Effect Size; WBhr =Walking along with bhrāmarī prāṇāyāma; WALK = Normal walking; Chg = Changes. *** $p < 0.001$, Post-hoc tests with Bonferroni adjustment, Post scores compared with respective Pre scores. Note: There was significant improvement after both (Walking along with bhrāmarī prāṇāyāma and Normal Walking sessions in total and net score.

5.3.2 Digit letter substitution test

There were significant differences in between Sessions (walk vs walk along with bhrāmarī prāṇāyāma) in (i) Total score [$F(1, 68) = 194.95, p < 0.001$]; (ii) Net score (i) Total score [$F(1, 68) = 186.62, p < 0.001$].

There were significant differences in between states (pre vs post) in (i) Total score [$F(1, 68) = 199.29, p < 0.001$]; (ii) Net score (i) Total score [$F(1, 68) = 87.46, p < 0.001$].

There was significant interaction between sessions and states in (i) Total score [$F(1, 68) = 129.95, p < 0.001$]; (ii) Net score [$F(1, 68) = 89.59, p < 0.001$].

Post-hoc test with Bonferroni adjustment showed a significant improvements in (i) Total score ($p < 0.001$) (ii) Wrong score ($p = 0.041$) and (iii) net score ($p = 0.018$) immediately after walk compared to the respective pre scores.

Similarly, Post-hoc test with Bonferroni adjustment showed a significant improvements in (i) Total score ($p < 0.001$) (ii) Wrong score ($p = 0.041$) and (iii) net score ($p < 0.001$) immediately after walk along with bhrāmarī prāṇāyāma compared to the respective pre scores. The group average values \pm S.D. are given in **Table 5.3.2.A**.

Table 5.3.2.A Total score, net score and score for wrong cancellation in a six-letter cancellation task pre and post walking along with bhrāmarī prāṇāyāma and normal walking sessions; values are group mean ± SD.

Variables		Between Groups				
		PRE	POST	% Chg	p values	p values
Total Score	WBhr	48.65± 13.03	59.09± 12.37***	21.46	0.001	0.028
	Walk	39.17± 12.62	40.28±12.71	2.83	0.001	
Wrong Score	WBhr	0.04±0.27	0.01±0.12	0.75	1.543	0.241
	Walk	0.06±0.29	0.03±0.17	0.50	0.05	
Net Score	WBhr	48.54±12.70	59.06± 12.39***	21.67	0.001	0.061
	Walk	38.39±13.43	40.25± 12.73***	4.85	0.001	

Abbreviations: ES = Effect Size; WBhr =Walking along with bhrāmarī prāṇāyāma; WALK = Normal walking; Chg = Changes. *** $p < 0.001$, Post-hoc tests with Bonferroni adjustment, Post scores compared with respective Pre scores. Note: There was significant improvement after both (Walking along with bhrāmarī prāṇāyāma and Normal Walking) sessions in total and net score.

CHAPTER 6

RESULT

6.1 Six Letter Cancellation Test

Figure-1(Pre –Post Total SLCT score)

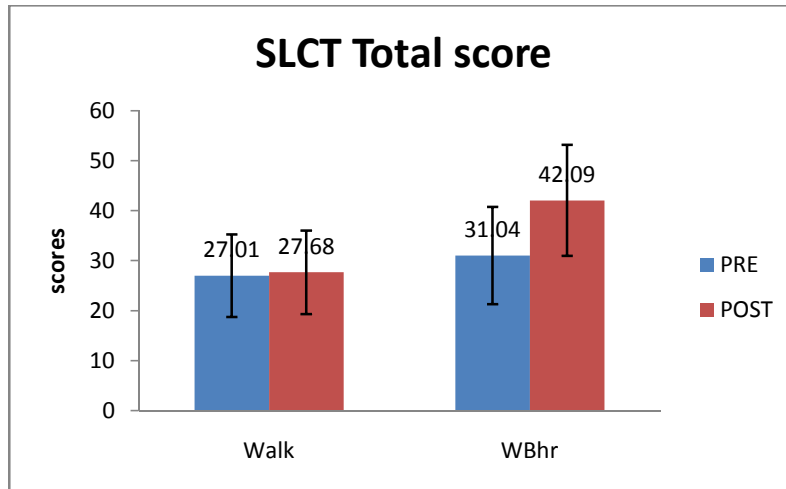


Figure-2 SLCT Pre-Post Wrong score

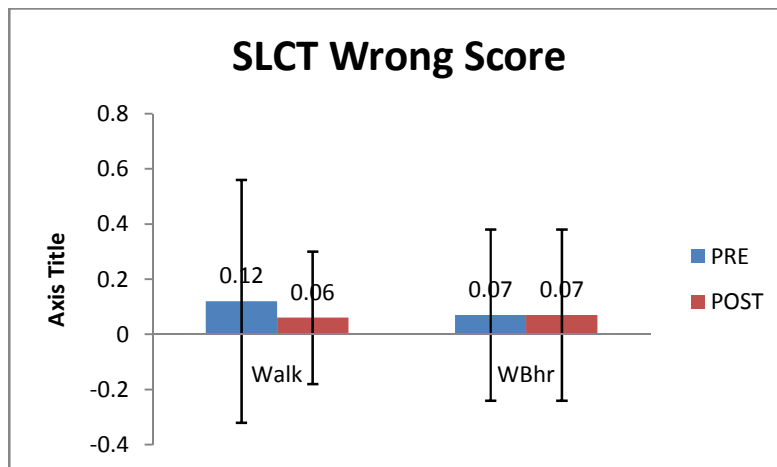
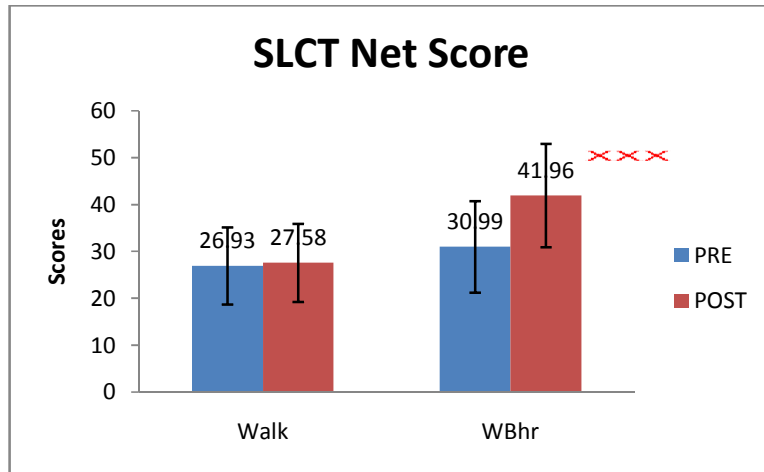


Figure-3 SLCT Net Score



DLST

6.2 Digit Letter Substitution Test

Figure-1 DLST Total score

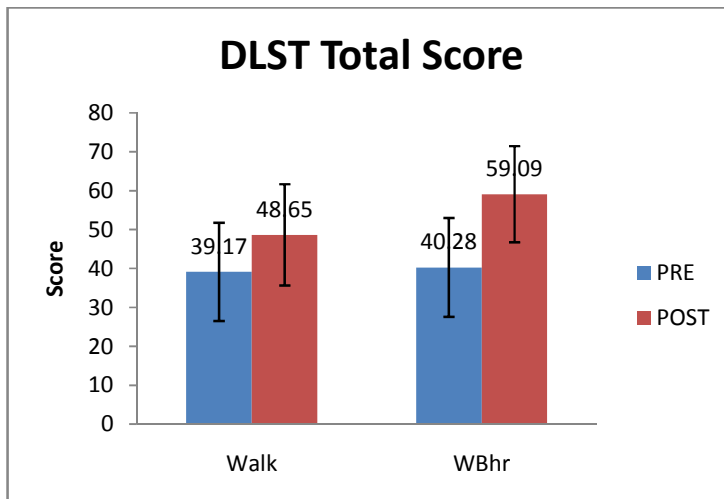


Figure-2 DLST Wrong score

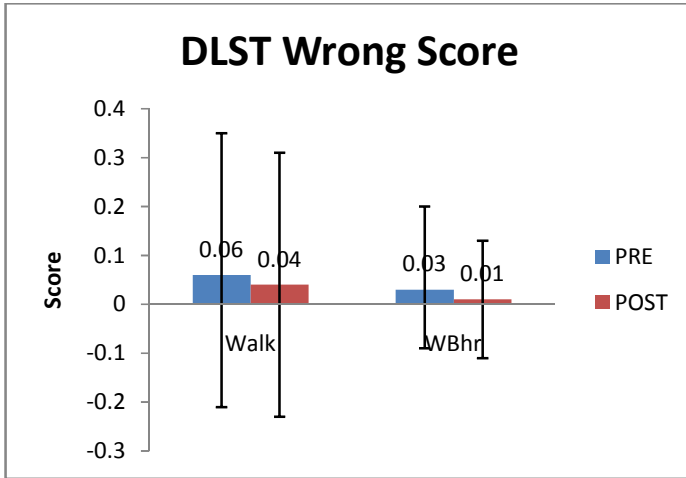
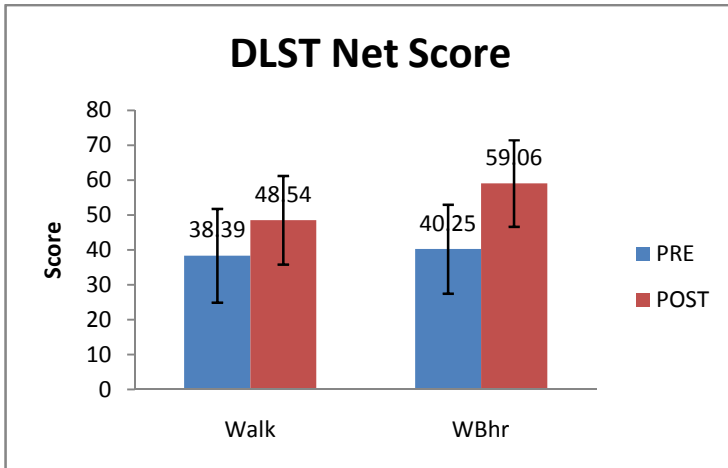


Figure-3 DLST Net Score



CHAPTER 7

7.1 DISCUSSION

The present self as control study showed that ten minute of bhrāmarī prāṇāyāma along with walking improved attention in school going students. There were significant changes observed immediately after bhrāmarī prāṇāyāma along with walking (35.6%) and in walking (0.05%) in net SLCT score.

Similarly higher performance is being observed in after bhrāmarī prāṇāyāma along with walking (21.6%) in comparison to (4.85%) in normal walking in net DLST score. The wrong score reduced to (0.75%) in bhrāmarī prāṇāyāma along with normal walking and 0.50% after alone walking.

The previous studies show the effect of yoga, relaxation and meditation in increased SLCT scores i) Khemka et al, (2009) found 24% change in SLCT and 15.99% in DLST following one minute Kapālabhāti interspersed with one minute of rest. Revant et al, (2012) found significant reduction following Bhr (36.86%) net SLCT. In the present study the variation of change is more might be due to the synergetic effect of both stimulation (walking) and mental relaxation (bhrāmarī prāṇāyāma).

7.2 Mechanisms

The slow pace bhrāmarī prāṇāyāma for 5 minutes found reduction in blood pressure by enhancing the parasympathetic activity on cardiovascular system (Pramanik T, Pudasaini B, & Prajapati R., 2010). In another study, (Viallette , F. B.Bakardjian, H.Prasad, R & Cichocki, A. 2009) has shown the improvement in theta activity due to resonating and repetitive effects of humming bee sound in bhrāmarī prāṇāyāma which resembled mantra repetition and meditation. This suggested that bhrāmarī prāṇāyāma had positive influence on mental and physical level.

Therefore, Normal walk on Treadmill not only causes physical exhaustion but also it distracts the mind of students as there is nothing to focus on. On the contrary, bhrāmarī prāṇāyāma along with walking had synergic effect (stimulation and relaxation) which has helped the students to perform better in the given task. Better concentration, reduction in thoughts and more calmness of the mind has contributed to enable the improvement in DLST and SLCT.

CHAPTER 8

SUMMARY AND CONCLUSION

8.1 SUMMARY

The present study of yoga intervention bhrāmarī prāṇāyāma along with walking has shown remarkable improvement in the attention levels of school children. This also encourages further study of yoga intervention within the school atmosphere which may open new vista in the field of yoga and its wider practical utility in the school system.

8.2 CONCLUSIONS

The study suggests that immediate effect of bhrāmarī prāṇāyāma along with normal walk is significant may be due to increased amount of mental alertness and reduction in mental anxiety level which might have improved physical capacity. This characteristic of bhrāmarī prāṇāyāma may help in better SLCT and DLST performance which can improve the all round capacity of students if implemented in an educational system.

8.3 LIMITATIONS

- The study was on immediate effect.
- The lasting effect is not calculated.
- No neurophysiologic measurements were used during yoga intervention.
- The age group of students selected was from 10-17 years and not more.
- Boys and girls are not taken in separate groups.

8.4 STRENGTHS

So far as our knowledge goes this was the first study on self as control trial on immediate effect of bhrāmarī prāṇāyāma with walking on task performance among school children using six letter cancellation test and digit letter substitution test which has shown improvement in attention, enhancement and accuracy in performance.

Introduction of bhrāmarī prāṇāyāma may prove to be easy to implement within a school setting which can help to raise the academic ability of the students along with their all round development .

8.5 FUTURE STUDIES

Future study may include different age group of students for a longer duration (more than one week), different levels of attention, assessment methods to check physiological changes and much more possible effects. In Future study, designs other than self as control can be used and also longer effect of bhrāmarī prāṇāyāma (more than 10 minutes) can be assessed.

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Appendix-2

INFORMED CONSENT FORM

Title of the project : Immediate Effect Of Bhrāmarī Prānāyāma With Walking On Task Performance Among School Students Using Six Letter Cancellation Test And Digit Letter Substitution Test

Investigator : Srinivas Gandikota

Name of the guide : BALARAM PRADHAN M.Sc, Ph.D

Name of the Participant : _____

Date and Time : _____ and _____

About the Project:

In order to understand the immediate effect of Bhrāmarī Prānāyāma With Walking On Task Performance Among School Students we will be recording cognitive performance task using individual paper pencil test i) Six Letter Cancellation Test ii) Digit Letter Substitution Test.

All these techniques are noninvasive and commonly used in routine clinical practice.

Please note:

1. All information obtained during the study will be confidential and individual report of the test will be given.
2. You can withdraw from the study at any point of time unconditionally.
3. In case the study does cause any adverse effect, the institution is not liable.

I hereby have understood the above and consent voluntarily to participate in the study.

Place:

Date:

Signature of the Participant