Chapter 8

Appraisal

8.0. APPRAISAL

8.1. SUMMARY OF THE FINDINGS:

The current study compared the immediate effects of the twenty-min intervention of *trāṭaka* and eye exercise on HRV and autonomic variables and cognitive task's SVRT Task and CBTT (working and spatial memory). We found an enhanced heart rate variability during and following the practice of *trāṭaka* and eye exercise. There was also an increase in RMSSD, pNN50 and LF Power, HF Power, and Total Power, which is indicative of a parasympathetic shift in autonomic activity. There was also a reduction noted in respiratory rate significantly in *trāṭaka* compared to eye exercise. Skin conductance was observed to increase during and following eye exercises.

The results also demonstrate an enhanced working and spatial memory and executive functions and inhibiting unnecessary responses to stimuli were more significant improvements following the practice of *trāṭaka* compared to eye exercise sessions through SVRT Task and CBTT.

Also, in the current study, the effect of the two-week practice of *trāṭaka* was found to reduce self-reported mind wandering & Symptoms of Visual Strain and enhanced state mindfulness.

8.2. CONCLUSIONS:

The practice of *trāṭaka* was found to reduce visual strain and mind wandering while improving state mindfulness. Thus, the *trāṭaka* (yogic visual concentration) leads to increased vagal tone and reduced sympathetic arousal along with reduction observed in SVRT Task. Also, *trāṭaka* enhanced working and spatial memory. The results indicate the practice of *trāṭaka* to be safe in healthy volunteers.

8.3. IMPLICATION OF THE STUDY:

People could use *Trāṭaka* to enhance their perception and performance while inducing relaxation. This study also suggests that the immediate practice of *Trāṭaka* is to inhibit unnecessary responses to stimuli and benefit working and spatial memory. *Trāṭaka* could also benefit from reducing visual strain and mind wandering by improving the state mindfulness.

8.4. APPLICATION OF THE STUDY:

As *trāṭaka* has shown benefits in visual strain and mind wandering, the intervention can be helpful to prolong or improper digital display users, such as computer professionals. Also, *trāṭaka* could enhance working, spatial memory, and spatial attention, thus the *trāṭaka* could be used to improve memory and attention among young adults, especially students.

8.5. STRENGTHS OF THE STUDY:

- The current study was the first attempt to understand the physiological changes during and following the practice of *trāṭaka* & its effects on cognitive functions such as visual reaction time, working, and spatial memory.
- The current study was also the first attempt to understand the effect of *trāṭaka* on visual strain and mind-wandering, which can be widely used as an application by computer professionals, with prolonged use of digital displays.
- The use of the state of art research tools such as polygraphs and the use computer-based programs such as inquisit for assessment of performance in cognitive tasks enabled robust results.

8.6. LIMITATION OF THE STUDY:

- A significant limitation of the study is the control condition which had eye exercise for 10 min followed by 10 min of quiet sitting in which they were told not to meditate. However, we are not sure during quiet sitting did they focus on breathing or let their mind wander freely.
- The limitation of the study includes not incorporating a neuro-imaging technique, which has limited our ability to predict the exact mechanism of action.

8.7. SUGGESTIONS FOR FUTURE STUDIES:

- Future studies on *trāṭaka* and cognitive performance should include EEG & Visual Evoked Potential to understand the underlying mechanisms.
- This intervention should broaden the current research and include clinical populations such as patients with ophthalmological disorders.
- Further studies on *trāṭaka* with visual strain may use clinical assessment tools such as tear break-up time, corneal fluorescein staining, tear osmolarity, ocular scattering index, and an objective tool like the tear film thickness.
- The role of *trāṭaka* in the prevention and management of eye syndromes is worth exploring in the future.
- The effects of *trāṭaka* on sleep can be assessed further.
- Understanding the changes in the visual cortex by *trāṭaka* practice with EEG measurement and changes around the eye muscles with EMG measurement can be assessed in the future.
- Future studies may also include visual fatigue, ocular pressure, and Electrooculogram.

Chapter 9

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Appendix 1

Informed Consent Form

STUDY:1

INFORMED CONSENT FORM

We are inviting university students with prior experience of yoga to participate in a research project is **"Effect of Trataka (Yogic Visual Concentration) practice on the Visual reaction time and its association with the Autonomic functions – A self as control trial."**

Name of Principal Investigator: Swathi P S

Names of Co-Investigator: Dr Raghavendra Bhat & Dr Apar Avinash Saoji

Name of Organization:

Swami Vivekananda Yoga Anusandhana Samsthana (SVYASA) Deemed to be University

PART I: INFORMATION SHEET

INTRODUCTION:

Yoga based techniques are known to bring autonomic balance by reducing sympathetic arousal and increased vagal tone. Trataka is said to bring calm state of mind and to increase visual reaction time. Myself, Swathi P S, with my colleagues, would like to investigate if *trataka*, have an impact on visual reaction time and its association with autonomic functions. I am going to give you the information and invite you to be part of this research. You do not have to decide today whether or not you will participate in the research. Before you decide, you can talk to anyone you feel comfortable with, about your participation in

this research. Feel free to stop me and ask more details about something that you do not understand. Even if you have questions later, you can ask them of me, or my colleagues.

PURPOSE OF THE RESEARCH:

The practice of trataka will help you relax leading to a calm state of mind. As limited studies in this field so we would like to understand physiological study before taking applying the technique for therapy.

TYPE OF RESEARCH INTERVENTION:

If you agree to participate in the study, you will be receiving a training two weeks of training in *trataka*, for 20 min/day. The first stage of *trataka* practice includes eyes exercise and second stage is the practice of *trataka* itself. Following the training, you will be assessed in two sessions on two separate days. On one of the days, you will be practicing trataka and on another you will be practicing eye exercises followed by quiet sitting.

PARTICIPANT SELECTION:

You will be examined by a physician prior to your selection for the study. You will be eligible for the study if you have no visual problems, physical ailments and psychological problems.

VOLUNTARY PARTICIPATION:

Your participation in this research is completely voluntary. It is your choice whether to participate or not. You may change your mind later and stop participating even if you agreed earlier.

PROCEDURES & PROTOCOL

We will be assessing you on two different days in the psychophysiology laboratory of S-VYASA. Your physiological functions will be assessed using a polygraph that will give us information about the way your autonomic and central nervous systems are working. For these sessions, we will be placing electrodes/probes on your limbs. Also, you will be asked to do a simple computer based task, which will be similar to a video game.

SIDE EFFECTS AND RISKS:

The practise of *trataka* is considered to be safe. We do not anticipate any discomfort or side-effect due to the practice.

BENEFITS:

If you participate in this research, trataka may benefit in relaxation and also leads to calm state of mind. It may help to reduce reaction time. Eventually, your participation is likely to help us find if trataka can impact on autonomic function and visual reaction time.

CONFIDENTIALITY:

The information that we collect from this research project will be kept confidential. Your personal information collected during the research will be put away, and no-one but the researchers will be able to see it. Any information about you will have a number on it instead of your name. It will not be shared with or given to anyone except the researchers.

SHARING THE RESULTS:

The knowledge that we get from doing this research will be shared with you through the mail before it is made widely available to the public. Confidential and personal information will not be shared. After these, we intend publish the results in scientific journal in order that other interested people may learn from our research

RIGHT TO REFUSE OR WITHDRAW:

You do not have to take part in this research if you do not wish to do so. You may also stop participating in the research at any time you choose. It is your choice and all of your rights will still be respected.

WHO TO CONTACT:

If you have any questions, you may ask now or later, even after the study has started. If you wish to ask questions later, you may contact any of the following: Swathi P S (swathisanketh@gmail.com), Apar Saoji (aparsaoji@svyasa.edu.in), Raghavendra Bhat (raghavendra.bhat@svyasa.edu.in)

PART II: CERTIFICATE OF CONSENT

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Name of the Participant_____

Signature of the Participant_____

Date_____(Date/month/year)

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

1. Experimental session Trataka

2. Control session

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant.

Name of Researcher_____

Signature of Researcher _____

Date _____(Day/month/year)

STUDY 2:

INFORMED CONSENT FORM

We are inviting university students with prior experience of yoga to participate in a research project is **"Effect of Trataka (Yogic Visual Concentration) practice on Psychological well-being and Visual Strain – A Randomized Controlled Trial".**

Name of Principal Investigator: Swathi P S

Name of Co-Investigator: Dr Raghavendra Bhat & Dr Apar Saoji

Name of Organization: Swami Vivekananda
Yoga Anusandhana Samsthana (SVYASA) deemed to be University

PART I: INFORMATION SHEET

INTRODUCTION:

Myself Swathi P S, with my colleagues, would like to investigate if *trataka* (a yoga technique) has an effect in reducing the visual strain and improving psychological functions. I am going to give you the information and invite you to be part of this research. You do not have to decide today whether or not you will participate in the research. Before you decide, you can talk to anyone you feel comfortable about your participation in this research. Feel free to stop me and ask for more details about something that you do not understand. Even if you have questions later, you can ask them of me, or my colleagues.

PURPOSE OF THE RESEARCH:

Because of regular and prolonged usage of digital display, there is increased irritation, dryness, eye strain, tiredness, burning sensation redness, blurred vision, and reducing the performance level and response time. We assume that, *trataka*, a cleansing procedure for the eyes described in *Hathayoga* may be useful to reduce visual strain and may improve psychological functions. Thus, we would like to undertake the study to evaluate if *Trataka* could reduce eye strain and psychological function. There are very few studies on impact of trataka in vision and psychology thus, we would like to investigate the same.

TYPE OF RESEARCH INTERVENTION:

If you agree to participate in the study, you will be randomized into an experimental or control group. Experimental group will be performing Trataka for 20 min/day for two weeks. The instructions will be administered through pre-recorded instructions. The Control group will continue with their routine activities. After two weeks, the control group will also be provided with an opportunity to practice trataka. The selection of the groups will be decided by random numbers using a computer generated random numbers.

PARTICIPANT SELECTION:

To participate in the study, you will be evaluated by a physician. You will be eligible to participate in the study if you have no visual, physical or psychological health issues other than visual strain.

VOLUNTARY PARTICIPATION:

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. You may change your mind later and stop participating even if you agreed earlier.

PROCEDURES & PROTOCOL

You will be asked to answer a few questionnaires which will indicate information about your vision and psychological health on first day and at the end of two weeks.

SIDE EFFECTS AND RISKS:

The practise of *trataka* is considered to be safe. We do not anticipate any discomfort or side-effect due to the practice.

BENEFITS:

If you participate in this research, it may help to overcome the eye strain. Eventually, your participation will help us find if trataka could be beneficial for eye strain and reduces mind wandering. Thus, the outcomes of the study could benefit society at large.

CONFIDENTIALITY:

The information that we collect from this research project will be kept confidential. Information about you that will be collected during the research will be put away, and no-one but the researchers will be able to see it. Any information about you will have a number on it instead of your name. It will not be shared with or given to anyone except the researchers.

SHARING THE RESULTS:

The knowledge that we get from doing this research will be shared with you through the mail before it is made widely available to the public. Confidential information will not be shared. After these, we will publish the results in order that other interested people may learn from our research

RIGHT TO REFUSE OR WITHDRAW:

You do not have to take part in this research if you do not wish to do so. You may also stop participating in the research at any time you choose. It is your choice and all of your rights will still be respected.

WHO TO CONTACT:

If you have any questions, you may ask now or later, even after the study has started. If you wish to ask questions later, you may contact any of the following: Swathi P S (swathisanketh@gmail.com), Apar Saoji (aparsaoji@svyasa.edu.in), Raghavendra Bhat (raghavendra.bhat@svyasa.edu.in)

PART II: CERTIFICATE OF CONSENT

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Name of the Participant_____

Signature of the Participant_____

Date_____(Date/month/year)

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

1. Trataka

2. Waitlisted Control group

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant.

Name of Researcher_____

Signature of Researcher _____

Date _____(Day/month/year)

Study 3:

INFORMED CONSENT FORM

We are inviting university students with prior experience of yoga to participate in a research project is **"Effect of Trataka (Yogic Visual Concentration) practice on the performance in the Corsi-block tapping task – A repeated measures study."**

Name of Principal Investigator: Swathi P S

Name of Co-Investigator: Dr Raghavendra Bhat

Dr Apar Saoji

Name of Organization:

Swami Vivekananda Yoga Anusandhana Samsthana (SVYASA) Deemed to be University

PART I: INFORMATION SHEET

INTRODUCTION:

The practice of trataka leads meditative state of mind which in turn it improves perception, attention and cognition. Thus, the trataka shall enhance the cognitive abilities and visual memory scores. Myself, Swathi P S, with my colleagues, would like to investigate if a yoga technique, *trataka*, have an impact on visuospatial attention and working memory. I am going to give you the information and invite you to be part of this research. You do not have to decide today whether or not you will participate in the research. Before you decide, you can talk to anyone you feel comfortable with about your participation in this research. Feel free to stop me

and ask more details about something that you do not understand. Even if you have questions later, you can ask them of me, or my colleagues.

PURPOSE OF THE RESEARCH:

According to traditional text, trataka is known to increase cognitive levels, few articles are explored in this field in a subjective way, the Corsi block tapping task is objective task where trataka can help to increase in visual processing and memory. As limited studies in this field so we would like to understand effect of trataka on cognition.

TYPE OF RESEARCH INTERVENTION:

If you agree to participate in the study, you will be receiving a training two weeks of training in *trataka*, for 20 min/day. The first stage of *trataka* practice includes eyes exercise and second stage is the practice of *trataka* itself. Following the training, you will be assessed in three sessions on three separate days (baseline, trataka and eye exercise). On first day you will be assessed for baseline data, either second or third day you will be assessed for trataka or eye exercise.

PARTICIPANT SELECTION:

You will be examined by a physician prior to your selection for the study. You will be eligible for the study if you have no visual problems, physical ailments and psychological problems.

VOLUNTARY PARTICIPATION:

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. You may change your mind later and stop participating even if you agreed earlier.

PROCEDURES & PROTOCOL

We will be assessing you on three different days in the psychology laboratory of S-VYASA. Your psychological functions will be assessed using a computer based task, which will be similar to video game.

SIDE EFFECTS AND RISKS:

The practise of *trataka* is considered to be safe. We do not anticipate any discomfort or side-effect due to the practice.

BENEFITS:

If you participate in this research, the practice of trataka may benefit in improving working and spatial memory. Eventually, your participation is likely to help us find if trataka can impact on visuo-spatial short-term working memory.

CONFIDENTIALITY:

The information that we collect from this research project will be kept confidential. Your personal information collected during the research will be put away, and no-one but the researchers will be able to see it. Any information about you will have a number on it instead of your name. It will not be shared with or given to anyone except the researchers.

SHARING THE RESULTS:

The knowledge that we get from doing this research will be shared with you through the mail before it is made widely available to the public. Confidential and personal information will not be shared. After these, we intend publish the results in scientific journal in order that other interested people may learn from our research

RIGHT TO REFUSE OR WITHDRAW:

You do not have to take part in this research if you do not wish to do so. You may also stop participating in the research at any time you choose. It is your choice and all of your rights will still be respected.

WHO TO CONTACT:

If you have any questions, you may ask now or later, even after the study has started. If you wish to ask questions later, you may contact any of the following: Swathi P S (swathisanketh@gmail.com), Apar Saoji (aparsaoji@svyasa.edu.in), Raghavendra Bhat (raghavendra.bhat@svyasa.edu.in)

PART II: CERTIFICATE OF CONSENT

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.

Name of the Participant_____

Signature of the Participant_____

Date_____(Date/month/year)

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands that the following will be done:

1. Experimental session of Trataka

2. Control session

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this ICF has been provided to the participant.

Name of Researcher_____

Signature of Researcher _____

Date _____(Day/month/year)

Appendix 2

Clearance letter from Institutional Ethics Committee

स्वामी विवेकानन्द योग अनुसंधान संस्थान
Swami Vivekananda Yoga Anusandhāna Samsthāna
(Declared as Deemed-to-be University under Section 3 of the UGC Act, 1956)
Eknath Bhavan, # 19, Gavipuram Circle, Kempegowda Nagar, Bangalore - 560 019
Ph: 080 - 2661 2669, Telefax: 080 - 2660 8645
E-mail: svyasa@svyasa.org Website: www.svyasa.org

Institutional Ethics Committee (IEC)
Clearance Certificate

Date: 13th January, 2021

Dear **Dr Swathi P S**

The institutional Ethics committee (IEC) of Swami Vivekananda Yoga Anusandhana Samsthana (Deemed-to-be University under Section 3 of the UGC Act, 1956) reviewed your application in the committee meeting held on 19th December, 2020 (Online) based on:

I. Documents

1. Covering Letter
2. Project Application
3. Project Proposal
4. Informed consent form
5. Undertaking

II. Presentation to IEC on 19th December, 2020.

III. Your clarification provided to the comments of the members made during presentation.

After perusal of this information, IEC has decided to approve your study. Details of approval are as follows:

Certificate Reference Number: RES/IEC-SVYASA/182-A/2021

Project Title: Effect of Trataka (Yogic Visual Concentration) practice on the Visual reaction time and its association with the Autonomic functions – A self as control trial.

Nature of Study: PhD

Authorised Personnel: Dr. Swathi P S, Dr. Raghavendra Bhat & Dr. Apar Avinash Saoji

APPROVED

INSTITUTIONAL ETHICS COMMITTEE
SVYASA, BANGALORE

स्वामी विवेकानन्द योग अनुसंधान संस्थान

Swami Vivekananda Yoga Anusandhāna Samsthāna

(Declared as Deemed-to-be University under Section 3 of the UGC Act, 1956)

Eknath Bhavan, # 19, Gavipuram Circle, Kempegowda Nagar, Bangalore - 560 019

Ph: 080 - 2661 2669, Telefax: 080 - 2660 8645

E-mail: svyasa@svyasa.org Website: www.svyasa.org

Approval Period: 04 Years

Condition of approval

- Research must be conducted according to the approved proposal.
- Report has to submitted to IEC on completion of study.
- Violation/deviation from the approved proposal has to be notified to IEC.
- The authorised personnel will comply to request for audit from IEC.
- IEC retains right to withdraw or amend this approved clearance certificate.

Please contact undersigned member Secretary if you have any quires / need clarification.

IEC wishes you all the best.

Dr. Ramesh M N
Member Secretary,
Institutional Ethics Committee,
S-VYASA, Bengaluru.

Member Secretary
Institutional Ethics Committee
Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA)
No. 19, Eknath Bhavan, Gavipuram Circle
K.G. Nagar, Bangalore-560019

स्वामी विवेकानन्द योग अनुसंधान संस्थान
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Ph: 080 - 2661 2669, Telefax: 080 - 2660 8645
E-mail: svyasa@svyasa.org Website: www.svyasa.org

Institutional Ethics Committee (IEC)
Clearance Certificate

Date: 13th January, 2021

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I. Documents

1. Covering Letter
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4. Informed consent form
5. Undertaking

II. Presentation to IEC on 19th December, 2020.

III. Your clarification provided to the comments of the members made during presentation.

After perusal of this information, IEC has decided to approve your study. Details of approval are as follows:

Certificate Reference Number: RES/IEC-SVYASA/182-B/2021

Project Title: Effect of Trataka (Yogic Visual Concentration) practice on Psychological well-being and Visual Strain – A Randomized Controlled Trial.

Nature of Study: PhD

Authorised Personnel: Dr. Swathi P S, Dr. Raghavendra Bhat & Dr. Apar Avinash Saoji

APPROVED

INSTITUTIONAL ETHICS COMMITTEE
SVYASA, BANGALORE

स्वामी विवेकानन्द योग अनुसंधान संस्थान

Swami Vivekananda Yoga Anusandhāna Samsthāna

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Ph: 080 - 2661 2669, Telefax: 080 - 2660 8645

E-mail: svyasa@svyasa.org Website: www.svyasa.org

Approval Period: 04 Years

Condition of approval

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- The authorised personnel will comply to request for audit from IEC.
- IEC retains right to withdraw or amend this approved clearance certificate.

Please contact undersigned member Secretary if you have any quires / need clarification.

IEC wishes you all the best.

Dr. Ramesh M N
Member Secretary,
Institutional Ethics Committee,
S-VYASA, Bengaluru.

Member Secretary
Institutional Ethics Committee
Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA)
No. 19, Eknath Bhavan, Gavipuram Circle
K.G. Nagar, Bangalore-560019

स्वामी विवेकानन्द योग अनुसंधान संस्थान
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Institutional Ethics Committee (IEC)
Clearance Certificate

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Dear **Dr Swathi P S**

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I. Documents

1. Covering Letter
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5. Undertaking

II. Presentation to IEC on 19th December, 2020.

III. Your clarification provided to the comments of the members made during presentation.

After perusal of this information, IEC has decided to approve your study. Details of approval are as follows:

Certificate Reference Number: RES/IEC-SVYASA/182-C/2021

Project Title: Effect of Trataka (Yogic Visual Concentration) practice on the performance in the Corsi-block tapping task – A repeated measures study.

Nature of Study: PhD

Authorised Personnel: Dr. Swathi P S, Dr. Raghavendra Bhat & Dr. Apar Avinash Saoji

APPROVED

INSTITUTIONAL ETHICS COMMITTEE
SVYASA, BANGALORE

स्वामी विवेकानन्द योग अनुसंधान संस्थान

Swami Vivekananda Yoga Anusandhāna Samsthāna

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Ph: 080 - 2661 2669, Telefax: 080 - 2660 8645

E-mail: svyasa@svyasa.org Website: www.svyasa.org

Approval Period: 04 Years

Condition of approval

- Research must be conducted according to the approved proposal.
- Report has to submitted to IEC on completion of study.
- Violation/deviation from the approved proposal has to be notified to IEC.
- The authorised personnel will comply to request for audit from IEC.
- IEC retains right to withdraw or amend this approved clearance certificate.

Please contact undersigned member Secretary if you have any quires / need clarification.

IEC wishes you all the best.

Dr. Ramesh M N
Member Secretary,
Institutional Ethics Committee,
S-VYASA, Bengaluru.

Member Secretary
Institutional Ethics Committee
Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA)
No. 19, Eknath Bhavan, Gavipuram Circle
K.G. Nagar, Bangalore-560019

Appendix 3

Clinical Trial Registry India

Clinical Trial Details (PDF Generation Date :- Fri, 04 Mar 2022 14:08:03 GMT)

CTRI Number Last	CTRI/2021/03/031871 [Registered on: 10/03/2021] - **Trial Registered Prospectively**
Modified On	22/02/2022
Post Graduate Thesis	Yes
Type of Trial	Interventional
Type of Study Study	Yoga & Naturopathy
Design Public Title of	Other
Study	Effect of yogic candle gazing on visual reaction and its association with autonomic function in healthy volunteers.
Scientific Title of Study	Effect of Trataka (Yogic Visual Concentration) practice on the Visual reaction time and its association with the Autonomic functions – A Self as Control trial

Secondary IDs if Any

Secondary ID	Identifier
NIL	NIL

Details of Principal Investigator or overall Trial Coordinator (multi-center study)

Details of Principal Investigator	
Name	Dr Swathi P S
Designation	Assistant Professor
Affiliation	Swami Vivekananda Yoga Anusandhana Samsthana
Address	Life Science Division, Prashanti Kutiram, Vivekananda Road, Kalluballu Post, Jigani, Anekal, Bengaluru Bangalore KARNATAKA 560105 India
Phone	9591164385
Fax	
Email	swathisanketh@gmail.com

Details Contact Person (Scientific Query)

Details Contact Person (Scientific Query)	
Name	Raghavendra Bhat
Designation	Associate Professor
Affiliation	Swami Vivekananda Yoga Anusandhana Samsthana
Address	Prashanti Kutiram, Vivekananda Road, Kalluballu Post, Jigani, Anekal, Bengaluru Bangalore KARNATAKA 560105 India
Phone	8147226351
Fax	
Email	raghavendra.bhat@svyasa.edu.in

Details Contact Person (Public Query)

Details Contact Person (Public Query)	
Name	Dr Apar Saoji
Designation	Associate Professor
Affiliation	Swami Vivekananda Yoga Anusandhana Samsthana
Address	Prashanti Kutiram, Viveknanda Road, Kallubalu Post, Jigani, Anekal Bangalore KARNATAKA 560105 India
Phone	8970345905

Source of Monetary or Material Support

Primary Sponsor

Details of Secondary Sponsor

Countries of Recruitment

Sites of Study

Details of Ethics Committee

Regulatory Clearance Status from DCGI

Health Condition / Problems Studied

Intervention / Comparator Agent

Inclusion Criteria

Fax	
Email	aparsaoji@gmail.com

Source of Monetary or Material Support
> Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA)

Primary Sponsor Details	
Name	Dr Swathi P S
Address	19, Eknath Bhavan, Gavipuram Circle, KG Nagar, Bengaluru - 560019
Type of Sponsor	Other []

Name	**Address**
NIL	NIL

List of Countries
India

Name of Principal Investigator	**Name of Site**	**Site Address**	**Phone/Fax/Email**
Dr Swathi P S	Swami Vivekananda Yoga Anusandhana Samsthana	Life Science Division, Prashanti Kuteeram, Vivekananda Road, Kalaballu Post, Jigani, Bengaluru 560105 Bangalore KARNATAKA	9591164385 swathisanketh@gmail.com

Name of Committee	**Approval Status**	**Date of Approval**	**Is Independent Ethics Committee?**
Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA)	Approved	13/01/2021	No

Status	**Date**
Not Applicable	No Date Specified

Health Type	**Condition**
Healthy Human Volunteers	Normal, healthy volunteers will be enrolled in the study.

Type	**Name**	**Details**
Intervention	Trataka	The volunteers in the trataka session will be performing yogic visual gazing using a candle light. The practice involves preparatory eye exercises followed by three stages of gazing on a candle flame from a distance of about 2 meters.
Comparator Agent	Eye exercises & Quite sitting	The control session includes eye exercises followed by quiet sitting for a total duration of 20 min.

Inclusion Criteria	
Age From	18.00 Year(s)
Age To	35.00 Year(s)
Gender	Both
Details	Normal vision (6/6) as checked using Snellen's chart, Physical health will be evaluated through routine clinical examination by a

	trained physician, psychological health will be assessed through GHQ 12, Participants with prior experience of yoga practices of minimum six months, Participants having the right hand dominance will be included since handedness impacts psychophysiology differentially

Exclusion Criteria

Exclusion Criteria	
Details	We will exclude participants with any known eye disorders, including refractive errors, colour blindness, glaucoma, cataract, history of Ophthalmological surgeries, including laser surgeries, and the presence of cognitive or neurological disorders, respiratory or cardiac disorders, sensory abnormalities. Participants who have difficulty in focusing/concentrating and history of smoking or alcoholism which may influence the psycho-physiological functions and Female participants during pregnancy or lactation. Additionally, assessments of female participants will be avoided during the menstrual phase as the menstrual cycle is known to influence the cognition and autonomic nervous system activity

Method of Generating Random Sequence	Computer generated randomization
Method of Concealment	Sequentially numbered, sealed, opaque envelopes
Blinding/Masking	Outcome Assessor Blinded

Primary Outcome

Outcome	Timepoints
Heart Rate Variabilty	At baseline and immediately after the session

Secondary Outcome

Outcome	Timepoints
Heart Rate, Breath rate and visual reaction time	At baseline and immediately after the session

Target Sample Size	**Total Sample Size=**30 **Sample Size from India=**30 **Final Enrollment numbers achieved (Total)=**106 **Final Enrollment numbers achieved (India)=**106
Phase of Trial	N/A
Date of First Enrollment (India)	17/03/2021
Date of First Enrollment (Global)	No Date Specified
Estimated Duration of Trial	**Years=**0 **Months=**6 **Days=**0
Recruitment Status of Trial (Global)	Not Applicable
Recruitment Status of Trial (India)	Completed
Publication Details	
Brief Summary	This study is a self as controlled trial designed to understand the effects of Yogic visual concentration (trataka) for 20 min on autonomic function via heart rate variability, Heart rate, respiratory rate and galvanic skin resistance. Also to assess the impact of trataka at the visual time and its association with the autonomic functions. The subjects will undergo for 2 weeks training on trataka.

Clinical Trial Details (PDF Generation Date :- Fri, 04 Mar 2022 14:07:37 GMT)

CTRI Number Last	CTRI/2021/01/030737 [Registered on: 25/01/2021] - **Trial Registered Prospectively**
Modified On	23/02/2022
Post Graduate Thesis	Yes
Type of Trial	Interventional
Type of Study Study	Yoga & Naturopathy
Design Public Title of	Randomized, Parallel Group Trial
Study	Effect of yogic candle gazing on psychological changes in healthy volunteers.
Scientific Title of Study	Effect of Trataka (Yogic Visual Concentration) practice on Psychological well-being and Visual Strain – A Randomized Controlled Trial

Secondary IDs if Any

Secondary ID	Identifier
NIL	NIL

Details of Principal Investigator or overall Trial Coordinator (multi-center study)

Details of Principal Investigator	
Name	DrSwathi PS
Designation	Assistant Professor
Affiliation	Swami Vivekananda Yoga Anusandhana Samsthana
Address	19, Eknath Bhavan, Gavipuram Circle, KG Nagar Bangalore KARNATAKA 560019 India
Phone	9591165385
Fax	
Email	swathisanketh@gmail.com

Details Contact Person (Scientific Query)

Details Contact Person (Scientific Query)	
Name	Dr Apar Saoji
Designation	Associate Professor
Affiliation	Swami Vivekananda Yoga Anusandhana Samsthana
Address	19, Eknath Bhavan, Gavipuram Circle, KG Nagar Bangalore KARNATAKA 560019 India
Phone	8970345905
Fax	
Email	aparsaoji@gmail.com

Details Contact Person (Public Query)

Details Contact Person (Public Query)	
Name	Dr Apar Saoji
Designation	Associate Professor
Affiliation	Swami Vivekananda Yoga Anusandhana Samsthana
Address	19, Eknath Bhavan, Gavipuram Circle, KG Nagar Bangalore KARNATAKA 560019 India
Phone	8970345905
Fax	
Email	aparsaoji@gmail.com

Source of Monetary or Material Support

Primary Sponsor

Source of Monetary or Material Support
> Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA)

Primary Sponsor Details	
Name	Dr Swathi P S
Address	19, Eknath Bhavan, Gavipuram Circle, KG Nagar, Bengaluru - 560019
Type of Sponsor	Other [Self]

Details of Secondary Sponsor

Name	Address
NIL	NIL

Countries of Recruitment

List of Countries
India

Sites of Study

Name of Principal Investigator	Name of Site	Site Address	Phone/Fax/Email
Dr Swathi PS	Swami Vivekananda Yoga Anusandhana Samsthana	19, Eknath Bhavan Gavipuram Circle KG Nagar Bengaluru Bangalore KARNATAKA	9591164385 swathisanketh@gmail.com

Details of Ethics Committee

Name of Committee	Approval Status	Date of Approval	Is Independent Ethics Committee?
Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA)	Approved	13/01/2021	No

Regulatory Clearance Status from DCGI

Status	Date
Not Applicable	No Date Specified

Health Condition / Problems Studied

Health Type	Condition
Healthy Human Volunteers	Normal healthy volunteers will be enrolled for the study.

Intervention / Comparator Agent

Type	Name	Details
Intervention	Trataka	The volunteers in the trataka group will be performing yogic visual gazing using a candle light. The twenty min practice will be repeated for 6 days/week for two weeks. The practice involves preparatory eye exercises followed by three stages of gazing on a candle flame from a distance of about 2 meters.
Comparator Agent	Wait-listed Control	The wait-listed control group will continue with their routine activities till the follow-up period of two weeks is completed. Once the follow-up period is completed, they will be offered the same trataka sessions for two weeks.

Inclusion Criteria

Inclusion Criteria	
Age From	18.00 Year(s)
Age To	35.00 Year(s)
Gender	Both

	Details	Normal vision (6/6) as checked using Snellen's chart, Physical health will be evaluated through routine clinical examination by a trained physician; psychological health will be assessed through GHQ 12, Participants with prior experience of yoga practices of minimum six months, Participants using digital displays (computer displays, mobile phones, TVs etc.) for long time (>4 hours) will be included.

Exclusion Criteria

Exclusion Criteria	
Details	We will exclude participants with any known eye disorders, including refractive errors, colour blindness, glaucoma, cataract, history of ophthalmological surgeries including laser surgeries, and the presence of cognitive or neurological disorders, respiratory or cardiac disorders, sensory abnormalities. c) Participants who have difficulty in focusing/concentrating and history of smoking or alcoholism which may influence the psycho-physiological functions

Method of Generating Random Sequence	Computer generated randomization
Method of Concealment	Sequentially numbered, sealed, opaque envelopes
Blinding/Masking	Outcome Assessor Blinded

Primary Outcome

Outcome	**Timepoints**
Mind wandering questionnaire	At baseline and at the end of two weeks

Secondary Outcome

Outcome	**Timepoints**
State mindful attention and awareness scale and Self-reported Visual strain using a fatigue and Symptom assessment checklist	At baseline and at the end of two weeks

Target Sample Size	**Total Sample Size=**110 **Sample Size from India=**110 **Final Enrollment numbers achieved (Total)=**106 **Final Enrollment numbers achieved (India)=**106
Phase of Trial	N/A
Date of First Enrollment (India)	25/01/2021
Date of First Enrollment (Global)	No Date Specified
Estimated Duration of Trial	**Years=**0 **Months=**6 **Days=**0
Recruitment Status of Trial (Global)	Not Applicable
Recruitment Status of Trial (India)	Completed
Publication Details	Swathi, P. S., Saoji, A. A., & Bhat, R. (2022). Role of Trataka in ameliorating visual strain and promoting psychological well-being during prolonged use of digital displays: randomized controlled trial. WORK, 71(2):327-333. DOI: 10.3233/WOR-210834.
Brief Summary	This study is a randomized controlled trial designed to understand the effects of Yogic visual concentration for 20 minutes of mind wandering. The secondary outcome state mindful attention and awareness scale and self reported visual strain using a fatigue and symptom checklist at baseline and at the end of two weeks of YVC. We will have a waistlisted control group.

Clinical Trial Details (PDF Generation Date :- Fri, 04 Mar 2022 14:08:18 GMT)

CTRI Number Last	CTRI/2021/03/031872 [Registered on: 10/03/2021] - **Trial Registered Prospectively**
Modified On	31/08/2021
Post Graduate Thesis	Yes
Type of Trial	Interventional
Type of Study Study	Yoga & Naturopathy
Design Public Title of	Other
Study	Effect of yogic candle gazing on cognition in healthy volunteers
Scientific Title of Study	Effect of Trataka (Yogic Visual Concentration) practice on the performance in the Corsi-block tapping task – A repeated measures study

Secondary IDs if Any

Secondary ID	Identifier
NIL	NIL

Details of Principal Investigator or overall Trial Coordinator (multi-center study)

Details of Principal Investigator	
Name	Dr Swathi P S
Designation	Assistant Professor
Affiliation	Swami Vivekananda Yoga Anusandhana Samsthana
Address	Life Science Division, Prashanti Kutiram, Vivekananda Road, Kalluballu Post, Jigani, Anekal Bangalore KARNATAKA 560105 India
Phone	9591164385
Fax	
Email	swathisanketh@gmail.com

Details Contact Person (Scientific Query)

Details Contact Person (Scientific Query)	
Name	Dr Raghavendra Bhat
Designation	Associate Professor
Affiliation	Swami Vivekananda Yoga Anusandhana Samsthana
Address	Prashanti Kutiram, Vivekananda Road, Kallubalu Post, Jigani, Anekal Bangalore KARNATAKA 560105 India
Phone	8147226351
Fax	
Email	raghavendra.bhat@svyasa.edu.in

Details Contact Person (Public Query)

Details Contact Person (Public Query)	
Name	Dr Apar Saoji
Designation	Associate Professor
Affiliation	Swami Vivekananda Yoga Anusandhana Samsthana
Address	Prashanti Kutiram, Vivekanda Road, Kalluballu Post, Jigani, Anekal Bangalore KARNATAKA 560105 India
Phone	8970345905
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Source of Monetary or Material Support

Email	aparsaoji@gmail.com

Primary Sponsor

Source of Monetary or Material Support
> Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA)

Primary Sponsor Details	
Name	Dr Swathi P S
Address	19, Eknath Bhavan, Gavipuram Circle, KG Nagar, Bengaluru - 560019
Type of Sponsor	Other []

Details of Secondary Sponsor

Name	**Address**
NIL	NIL

Countries of Recruitment

List of Countries
India

Sites of Study

Name of Principal Investigator	**Name of Site**	**Site Address**	**Phone/Fax/Email**
Dr Swathi P S	Swami Vivekananda Yoga Anusandhana Samsthana	Division of Life Science, Prashanti Kuteeram, Vivekananda Road, Kallaballu Post, Jigani, Bengaluru 560105 Bangalore KARNATAKA Bangalore KARNATAKA	9591164385 swathisanketh@gmail.com

Details of Ethics Committee

Name of Committee	**Approval Status**	**Date of Approval**	**Is Independent Ethics Committee?**
Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA)	Approved	13/01/2021	No

Regulatory Clearance Status from DCGI

Health Condition / Problems Studied

Status	**Date**
Not Applicable	No Date Specified

Health Type	**Condition**
Healthy Human Volunteers	Normal, healthy volunteers will be enrolled in the study.

Intervention / Comparator Agent

Type	**Name**	**Details**
Intervention	Trataka	The volunteers in the trataka session will be performing yogic visual gazing using a candle light. The practice involves preparatory eye exercises followed by three stages of gazing on a candle flame from a distance of about 2 meters.
Comparator Agent	Eye exercise & Quiet sitting	The control session includes eye exercises followed by quiet sitting for a total duration of 20 min.

Inclusion Criteria

Inclusion Criteria	
Age From	18.00 Year(s)
Age To	35.00 Year(s)
Gender	Both
Details	Normal vision (6/6) as checked using Snellen's chart, Physical

	health will be evaluated through routine clinical examination by a trained physician; psychological health will be assessed through GHQ 12, Participants with prior experience of yoga practices of minimum six months, Participants having the right hand dominance will be included since handedness impacts psychophysiology differentially

Exclusion Criteria

Exclusion Criteria	
Details	We will exclude participants with any known eye disorders, including refractive errors, colour blindness, glaucoma, cataract, history of Ophthalmological surgeries, including laser surgeries, and the presence of cognitive or neurological disorders, respiratory or cardiac disorders, sensory abnormalities. Participants who have difficulty in focusing/concentrating and history of smoking or alcoholism which may influence the psycho-physiological functions

Method of Generating Random Sequence	Computer generated randomization
Method of Concealment	Sequentially numbered, sealed, opaque envelopes
Blinding/Masking	Outcome Assessor Blinded

Primary Outcome

Outcome	Timepoints
Working Memory	At baseline and immediately after the session

Secondary Outcome

Outcome	Timepoints
Cognition and attention	At baseline and immediately after the session

Target Sample Size	**Total Sample Size=**40 **Sample Size from India=**40 **Final Enrollment numbers achieved (Total)=**0 **Final Enrollment numbers achieved (India)=**41
Phase of Trial	N/A
Date of First Enrollment (India)	17/03/2021
Date of First Enrollment (Global)	No Date Specified
Estimated Duration of Trial	**Years=**0 **Months=**6 **Days=**0
Recruitment Status of Trial (Global)	Not Applicable
Recruitment Status of Trial (India)	Completed
Publication Details	NIL
Brief Summary	This study is a repeated measures design to understand the effects of Yogic visual concentration for 20 minutes on visuospatial short term and working memory. Before starting the experiment we will give two weeks of training in Trataka and then we will assess for the immediate effect at baseline and after the practice.

Appendix 4

QUESTIONNAIRES

VCU

Monroe Campus

Virginia Commonwealth University

Department of Psychology

White House
806 West Franklin Street
P.O. Box 842018
Richmond, Virginia 23284-2018

804 828-6754
Fax: 804 828-2237
TDD: 1-800-828-1120

Dear Colleague,

The state Mindful Attention Awareness Scale (MAAS) is in the public domain and special permission is not required to use it for research or clinical purposes. To date, the state MAAS has been validated for use with college student and community adults (Brown & Ryan, 2003). A detailed description of the state MAAS is found below. The state MAAS has been adapted to assess both recent (e.g., past day) and current experiences of mindfulness. A validated 'current experience' version of the scale and its scoring is reproduced below. Other adaptations of the state MAAS, as well as a validated trait version of the MAAS, are available upon request.

Feel free to e-mail me with any questions about the use or interpretation of the MAAS. I would appreciate hearing about any clinical or research results you obtain using the scale.

Yours,

Kirk Warren Brown, PhD
Department of Psychology
Virginia Commonwealth University
806 West Franklin St.
Richmond, VA 23284-2018
e-mail kwbrown@vcu.edu

Mindful Attention Awareness Scale (MAAS), state version

Characteristics of the scale:

The state MAAS is a 5-item scale designed to assess the short-term or current expression of a core characteristic of mindfulness, namely, a receptive state of mind in which attention, informed by a sensitive awareness of what is occurring in the present, simply observes what is taking place. This is in contrast to the conceptually driven mode of processing, in which events and experiences are filtered through cognitive appraisals, evaluations, memories, beliefs, and other forms of cognitive manipulation. The state MAAS draws items drawn from the trait form of the MAAS (e.g., "I'm finding it difficult to stay focused on what's happening in the present"). Though not as frequently used as the trait MAAS, the state MAAS has shown excellent psychometric properties (e.g., Cronbach's alpha = .92; Brown & Ryan, 2003). Trait MAAS scores have been shown to predict state MAAS scores, and state scores have been related to psychological well-being outcomes (Brown & Ryan, 2003), both of these findings providing evidence for the construct validity of the state measure. Trait and state MAAS scores have been shown to have independent effects on well-being outcomes, suggesting that the state measure has incremental validity in relation to the trait scale.

Appropriate validity reference for the state MAAS:

Brown, K.W. & Ryan, R.M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84,* 822-848.

Experiences at Time of Signal

Instructions: Using the 0-6 scale shown, please indicate to what degree were you having each experience described below *when you were paged*. Please answer according to what *really reflected* your experience rather than what you think your experience should have been.

	not at all			some what			very much
1. I was finding it difficult to stay focused on what was happening.	0	1	2	3	4	5	6
2. I was doing something without paying attention.	0	1	2	3	4	5	6
3. I was preoccupied with the future or the past.	0	1	2	3	4	5	6
4. I was doing something automatically, without being aware of what I was doing.	0	1	2	3	4	5	6
5. I was rushing through something without being really attentive to it.	0	1	2	3	4	5	6

MAAS Scoring

To have high scores reflect higher state mindfulness, reverse score all items then average all 5 values.

Mind-Wandering Questionnaire (MWQ)

Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your feelings at best.

	Almost never	Very infrequently	Somewhat infrequently	Somewhat frequently	very frequently	Almost always
1. I have difficulty maintaining focus on simple or repetitive work	1	2	3	4	5	6
2. While reading, I find I haven't been thinking about the text and must therefore read it again	1	2	3	4	5	6
3. I do things without paying full attention	1	2	3	4	5	6
4. I find myself listening with one ear, thinking about something else at the same time	1	2	3	4	5	6
5. I mind-wander during lectures of presentations	1	2	3	4	5	6

VISUAL FATIGUE SCALE (VFS)

Guidelines for filling up the Visual Fatigue Scale

- ✓ A rating scale of visual fatigue which will be administered at the beginning and at the end of each reading session.
- ✓ This scale is consisted of six items and each item will be rated on a 10-point Likert scale.
- ✓ Based on your personal experience **please circle(or tick)** , you choice from following statements that best indicates

Scale Description

1) I have difficulties in seeing

2) I have a strange feeling around the eyes

3) My eyes feel tired

4) I feel numb

5) I have a headache

6) I feel dizzy looking at the screen.

Name :

Contact:

Thank you for your valuable responses

VISUAL STRAIN CHECKLIST

HOW OFTEN HAVE YOU EXPERIENCED THE FOLLOWING SYMTOMS IN LAST ONE WEEK?					
PARTICULARS	**NEVER**	**RARELY**	**OCCASIONALLY**	**OFTEN**	**NEARLY ALWAYS**
TIREDNESS/SORENESS/ACHE OF THE EYES	0	1	2	3	4
IRRITATION/BURNING EYES	0	1	2	3	4
WATERY EYE	0	1	2	3	4
BLURRED VISION/DIFFICULTY IN FOCUSING	0	1	2	3	4
REDNESS OF EYE	0	1	2	3	4
HEADACHE/HEAVINESS OF HEAD	0	1	2	3	4
NAUSEA/VOMITING	0	1	2	3	4

VSC: An average of all scores on the Likert scale was calculated and reported

Appendix 5

Data of Autonomic Variables and Simple Visual reaction Time task

Table 18: LF power recorded at pre, during and post following Experimental and control sessions

Sl.No	Name	Trataka LF Power						Eye exercise LF Power					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	316.9643	1852.508	607.8292	1170.588	1964.709	1359.35	302.1394	219.3575	252.1207	322.4817	605.0349	566.0305
2	AHV	509.0834	375.2044	368.4584	1163.166	891.4372	1439.199	1004.076	897.4895	1412.926	1414.502	344.2745	481.631
3	BBV	603.768	559.3066	854.7331	738.5755	918.011	764.845	530.7774	758.5409	556.4514	697.4476	1685.725	891.8282
4	VVB	339.8226	555.056	677.787	368.5401	2467.238	1485.97	389.3286	278.3176	148.5993	377.6849	438.4315	413.9965
5	BVB	828.6414	437.9646	851.8241	1111.619	1449.795	769.9431	496.5822	551.1661	874.5792	788.8206	1390.794	1936.346
6	RAH	178.8445	432.5997	757.8258	1302.232	481.5153	3424.682	562.0943	383.4054	237.6146	303.623	566.4397	1324.299
7	HAR	817.0592	275.0868	647.5646	1266.92	447.5806	1495.085	111.2681	129.9399	38.2517	47.7361	497.4736	757.7118
8	FTR	99.5683	62.3611	49.9938	77.0561	348.2402	373.0422	1433.546	1426.21	3046.437	3086	3603.605	5486.605
9	SEY	687.7224	541.611	123.997	415.9901	320.4784	986.374	736.9301	863.1661	471.5764	745.5074	1898.396	934.4515
10	JHU	854.0228	311.9847	234.3539	114.9319	141.3347	384.3364	318.7378	755.3818	423.698	125.469	547.2126	697.8577
11	KJU	1460.612	2433.688	614.3149	1310.348	2461.352	1260.679	1490.506	2526.794	1536.592	1671.024	1300.356	1066.644
12	GYU	5218.253	1726.501	1143.954	2115.543	1248.058	4637.044	346.4176	249.4453	230.2106	110.8197	665.0198	798.6393
13	MNN	257.0019	134.634	248.4703	784.0028	319.9444	389.1911	502.4035	766.9696	1021.553	640.7932	1028.483	840.0619
14	ABH	905.7276	786.2953	786.8923	850.5451	630.0598	1258.97	690.6533	205.0563	278.0545	513.6501	385.4975	508.1345
15	SRS	260.4411	300.6843	194.5414	150.9084	257.5543	1338.478	1212.799	1311.855	1909.223	1956.99	807.4247	1509.574

16	NMN	121.5244	53.0551	114.94	497.6798	617.573	824.5176	231.9144	188.5312	160.5147	259.7462	1626.363	2060.951
17	PKU	1880.312	3144.266	2325.991	1436.063	2251.606	526.6199	80.0323	127.3294	480.1978	1056.897	1187.264	131.9776
18	PIN	384.6576	115.1693	221.3705	511.1544	504.89	1225.662	1052.738	564.5247	922.9887	595.2878	803.6885	2113.707
19	RAC	1681.496	181.8487	657.4979	124.0336	429.3961	220.4079	897.6175	502.8863	704.9392	562.9053	358.7045	890.2045
20	RAJ	771.7565	599.7057	593.0093	506.7504	494.6475	839.3242	31.0403	195.5842	318.6484	104.4942	539.8053	1039.321
21	RUB	238.4975	382.9165	1208.781	403.0932	628.1873	1145.532	802.8842	836.0322	1543.022	290.6604	234.3452	615.3941
22	SAT	62.3999	82.028	117.7191	187.8061	262.4024	944.6207	1947.401	2581.504	4301.789	2578.62	3465.79	4208.492
23	SHI	498.3275	815.0408	581.6278	884.3553	543.2783	363.7631	424.0636	313.8866	936.2424	2013.334	2737.041	1851.057
24	SPO	253.9992	415.3914	483.9869	769.5473	1091.462	1138.687	728.2185	723.2424	1328.44	402.7355	695.9471	3547.094
25	SUR	656.7635	748.8421	394.825	346.6324	764.9716	751.8535	394.988	952.3931	719.4527	783.0731	1053.776	885.3854
26	SWE	271.1394	426.9717	340.1188	451.439	445.8661	1263.508	480.2934	113.8408	79.3614	156.1792	80.3859	205.1368
27	TEJ	874.6722	682.8612	487.7467	505.7243	449.8546	687.3266	311.0832	262.0978	289.2072	347.4339	526.1687	280.3338
28	VIV	177.0751	252.1274	540.3603	668.3748	1208.405	938.4733	384.5758	380.2794	732.1514	1215.37	1061.069	2173.235
29	YAJ	91.6064	944.8093	1652.973	924.6651	419.8856	1051.172	738.9806	965.539	651.4313	722.0436	1366.79	1740.112
30	THJ	670.7842	1330.459	834.1578	1151.118	453.1494	1834.332	1002.159	501.7648	1092.91	3971.392	1920.61	2929.93
Mean		**732.4181**	**698.6993**	**623.9215**	**743.6468**	**830.4294**	**1170.766**	**654.5416**	**684.4177**	**889.9728**	**928.7574**	**1114.064**	**1429.538**
Std.dev		**947.2301**	**712.9472**	**474.2442**	**473.2296**	**652.4117**	**872.8841**	**439.7195**	**606.4336**	**900.2311**	**936.6878**	**873.8279**	**1220.849**

Table 19: HF power recorded at pre, during and post following Experimental and Control sessions

Sl.No	Name	Trataka_HF Power						Eye exercise_HF Power					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	700.884	1206.734	774.4584	1053.08	1061.508	919.5716	264.6908	102.6929	73.4367	150.8169	189.8386	224.8654
2	AHV	186.8191	245.3821	318.1341	216.0892	822.7686	540.9361	1541.504	1304.858	1814.84	1492.089	2115.961	1649.324
3	BBV	965.2576	1196.872	592.9528	824.9174	992.2629	1096.844	5947.436	5914.319	5959.299	4588.099	5453.611	4702.411
4	VVB	621.7274	631.3998	507.1203	658.9601	1110.22	1419.617	449.2583	512.0269	426.9191	532.3547	925.8353	365.3369
5	BVB	930.3925	1199.892	980.3128	1069.852	1566.147	777.9741	1931.022	1906.098	995.7043	1152.829	2382.461	2924.217
6	RAH	858.5168	1251.773	384.6575	861.1718	1234.622	1020.796	1168.2	1277.704	582.3554	742.9562	1544.344	1554.532
7	HAR	1277.623	773.538	1401.31	614.8403	585.0475	2132.092	123.3619	98.8859	34.2989	53.3883	202.1014	373.6539
8	FTR	132.7209	80.1525	41.8285	26.3161	167.1528	143.7627	3043.735	1384.111	3353.061	2935.527	3872.445	5732.87
9	SEY	217.6209	124.2055	184.8412	229.4639	220.7514	371.894	652.2616	1031.656	972.1802	2703.12	1933.119	1522.738
10	JHU	598.4107	210.6042	287.1552	190.0152	237.2332	280.8248	131.3921	196.3854	151.5396	83.1393	202.4578	210.6975
11	KJU	3463.154	2863.61	2513.606	5369.447	4055.34	4096.761	1066.568	1563.453	1574.149	1371.638	1150.537	1431.434
12	GYU	3446.412	2804.215	2889.079	3816.973	2843.07	4652.369	324.2928	307.1878	478.2317	140.946	821.0112	776.8338
13	MNN	189.9012	72.8386	125.1452	155.9196	170.6437	159.859	885.8732	781.7227	876.2491	1994.821	2441.433	1585.527
14	ABH	810.3883	592.0763	428.6984	483.4694	437.8856	815.7311	967.1218	91.2215	228.8042	473.9604	172.354	269.628
15	SRS	237.7934	208.1773	247.2647	229.0034	344.4376	465.7146	1109.128	1379.818	699.5093	842.5291	372.1966	1100.753

16	NMN	162.575	167.0589	280.2633	278.731	299.169	444.4105	262.3204	211.2207	335.6844	226.9718	1469.645	2119.383
17	PKU	381.5208	854.8603	867.2116	630.9121	427.7822	506.0484	110.6112	152.5112	296.7423	388.6277	452.6512	186.3478
18	PIN	338.006	73.7177	182.0969	320.4803	239.7019	544.6408	447.0973	995.3873	469.7349	686.0008	1580.483	1576.957
19	RAC	318.2784	144.9699	249.4137	200.9657	199.7854	326.3698	1272.833	1472.136	1263.365	1060.39	1104.169	986.7969
20	RAJ	1054.563	771.3758	1146.958	1027.873	840.835	1116.318	124.9498	296.3742	461.9425	192.4486	1422.459	1013.601
21	RUB	1054.073	892.3883	1145.412	1228.808	1421.736	1364.726	1121.763	1411.859	1709.303	528.5319	765.2759	2876.997
22	SAT	425.6731	191.2115	287.9932	252.642	450.3481	1085.121	1217.266	1219.06	791.5655	731.7748	817.8192	1268.61
23	SHI	1214.751	1160.738	1344.489	1157.544	1261.144	2147.731	1407.815	890.8855	766.1357	1899.274	2014.35	2280.091
24	SPO	787.4049	1158.014	1544.247	1513.411	2201.236	3502.966	736.0432	954.4791	1171.208	840.0972	768.0882	3258.593
25	SUR	438.2421	375.6111	215.0721	390.479	709.6146	848.5842	4117.156	4571.899	4638.972	4820.596	5370.584	4482.456
26	SWE	1051.429	491.3884	551.2743	580.8127	508.676	1880.512	367.2059	345.2162	464.4025	437.0393	458.2795	730.6763
27	TEJ	597.8591	631.9257	942.2949	816.4894	1065.764	1058.84	1285.171	617.7011	1046.698	1219.629	1441.909	1377.099
28	VIV	359.5067	448.9768	449.6818	565.9118	857.9763	566.079	937.9329	590.3119	921.1201	1204.588	1330.158	1693.08
29	YAJ	343.9329	697.0315	796.7633	743.5541	785.9676	673.9096	710.0212	803.3705	906.4096	888.1272	1180.222	739.9815
30	THJ	3780.939	2302.649	3768.43	3548.045	2717.137	6500.217	1484.517	966.2082	1860.299	5787.687	1609.48	6267.376
Mean		**898.2125**	**794.1129**	**848.2722**	**968.5393**	**994.5321**	**1382.041**	**1173.618**	**1111.692**	**1177.472**	**1339**	**1518.843**	**1842.762**
Std.dev		**948.7711**	**735.6709**	**855.2643**	**1178.848**	**895.1829**	**1452.052**	**1227.641**	**1225.605**	**1299.49**	**1438.074**	**1314.033**	**1590.237**

Table 20: Total power recorded at pre, during and post following Experimental and Control sessions

Sl.No	Name	Trataka_Total Power						Eye exercise_Total Power					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	1377.42	3623.117	1822.863	4126.461	4533.28	3642.33	1599.673	992.071	760.8353	650.7406	1211.255	1147.265
2	AHV	1679.682	1343.573	1624.57	3899.765	5424.72	3167.793	3364.124	6499.437	4612.764	3823.455	3094.715	3409.813
3	BBV	3211.744	2714.338	2395.312	2583.777	4132.041	3157.367	6809.652	7131.468	6789.672	5755.056	8040.301	6154.86
4	VVB	1170.031	1535.721	2151.068	1760.193	4243.405	3508.657	1430.618	911.7285	619.0138	1278.218	2319.638	1310.854
5	BVB	2231.357	2558.762	2246.489	3548.304	4786.237	2165.179	2937.426	2762.176	2661.257	3079.983	4769.734	6524.352
6	RAH	1223.001	2729.163	1774.792	2824.606	1969.739	6095.876	2117.269	1967.129	1374.241	1998.601	2606.636	4102.177
7	HAR	3303.047	1205.882	3266.651	2931.829	1437.168	4181.588	415.3623	392.6355	202.9414	434.8705	874.7316	1390.175
8	FTR	451.6038	255.1261	230.2741	166.5631	581.9138	621.8084	5733.526	3631.73	7980.115	7625.067	10593.71	15908.84
9	SEY	1108.007	916.8615	487.381	984.9327	964.0749	2021.777	2248.142	4602.253	1889.401	4468.375	6133.645	3709.714
10	JHU	2532.746	804.4291	919.856	448.3802	672.4079	1240.977	691.6453	1719.967	679.7279	523.1401	999.6407	1806.087
11	KJU	7175.299	6053.864	3483.253	7526.906	6912.84	6732.319	3549.85	5567.395	3722.574	3895.626	3614.144	5298.818
12	GYU	9251.039	4919.223	4571.309	6437.035	4557.218	9602.3	1193.643	834.5484	1048.807	337.978	1678.306	1793.018
13	MNN	1426.321	362.0116	455.3854	1942.542	920.3606	1237.275	1738.591	2377.219	2502.084	4295.452	3886.447	3184.751
14	ABH	2730.45	2343.613	2583.481	2138.278	2098.467	6123.177	4599.57	750.6774	1485.122	1633.913	1325.978	1778.519
15	SRS	845.1108	797.0412	570.8306	859.0378	2790.766	2540.499	3061.464	4212.708	4212.265	6609.867	1911.964	3336.622

16	NMN	392.7726	284.5297	587.9485	1251.456	1813.431	2484.961	711.3025	749.6713	832.687	1407.275	3851.533	6642.287
17	PKU	4132.388	6340.015	5508.234	3752.925	3788.952	3623.568	539.8184	433.1495	1041.124	2244.518	2127.59	431.9281
18	PIN	1116.751	359.9661	590.9907	995.4414	1857.06	3825.867	1882.588	2158.874	1989.008	1531.564	2719.851	4489.182
19	RAC	2585.594	1047.336	1929.715	459.0585	1154.074	1051.77	2971.123	2636.446	2968.596	4534.027	4341.884	2958.476
20	RAJ	2106.531	2129.701	2667.543	1961.809	1845.259	2941.808	754.7761	687.5678	1197.655	425.0982	2530.782	2765.58
21	RUB	2015.618	2223.662	4106.107	3657.276	4039.724	5852.004	2828.937	2577.961	3989.142	1558.571	1502.606	3755.558
22	SAT	617.8837	441.2629	589.4993	554.7977	875.2053	2699.626	6273.475	5909.897	6510.81	5584.254	5549.216	7886.42
23	SHI	2031.227	2642.836	2587.046	2624.635	2396.221	3818.133	2067.973	1376.1	2313.819	4674.706	5402.029	5014.296
24	SPO	1307.234	2365.432	2530.995	2903.167	4254.147	4972.846	2138.221	2078.435	3357.314	2190.334	2664.224	9278.312
25	SUR	1336.583	1890.408	960.9679	1178.039	1699.401	2121.077	6262.895	5806.89	5966.641	6219.056	6868.042	6115.819
26	SWE	1715.556	1220.116	1338.953	1928.65	2120.555	4396.363	1118.809	563.4412	712.4705	684.5495	607.9245	1546.665
27	TEJ	1776.122	2203.922	2126.135	1494.676	2063.622	2352.434	1991.537	1468.156	1846.565	1871.201	2997.699	2250.565
28	VIV	823.5279	834.617	1309.872	2132.495	4114.262	2236.348	1676.866	1221.334	1931.696	2888.272	2576.921	4831.639
29	YAJ	665.9037	2175.27	3292.006	2513.714	4085.911	3083.707	2107.018	2013.254	2511.758	2427.385	3467.788	3121.839
30	THJ	4697.1	4452.094	4944.177	5139.983	3547.588	8757.024	3012.642	2396.138	3426.623	11283.63	4030.629	12728.91
Mean		**2234.588**	**2092.463**	**2121.79**	**2490.891**	**2856.002**	**3675.215**	**2594.285**	**2547.682**	**2704.558**	**3197.826**	**3476.652**	**4489.111**
Std.dev		**1915.305**	**1595.231**	**1389.543**	**1710.159**	**1603.433**	**2112.031**	**1735.588**	**1940.196**	**1991.676**	**2514.845**	**2227.089**	**3383.886**

Table 21: LFnu recorded at pre, during and post following Experimental and Control sessions

Sl.No	Name	Trataka_LFnu						Eye exercise_LFnu					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	31.1234	60.5305	43.959	52.6306	64.9017	59.6387	53.2951	68.0482	77.4164	68.0915	76.0803	71.5469
2	AHV	73.1207	60.316	53.6448	84.3265	51.9749	72.6655	39.4069	40.7419	43.7305	48.65	13.9892	22.5956
3	BBV	38.4595	31.7169	58.9826	47.1933	48.0251	41.0764	8.1887	11.366	8.5381	13.1913	23.5988	15.9335
4	VVB	35.335	46.7763	57.1881	35.858	68.9389	51.1013	46.4165	35.2009	25.8137	41.4281	32.1109	53.101
5	BVB	47.1048	26.7238	46.4466	50.9071	48.0529	49.7237	20.4492	22.4273	46.7201	40.6137	36.8398	39.809
6	RAH	17.1963	25.6084	64.8651	59.9363	28.0534	77.0192	32.4587	23.0784	28.9609	29.0002	26.8282	45.9669
7	HAR	38.9789	26.233	31.5881	67.3165	43.3189	41.206	47.416	56.7369	51.8136	46.8415	70.9236	66.8528
8	FTR	42.8603	43.7533	54.4404	74.5214	67.5576	72.171	32.0157	50.741	47.5875	51.2309	48.1887	48.884
9	SEY	75.934	81.3207	40.1361	64.4402	59.2084	72.61	53.0441	45.5496	32.6604	21.6171	49.5406	38.0192
10	JHU	58.7839	59.6743	44.9354	37.6691	37.2963	57.7719	70.7965	79.3616	73.6307	60.1061	72.9751	76.8078
11	KJU	29.5925	45.8454	19.5973	19.6018	37.7462	23.504	58.279	61.7654	49.3791	54.9087	53.0527	42.6608
12	GYU	60.1846	38.1045	28.3643	35.6491	30.4622	49.875	51.6411	44.8097	32.482	43.9846	44.747	50.6743
13	MNN	57.5007	64.8807	66.4915	83.3931	65.1554	70.8732	36.026	49.4458	53.6026	24.0432	29.5384	34.4854
14	ABH	52.6816	56.8899	64.6526	63.5176	58.9524	60.6519	41.5875	69.0259	54.8388	52.0059	69.0837	65.286
15	SRS	52.2654	58.13	44.0272	39.7132	42.6884	74.1799	52.1487	48.7004	73.1023	69.8324	68.17	57.7275

16	NMN	42.7622	24.0939	29.0693	64.0864	67.3584	64.9595	46.9081	47.1591	32.3399	53.146	52.5112	49.2902
17	PKU	83.1179	78.6106	72.8183	69.4553	84.0183	50.9851	41.9559	45.4887	61.7892	73.0917	72.3859	41.4064
18	PIN	53.0462	60.969	54.79	61.4105	67.7911	69.2108	70.1343	36.1725	66.271	46.4581	33.6996	57.2665
19	RAC	84.0437	55.6352	72.4527	38.1563	68.2425	40.2653	41.3127	25.4512	35.774	34.6613	24.5027	47.4261
20	RAJ	42.2492	43.7301	34.0725	33.0172	37.0236	42.9149	19.7461	39.4842	39.9516	35.1577	27.5049	50.5459
21	RUB	18.449	30.0161	51.3204	24.6963	30.6328	45.6281	41.6684	37.1688	47.3751	35.4771	23.4308	17.6206
22	SAT	12.7663	29.7188	28.2636	42.1168	36.5807	46.5226	61.5308	67.861	84.4262	77.85	80.8934	76.813
23	SHI	29.0788	41.2443	30.1802	43.3019	30.088	14.4792	23.1469	26.0133	54.8807	51.4177	57.5503	44.7814
24	SPO	24.3798	26.3874	23.8605	33.7052	33.138	24.5313	49.6735	43.0902	53.1185	32.3832	47.523	52.1126
25	SUR	59.9682	66.5267	64.6739	47.0158	51.8616	46.9453	8.7533	17.2372	13.4244	13.9636	16.4016	16.4903
26	SWE	20.4817	46.0594	38.0121	43.6957	46.6791	40.1745	56.5974	24.7694	14.5923	26.3124	14.8686	21.8533
27	TEJ	59.376	51.8913	34.0915	38.2321	29.6694	39.358	19.4854	29.7119	21.6403	22.1622	26.7257	16.9033
28	VIV	32.9905	35.8595	54.5424	54.1382	58.4553	62.3638	29.0771	39.1587	44.271	50.2203	44.3577	56.1933
29	YAJ	20.9766	57.4078	67.3181	55.4124	34.6838	60.8484	50.9813	54.5399	41.7851	44.8373	53.6543	70.1528
30	THJ	15.0605	36.6063	18.1024	24.4893	14.2761	22.0016	40.2945	34.0356	36.9236	40.5799	54.2133	31.5821
Mean		**43.66227**	**47.042**	**46.42957**	**49.65344**	**48.09438**	**51.50854**	**41.48118**	**42.47802**	**44.96132**	**43.44212**	**44.863**	**46.02628**
Std.dev		**19.91148**	**15.77011**	**15.98925**	**16.65073**	**16.31119**	**16.61289**	**15.92125**	**16.2502**	**18.65829**	**16.43903**	**19.70785**	**17.7905**

Table 22: HFnu recorded at pre, during and post following Experimental and control sessions

Sl.No	Name	Trataka_HFnu						Eye exercise_Hfnu					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	68.8213	39.4299	56.0098	47.3473	35.0656	40.3444	46.6894	31.857	22.5495	31.8447	23.8713	28.4232
2	AHV	26.8332	39.4464	46.318	15.6659	47.9712	27.312	60.4994	59.2345	56.1699	51.3185	85.9796	77.3777
3	BBV	61.4861	67.8717	40.9179	52.7104	51.9095	58.9065	91.7553	88.6203	91.4383	86.7777	76.346	84.0139
4	VVB	64.6476	53.21	42.7882	64.1152	31.0215	48.8195	53.5614	64.7598	74.1615	58.3938	67.8086	46.8597
5	BVB	52.8889	73.2153	53.4526	48.9944	51.9094	50.2424	79.5194	77.5602	53.1906	59.3553	63.1073	60.1184
6	RAH	82.5485	74.1008	32.9242	39.6361	71.9299	22.9571	67.4588	76.909	70.9786	70.9625	73.1446	53.9584
7	HAR	60.9507	73.7667	68.3556	32.6689	56.6235	58.7624	52.5697	43.1775	46.4594	52.3878	28.8131	32.9674
8	FTR	57.1313	56.2359	45.5489	25.4505	32.4271	27.8132	67.9764	49.2432	52.3772	48.7329	51.7837	51.0781
9	SEY	24.0284	18.6489	59.8305	35.5458	40.7838	27.32	46.9496	54.4408	67.3311	78.3811	50.4467	61.9543
10	JHU	41.1896	40.2829	55.0595	62.2778	62.6026	42.2125	29.1842	20.6325	26.3347	39.828	26.9993	23.1898
11	KJU	70.1647	53.9442	80.1867	80.3229	62.1909	76.3796	41.703	38.2173	50.586	45.0711	46.9403	57.2507
12	GYU	39.7491	61.89	71.6347	64.3201	69.3927	50.0399	48.3429	55.1824	67.477	55.9418	55.2431	49.2907
13	MNN	42.4878	35.1012	33.4893	16.5849	34.7509	29.1109	63.5235	50.3969	45.9782	74.8477	70.1188	65.0876
14	ABH	47.1362	42.8378	35.2227	36.1049	40.9713	39.2986	58.235	30.7069	45.1255	47.9874	30.887	34.6423
15	SRS	47.7205	40.2461	55.9591	60.2647	57.089	25.8104	47.691	51.2234	26.7836	30.0645	31.4241	42.0938

16	NMN	57.2071	75.8665	70.8811	35.8923	32.6302	35.0128	53.0582	52.8347	67.6325	46.4401	47.4511	50.6877
17	PKU	16.8649	21.3726	27.1492	30.5141	15.9626	48.9934	57.9865	54.4849	38.1832	26.8763	27.5975	58.4644
18	PIN	46.6127	39.025	45.0696	38.5028	32.1845	30.7548	29.786	63.7805	33.7272	53.5377	66.2715	42.7244
19	RAC	15.908	44.3524	27.484	61.8228	31.7512	59.623	58.5819	74.5052	64.1128	65.2942	75.4245	52.5722
20	RAJ	57.7312	56.2481	65.9007	66.9707	62.9351	57.0776	79.4863	59.8316	57.9175	64.7505	72.4791	49.2951
21	RUB	81.5377	69.9526	48.63	75.2853	69.3293	54.3589	58.2177	62.7692	52.4804	64.5109	76.5153	82.3772
22	SAT	87.0878	69.2761	69.1454	56.6566	62.7816	53.4423	38.4612	32.0459	15.5351	22.0927	19.0883	23.1545
23	SHI	70.8842	58.7379	69.7645	56.6784	69.845	85.4882	76.8435	73.832	44.9094	48.5047	42.3546	55.1607
24	SPO	75.5782	73.562	76.1312	66.2854	66.832	75.4661	50.2072	56.8671	46.8315	67.5506	52.4492	47.874
25	SUR	40.0153	33.3691	35.2296	52.963	48.1086	52.9851	91.2395	82.7461	86.5597	85.9602	83.5908	83.4858
26	SWE	79.4241	53.0084	61.6111	56.218	53.2549	59.7928	43.2713	75.1119	85.3907	73.6306	84.7656	77.8392
27	TEJ	40.5849	48.0206	65.8626	61.7256	70.2906	60.6318	80.4996	70.0237	78.3206	77.7979	73.2388	83.035
28	VIV	66.979	63.8569	45.3896	45.8387	41.5037	37.6173	70.9155	60.7865	55.6974	49.7748	55.6069	43.7779
29	YAJ	78.7558	42.3525	32.4486	44.5589	64.9234	39.0101	48.9835	45.3796	58.1403	55.1507	46.3304	29.8325
30	THJ	84.8902	63.3552	81.7801	75.4824	85.6011	77.9659	59.6891	65.5395	62.8496	59.1389	45.431	67.5569
Mean		**56.2615**	**52.75279**	**53.33917**	**50.24683**	**51.81909**	**48.45165**	**58.42953**	**57.42334**	**54.84097**	**56.43019**	**55.05027**	**53.87145**
Std.dev		**19.88632**	**15.75993**	**15.98542**	**16.64801**	**16.27067**	**16.60887**	**15.89187**	**16.25007**	**18.67727**	**16.41247**	**19.71024**	**17.75383**

Table 23: LFHF Ratio recorded at pre, during and post following Experimental and Control sessions

Sl.No	Name	Trataka_LFHF Ratio						Eye exercise_LFHF Ratio					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	0.4522	1.5351	0.7848	1.1116	1.8509	1.4782	1.1415	2.1361	3.4332	2.1382	3.1871	2.5172
2	AHV	2.725	1.5291	1.1582	5.3828	1.0835	2.6606	0.6514	0.6878	0.7785	0.948	0.1627	0.292
3	BBV	0.6255	0.4673	1.4415	0.8953	0.9252	0.6973	0.0892	0.1283	0.0934	0.152	0.3091	0.1897
4	VVB	0.5466	0.8791	1.3365	0.5593	2.2223	1.0467	0.8666	0.5436	0.3481	0.7095	0.4736	1.1332
5	BVB	0.8906	0.365	0.8689	1.039	0.9257	0.9897	0.2572	0.2892	0.8784	0.6842	0.5838	0.6622
6	RAH	0.2083	0.3456	1.9701	1.5122	0.39	3.3549	0.4812	0.3001	0.408	0.4087	0.3668	0.8519
7	HAR	0.6395	0.3556	0.4621	2.0606	0.765	0.7012	0.902	1.314	1.1152	0.8941	2.4615	2.0278
8	FTR	0.7502	0.778	1.1952	2.9281	2.0834	2.5948	0.471	1.0304	0.9086	1.0513	0.9306	0.957
9	SEY	3.1602	4.3606	0.6708	1.8129	1.4518	2.6523	1.1298	0.8367	0.4851	0.2758	0.982	0.6137
10	JHU	1.4272	1.4814	0.8161	0.6049	0.5958	1.3686	2.4259	3.8464	2.796	1.5091	2.7028	3.3121
11	KJU	0.4218	0.8499	0.2444	0.244	0.6069	0.3077	1.3975	1.6162	0.9761	1.2183	1.1302	0.7452
12	GYU	1.5141	0.6157	0.396	0.5542	0.439	0.9967	1.0682	0.812	0.4814	0.7863	0.81	1.0281
13	MNN	1.3533	1.8484	1.9855	5.0282	1.8749	2.4346	0.5671	0.9811	1.1658	0.3212	0.4213	0.5298
14	ABH	1.1176	1.328	1.8355	1.7593	1.4389	1.5434	0.7141	2.2479	1.2153	1.0837	2.2367	1.8846
15	SRS	1.0952	1.4444	0.7868	0.659	0.7478	2.874	1.0935	0.9507	2.7294	2.3228	2.1694	1.3714

16	NMN	0.7475	0.3176	0.4101	1.7855	2.0643	1.8553	0.8841	0.8926	0.4782	1.1444	1.1066	0.9724
17	PKU	4.9285	3.6781	2.6821	2.2762	5.2634	1.0407	0.7235	0.8349	1.6182	2.7196	2.6229	0.7082
18	PIN	1.138	1.5623	1.2157	1.595	2.1063	2.2504	2.3546	0.5671	1.9649	0.8678	0.5085	1.3404
19	RAC	5.2831	1.2544	2.6362	0.6172	2.1493	0.6753	0.7052	0.3416	0.558	0.5308	0.3249	0.9021
20	RAJ	0.7318	0.7774	0.517	0.493	0.5883	0.7519	0.2484	0.6599	0.6898	0.543	0.3795	1.0254
21	RUB	0.2263	0.4291	1.0553	0.328	0.4418	0.8394	0.7157	0.5922	0.9027	0.5499	0.3062	0.2139
22	SAT	0.1466	0.429	0.4088	0.7434	0.5827	0.8705	1.5998	2.1176	5.4345	3.5238	4.2378	3.3174
23	SHI	0.4102	0.7022	0.4326	0.764	0.4308	0.1694	0.3012	0.3523	1.222	1.0601	1.3588	0.8118
24	SPO	0.3226	0.3587	0.3134	0.5085	0.4958	0.3251	0.9894	0.7577	1.1342	0.4794	0.9061	1.0885
25	SUR	1.4986	1.9937	1.8358	0.8877	1.078	0.886	0.0959	0.2083	0.1551	0.1624	0.1962	0.1975
26	SWE	0.2579	0.8689	0.617	0.7773	0.8765	0.6719	1.308	0.3298	0.1709	0.3574	0.1754	0.2807
27	TEJ	1.463	1.0806	0.5176	0.6194	0.4221	0.6491	0.2421	0.4243	0.2763	0.2849	0.3649	0.2036
28	VIV	0.4926	0.5616	1.2017	1.1811	1.4084	1.6578	0.41	0.6442	0.7948	1.009	0.7977	1.2836
29	YAJ	0.2663	1.3555	2.0746	1.2436	0.5342	1.5598	1.0408	1.2019	0.7187	0.813	1.1581	2.3516
30	THJ	0.1774	0.5778	0.2214	0.3244	0.1668	0.2822	0.6751	0.5193	0.5875	0.6862	1.1933	0.4675
Mean		**1.167257**	**1.13767**	**1.069723**	**1.34319**	**1.200327**	**1.339517**	**0.851667**	**0.938807**	**1.15061**	**0.974497**	**1.15215**	**1.10935**
Std.dev		**1.261761**	**0.913614**	**0.69455**	**1.212154**	**0.983405**	**0.859602**	**0.559088**	**0.772811**	**1.119267**	**0.767474**	**1.018276**	**0.841533**

Table 24: Heart rate recorded at pre, during and post following Experimental and Control sessions

Sl.No	Name	Trataka_HR						Eye Exercise_HR					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	66.2721	68.216	67.4998	69.3291	71.8889	73.8356	83.4566	85.7235	86.9692	81.6786	81.4624	81.5482
2	AHV	83.0128	83.4714	85.5105	85.1871	84.1627	84.5154	62.0097	65.043	64.8438	64.0353	61.2139	64.2038
3	BBV	68.1426	70.0598	68.16	67.7686	69.9625	70.8961	62.3955	61.288	62.1708	61.4303	60.7152	61.1024
4	VVB	97.3222	94.1675	90.8766	88.5454	88.0146	83.5961	80.4285	81.6642	79.6691	80.649	78.8186	81.6758
5	BVB	77.5625	73.8422	77.5836	75.4407	74.1774	79.2356	78.1378	77.8402	82.093	81.7397	75.857	83.1193
6	RAH	67.222	65.7095	67.0762	68.5793	63.6465	69.9851	85.847	83.6619	86.2573	84.8037	81.4285	83.4861
7	HAR	88.5612	87.3644	84.4487	86.5902	86.1222	81.2584	95.7597	95.175	96.6381	96.3953	91.6025	91.1762
8	FTR	118.9857	123.7797	127.8372	129.2965	130.0106	132.1545	68.6593	73.2471	72.1873	66.3044	66.0284	66.3991
9	SEY	78.4844	78.9753	76.281	75.8299	74.6705	71.377	73.8415	71.8181	71.9151	68.2822	69.5769	68.0595
10	JHU	86.996	87.5115	88.5912	85.9153	85.8884	88.8932	78.5189	79.6065	80.0455	81.3302	77.4586	77.1626
11	KJU	83.298	82.2032	80.0808	78.4564	77.9602	77.3204	72.1807	67.9352	68.3317	73.5224	74.9515	71.6806
12	GYU	76.9009	79.3088	75.578	73.1017	76.1324	77.1475	91.3209	91.5102	88.888	91.4248	85.9238	85.1643
13	MNN	100.1715	100.6346	102.483	102.4926	100.3022	99.9191	91.1953	87.4925	87.7387	86.7343	85.5156	86.3908
14	ABH	75.4732	75.7165	77.4766	77.4392	79.1515	77.165	86.9316	88.2682	89.5539	90.1472	86.4346	86.406
15	SRS	75.9451	77.0491	76.7856	76.6821	76.5061	76.2416	80.3993	81.9139	81.0591	80.6147	85.1841	80.4347

16	NMN	86.9185	87.2084	84.315	81.128	80.3323	81.3471	79.4303	78.2507	77.9957	76.7812	69.6102	70.4593
17	PKU	81.4315	86.1705	79.7773	82.6072	85.1651	78.3253	88.8583	85.9352	80.8876	78.9275	78.2669	86.0958
18	PIN	103.3908	101.2911	97.4723	96.2274	96.5309	96.8309	79.7502	77.5397	77.6573	75.0962	70.2438	71.1119
19	RAC	87.9276	88.8514	86.2591	84.7999	84.3719	84.2553	72.2101	68.5901	71.1271	72.1705	73.1511	79.4131
20	RAJ	73.9826	76.7794	77.0733	77.3687	79.9792	79.4283	100.9164	96.6875	95.3039	96.6627	92.3379	92.7504
21	RUB	80.2129	84.3312	78.3345	72.9823	72.7155	77.8471	79.0767	79.3045	76.7776	74.1141	73.3069	72.1402
22	SAT	96.2862	96.2265	95.3064	92.6373	91.0563	87.399	67.773	68.4062	70.2499	72.0309	67.3666	70.5777
23	SHI	73.7716	72.3381	72.1265	74.9585	74.7285	71.9953	75.4421	74.7452	78.0814	74.399	73.8361	74.0515
24	SPO	69.7255	68.9148	68.4386	70.3844	71.9505	70.8864	69.3965	71.0614	69.7606	67.3531	69.6337	65.7255
25	SUR	84.901	85.6397	85.6128	84.1927	82.1839	80.9854	65.0636	65.3987	62.1632	61.9789	61.7467	60.4593
26	SWE	77.9178	78.7986	78.0028	78.2482	79.5137	73.442	80.3862	81.228	80.2598	80.9822	80.2307	81.9508
27	TEJ	69.291	69.0435	67.4154	66.5368	67.457	69.0636	83.0753	83.035	83.2766	84.0344	85.4043	84.4887
28	VIV	72.8503	71.4435	67.6691	68.7702	69.6429	70.9505	83.2106	85.5602	81.3908	79.6153	80.4045	81.8021
29	YAJ	73.7663	76.1153	72.8765	71.0066	70.4162	71.8459	80.7919	78.3399	75.3243	76.439	76.0275	77.7787
30	THJ	78.2528	79.6539	78.2975	76.1822	76.3659	75.3124	73.9415	77.0248	79.8263	85.2184	81.3372	87.0414
Mean		**81.83255**	**82.36051**	**81.17486**	**80.62282**	**80.70022**	**80.4485**	**79.0135**	**78.77649**	**78.61476**	**78.16318**	**76.50252**	**77.46186**
Std.Dev		**11.77171**	**12.04075**	**12.54074**	**12.45533**	**12.30487**	**12.11776**	**9.264709**	**8.743726**	**8.646558**	**9.111335**	**8.406523**	**8.760306**

Table 25: Respiratory Rate recorded at pre, during and post following Experimental and Control sessions

Sl.No	Name	Trataka_RR						Eye exercise_RR					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	17.06	17.18	17.85	18.02	17.33	17.98	19.75	19.01	17.73	19.32	17.28	17.43
2	AHV	18.42	17.01	14.74	15.57	14.7	12.49	14.82	15.86	15.14	15.47	13.92	14.93
3	BBV	20.37	21.2	18.62	19.73	19.29	16.95	20.83	21.35	21.63	21.27	21.19	20.07
4	VVB	14.34	14.08	14.27	14.12	12.61	14.02	16.01	18.94	15.99	16.18	17.33	16.35
5	BVB	16.17	16.42	15.39	15.25	14.63	13.02	16.75	15.66	16.88	16.75	14.94	14.94
6	RAH	14.78	14.28	14.12	14.54	14.62	14.56	16.34	17.22	16.23	13.78	14.98	15.19
7	HAR	14.28	12.97	12.66	11.69	12.54	10.43	13.5	16.43	17.3	16.98	16.74	15.89
8	FTR	20.82	21.15	20.27	21.12	21.43	20.83	15.16	18.49	21.34	21.97	19.76	19.86
9	SEY	17.21	18.45	18.25	18.41	18.05	16.57	20.2	18.33	18.82	20.02	20.68	19.98
10	JHU	16.8	17.06	16.49	15.84	16.03	15.24	13.9	15.62	13.71	14.08	14.71	15.17
11	KJU	14.41	16.62	15.89	15.85	14	12.31	16.87	20.25	20.6	18.38	17.6	11.39
12	GYU	16.75	17.48	18.25	16.79	16.37	16.45	17.11	16.93	16.56	15.13	16.32	17.22
13	MNN	16.07	15.55	14.49	15.68	10.49	9.48	14.99	14.24	13.31	14.83	13.73	13.18
14	ABH	17.54	17.83	17.83	16.92	17.56	17.49	24.54	21.97	21.31	21.97	21.7	21.74
15	SRS	13.13	18.67	19.92	22.08	19.88	15.87	14.43	13.46	10.23	15.56	16.99	12.22

16	NMN	18.4	19.63	18.45	18.56	18.87	18.87	17.24	19.38	18.5	11.08	17.22	16.24
17	PKU	19.41	21.86	21.19	21.7	21.74	19.05	21.26	20.2	21.91	22.29	23.37	20.8
18	PIN	18.36	20.9	18.87	18.8	16.8	15.27	17.78	18.56	19.29	19.68	18.04	17.97
19	RAC	16.41	13.3	14.42	13.4	13.18	14.84	17.33	17.31	18.21	18.23	18.24	19.39
20	RAJ	15.93	18.66	17.85	18.75	17.07	16.52	19.76	24.04	33.24	42.92	36.25	26.36
21	RUB	11.38	14.4	12.04	11.96	12.81	10.21	14.47	14.76	15.75	18.04	14.99	16.98
22	SAT	13.67	17.57	16.57	16.59	17.13	15.31	14.05	18.62	19.69	17.02	17.59	15.07
23	SHI	16.93	17.76	17.09	17.69	18.62	18.16	4.1	7.68	11.68	14.76	14.14	13.76
24	SPO	18.69	18.9	18.21	17.08	17.6	16.46	13.98	16.76	21.93	22.63	15.53	14.84
25	SUR	14.62	15.34	14.79	14.56	13.96	11.92	19.35	19.44	19.76	19.75	19.07	19.26
26	SWE	22.1	21.21	21.2	20.2	19.68	19.05	15.52	17.53	18.93	19.66	18.63	17.93
27	TEJ	19.89	22.46	21.74	20	19.91	18.78	17.73	19.94	19.26	17.95	20.26	17.58
28	VIV	18.84	18.13	17.43	17.8	17.06	17.77	17.98	17.05	19.21	18.72	17.42	17.57
29	YAJ	19.5	20.44	18.23	16.98	17.48	17.09	13.36	16.62	18.89	14.84	14.88	15.34
30	THJ	19.23	21.34	19.47	20.37	20.37	18.83	20.79	20.22	22.31	19.71	20.82	16.73
Mean		**17.05033**	**17.92833**	**17.21967**	**17.20167**	**16.727**	**15.72733**	**16.66333**	**17.729**	**18.51133**	**18.63233**	**18.144**	**17.046**
Std.Dev		**2.46477**	**2.616016**	**2.48053**	**2.653186**	**2.819856**	**2.876237**	**3.568691**	**2.963745**	**4.058267**	**5.317375**	**4.17028**	**3.013715**

Table 26: Skin Conductance recorded at pre, during and post following Experimental and Control sessions

Sl.No	Name	Trataka_SC						Eye exercise_SC					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	2.23	2.65	2.76	2.82	2.78	2.26	1.49	1.96	1.92	2.03	2.01	2.06
2	AHV	4.65	6.1	6.54	6.77	6.85	6.91	0.4	0.77	0.99	1.22	1.33	1.39
3	BBV	2.28	3.38	3.38	3.23	2.66	1.19	1.41	1.59	1.45	1.35	1.13	0.62
4	VVB	1.09	1.49	1.84	2.1	2.09	2.05	1.62	2.41	2.91	3.42	3.99	4.28
5	BVB	0.7	1.73	2.08	2	1.77	1.36	1.98	3.54	4.48	5.05	5.48	5.87
6	RAH	2.01	2.56	2.68	2.89	3.1	3.18	3.3	2.52	3.38	3.95	3.36	2.24
7	HAR	1.39	2.54	2.63	2.95	2.63	2.85	1.84	2.08	2.05	1.93	1.93	1.86
8	FTR	0.87	0.56	0.3	0.28	0.11	0	0.51	0.87	0.97	1.18	1.14	1.18
9	SEY	1.54	2.58	2.9	3.03	3.16	3.27	0.79	0.98	0.12	1.2	0.11	4.22
10	JHU	2.65	4.01	4.71	5.19	5.52	5.8	1.41	2.15	2.74	1.35	1.13	1.11
11	KJU	2.46	4.72	4.97	4.1	4.37	4.95	1.64	1.47	3.86	3.24	2.73	2.89
12	GYU	3.18	3.47	3.49	3.56	3.55	3.59	2.57	3.02	3.18	3.15	3.26	3.38
13	MNN	4.45	5.37	5.88	6.26	6.75	6.93	1.1	1.71	1.65	1.65	1.5	1.54
14	ABH	5.51	5.42	6.8	7.09	7.34	7.5	3.97	3.62	3.6	3.5	3.38	3.34
15	SRS	0.38	1.69	1.55	1.23	1.92	1.29	1.79	2.21	2.29	2.19	2.1	2.11

16	NMN	0.35	0.43	0.47	0.5	0.55	0.44	0.42	0.44	0.44	0.57	0.74	0.86
17	PKU	3.47	3.75	3.8	3.77	3.73	3.72	2.36	2.65	2.78	3.04	3.19	3.28
18	PIN	5.56	6.06	3.38	5.47	0.03	1.14	2.59	4.86	4.1	4.38	3.81	3.74
19	RAC	1.11	3.21	3.57	4.19	4.32	4.5	0.83	0.67	0.32	0.12	0.29	0.74
20	RAJ	3.9	4.87	5.65	6.3	7.75	9.37	0.73	1.13	1.88	2.17	0.75	3.17
21	RUB	3.33	4.74	0.53	0.96	1.09	0.07	1.42	1.72	1.97	2.21	2.79	3.75
22	SAT	2.34	3.11	3.04	2.84	3.12	2.98	3.43	4.03	4.16	4.21	4.04	4.09
23	SHI	1.58	2.34	2.56	2.59	2.54	2.56	2.99	4.68	4.72	4.97	4.74	4.2
24	SPO	0.14	0.26	0.44	0.63	0.95	1.07	0.49	0.8	0.12	0.04	3.08	3.77
25	SUR	1.77	2.75	3.13	3.18	3.38	3.45	2.5	2.57	2.29	2.2	2.33	2.48
26	SWE	2.5	2.95	3.37	3.72	3.85	3.95	2.97	5.08	4.92	4.31	3.11	1.86
27	TEJ	0.84	1	1.28	1.57	1.71	1.74	0.26	2.1	2.89	3.28	3.37	3.33
28	VIV	2.51	0.88	0.23	1.94	0.92	0.63	0.37	0.51	0.97	0.39	3.81	7.79
29	YAJ	0.59	0.12	0.06	0.32	0.4	0.44	0.5	0.81	0.73	0.84	0.63	0.35
30	THJ	0.54	1.05	1.14	1.21	1.28	1.22	2	2.48	2.41	2.35	2.41	2.32
Mean		**2.197333**	**2.859667**	**2.838667**	**3.089667**	**3.007333**	**3.013667**	**1.656**	**2.181**	**2.343**	**2.383**	**2.455667**	**2.794**
Std.Dev		**1.492713**	**1.720604**	**1.860437**	**1.909774**	**2.103635**	**2.354637**	**1.023444**	**1.291008**	**1.385388**	**1.411626**	**1.354259**	**1.606463**

Table 27: SDNN recorded at pre, during and post following Experimental and control sessions

Sl.No	Name	Trataka_SDNN						Eye exercise_SDNN					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	49.9885	57.7357	43.4338	59.2322	67.8454	61.4166	41.9202	26.6694	30.6954	31.1965	36.3312	36.9379
2	AHV	42.0351	37.0061	38.7574	50.2923	67.9575	54.7839	59.8019	76.6923	67.6053	58.4153	61.7506	67.3355
3	BBV	57.856	58.4481	58.1727	51.097	59.7052	55.8944	83.2468	84.7158	88.7286	81.8928	90.9125	85.077
4	VVB	34.282	45.6493	43.9698	54.8463	68.1917	69.5884	37.7512	32.179	27.1308	35.0011	39.1955	41.0659
5	BVB	55.6672	57.9209	51.7308	62.2163	69.5619	54.6972	52.9608	61.3749	51.2361	57.632	71.5503	78.9844
6	RAH	38.83	45.9518	50.3837	64.8705	49.33	92.495	47.5	47.2864	39.6637	43.7659	55.5184	62.2676
7	HAR	50.5038	40.7514	52.346	46.7618	44.5622	68.2165	19.2371	18.9364	18.5975	18.8599	28.8517	35.0727
8	FTR	18.5204	17.4424	17.7691	17.7764	23.2591	26.5883	81.7979	70.0493	80.7438	104.5029	113.8268	123.7387
9	SEY	31.8914	31.8684	27.4676	31.5377	41.8071	48.508	53.9369	66.9236	56.6811	72.4855	70.9124	68.0108
10	JHU	40.4873	26.9153	28.0883	28.1878	33.5229	44.9242	26.8532	34.2627	26.8393	29.0741	30.9862	36.536
11	KJU	81.0281	75.4051	70.1479	85.6489	94.2998	104.4819	60.2568	75.4143	64.8817	73.8865	70.8865	72.6868
12	GYU	98.7517	73.5833	81.7543	86.31	82.5425	98.374	31.8166	31.0539	36.6588	24.3123	41.0296	44.2937
13	MNN	31.7883	21.9826	27.2633	33.6721	32.304	35.8366	46.3502	67.9596	57.6741	66.7311	68.7282	68.4622
14	ABH	57.6865	55.2956	46.6791	55.5795	58.7807	73.005	60.433	33.068	41.9311	44.874	40.3209	38.9708
15	SRS	32.1418	32.7214	30.0018	35.0345	56.2834	43.8068	56.7772	59.3304	57.637	69.7002	53.54	59.6617

16	NMN	21.1811	19.6967	35.3454	45.2964	42.4956	51.1161	28.6163	26.5897	29.6644	40.904	67.0107	89.4199
17	PKU	68.585	78.3154	72.6137	73.0929	69.7418	74.8154	28.2442	28.1874	44.5577	51.5556	50.2526	37.5118
18	PIN	37.4286	22.0108	32.974	34.0837	47.6632	51.7248	48.6649	43.3354	42.9013	48.8049	50.8302	68.3079
19	RAC	39.4491	32.3327	40.841	36.779	38.9301	34.7817	59.0969	64.4045	56.2922	70.0109	73.5205	55.0291
20	RAJ	44.6216	49.2942	46.3888	48.5148	46.5833	53.2901	23.8505	31.6757	34.0515	26.7231	47.2668	55.2566
21	RUB	48.5318	44.6331	64.8974	57.8887	81.1364	70.3174	66.5275	53.5417	71.4426	44.9052	38.2936	58.0028
22	SAT	28.2421	23.3383	23.9982	28.5445	36.1695	49.5805	84.5832	80.2698	78.4695	77.8739	74.1435	82.1729
23	SHI	50.1397	53.7455	54.2021	55.508	53.1439	60.9582	45.7924	42.9521	46.9833	70.1913	65.5824	71.2184
24	SPO	49.3547	53.2113	57.9434	63.5385	67.7157	63.234	48.6895	49.5427	56.9729	65.1353	69.7129	87.1195
25	SUR	45.4677	49.1725	39.8743	42.3602	41.5729	45.79	79.2496	80.2604	81.3359	78.4844	93.1539	87.2601
26	SWE	41.2947	37.6752	38.2492	49.803	50.6779	69.1854	34.7909	28.5767	32.116	30.4583	33.4676	37.6435
27	TEJ	45.5754	52.6358	49.7082	48.4453	62.0748	56.3239	40.1841	48.8647	41.2168	44.283	50.1264	44.9904
28	VIV	33.0352	52.411	54.8111	53.9474	61.9157	58.7736	45.2322	38.5736	54.1785	55.6884	60.1819	77.1517
29	YAJ	40.2214	49.5975	53.7311	59.0391	56.9793	64.9918	46.8567	47.2929	49.3411	57.3437	61.5924	56.5873
30	THJ	72.2045	72.6661	70.5192	76.0329	68.8015	101.2339	69.8818	55.7844	100.1168	102.1892	67.4246	87.1994
Mean		**46.22636**	**45.64712**	**46.80209**	**51.19792**	**55.85183**	**61.29112**	**50.36335**	**50.19226**	**52.21149**	**55.89604**	**59.23003**	**63.7991**
Std.Dev		**16.83571**	**16.74252**	**15.42065**	**16.30083**	**16.11213**	**18.69261**	**17.64376**	**18.84572**	**19.82029**	**21.62841**	**19.34564**	**20.88394**

Table 28: RMSSD recorded at pre, during and post following Experimental and control sessions

Sl.No	Name	Trataka_RMSSD						Eye exercise_RMSSD					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	50.1099	48.462	45.5399	50.7357	53.6801	48.0444	19.8944	15.3049	15.4643	20.2581	22.47	21.4082
2	AHV	29.8449	27.721	27.3679	28.0522	34.1679	36.2044	69.61	65.8551	62.8334	64.6454	78.7709	65.2925
3	BBV	59.9306	57.3797	51.3317	50.2544	52.7709	50.2171	109.1501	111.6738	114.0503	108.3593	107.9805	107.9884
4	VVB	24.3005	29.9794	33.0912	43.6893	50.4138	61.7467	36.1738	31.7862	33.3335	32.6773	40.16	31.9437
5	BVB	44.816	57.2629	50.6037	53.1525	61.9079	44.4235	56.1768	59.4671	42.8074	48.6974	68.0531	70.2684
6	RAH	54.0553	55.1426	48.361	48.9275	62.5847	63.7836	35.4266	47.44	34.64	39.1886	50.0634	44.2658
7	HAR	38.8262	38.275	47.0045	36.3239	35.7108	51.9925	12.8661	14.002	11.9659	12.4927	20.6954	26.3271
8	FTR	8.246	7.2371	6.4095	7.0325	9.7823	11.0192	75.8148	56.9115	71.104	85.4558	98.6359	104.3547
9	SEY	23.4387	20.9039	21.6513	23.9632	27.7523	35.658	36.6659	43.1092	43.4346	54.416	51.965	55.095
10	JHU	25.2874	19.2504	18.6501	21.4793	20.3901	18.7161	17.5069	19.8427	18.5461	15.5547	20.4926	21.4195
11	KJU	94.4565	90.3626	88.6244	105.1007	117.8422	135.671	50.1807	62.0515	61.0931	52.2917	49.0332	57.9252
12	GYU	82.4904	63.6587	79.177	92.5927	79.5698	86.7827	22.2887	21.1883	26.4461	17.2902	32.7882	33.6452
13	MNN	14.8128	12.0898	12.9095	15.3277	15.0166	13.2214	45.4397	74.6448	58.6479	74.7632	85.3877	75.752
14	ABH	46.8647	45.6028	39.4126	38.5496	40.2731	45.4074	52.3756	22.2449	22.7385	24.4507	23.2224	22.729
15	SRS	26.4932	25.6704	26.256	26.4422	28.4331	25.8227	50.6848	45.8887	47.3193	50.4987	44.189	52.9132

16	NMN	19.8362	18.4024	23.4087	28.7307	28.6053	29.0129	23.2134	23.8606	27.449	28.8002	56.316	57.9672
17	PKU	34.397	45.8125	44.8632	37.0943	52.4889	35.8223	19.3329	19.6998	28.2153	33.652	34.8755	23.4602
18	PIN	36.9973	13.7923	20.2576	23.8243	26.4369	27.058	33.0846	34.1031	32.1119	39.3207	49.0607	49.0201
19	RAC	22.5298	17.1253	23.0639	24.2372	21.5767	24.5621	55.5987	63.9956	57.2267	54.8917	54.4943	43.9043
20	RAJ	43.5619	40.5878	40.3206	39.8205	35.3612	35.8531	17.4206	29.7554	32.8551	27.0828	45.614	47.1536
21	RUB	42.9194	35.5192	48.671	54.1547	54.6214	47.7224	78.6456	50.8868	56.9692	38.9627	37.4427	51.4795
22	SAT	25.2685	22.6875	25.3928	30.054	38.0919	47.6113	59.2204	52.3108	53.4173	49.8221	49.8703	49.2718
23	SHI	53.5904	56.2256	53.9087	51.29	47.8658	53.8373	52.9759	50.1356	45.6604	61.7751	68.0899	66.7508
24	SPO	45.4651	49.783	54.7623	53.6281	58.5278	56.9897	42.8527	43.9538	49.1117	55.6142	49.6408	74.8391
25	SUR	35.076	36.1691	29.8994	34.7701	42.487	45.2484	92.9837	92.3315	97.2254	97.8013	105.2611	109.5505
26	SWE	43.5176	38.4373	40.9138	42.763	41.148	73.2854	30.6392	29.9333	34.7135	32.9241	36.0143	35.3904
27	TEJ	39.5027	43.2517	47.0109	49.4528	54.3844	53.4486	41.6056	44.2454	42.6797	42.4557	41.8949	42.5252
28	VIV	29.9808	61.1215	44.2156	41.4578	41.5246	58.4589	41.1936	35.1033	54.8075	49.0513	52.9961	80.6184
29	YAJ	34.2055	42.0576	42.7354	44.8238	52.792	43.3935	37.3591	45.0206	47.0601	48.144	49.2083	45.0586
30	THJ	67.8356	67.0885	62.811	71.5681	65.748	100.5753	66.9978	57.298	132.0508	140.5979	80.1802	120.7646
Mean		**39.95523**	**39.56865**	**39.95417**	**42.30976**	**45.06518**	**48.71966**	**46.11262**	**45.46814**	**48.5326**	**50.06452**	**53.49555**	**56.30274**
Std.Dev		**18.57928**	**18.91321**	**17.99447**	**20.30849**	**20.86379**	**25.29951**	**22.85706**	**22.18959**	**26.70759**	**28.0787**	**23.40383**	**26.82955**

Table 29: pNN50 recorded at pre, during and post following Experimental and control sessions

Sl.No	Name	Trataka_ pNN50						Eye exercise_pNN50					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	28.9634	26.2537	26.4881	32.2674	32.0225	32.2404	1.4493	0.2342	0.4619	1.9656	2.963	2.4691
2	AHV	8.5158	7.2289	5.6338	8.5106	14.1827	15.9905	57.9805	51.5528	45.9627	51.2579	62.8289	51.7241
3	BBV	45.4006	46.2644	36.6864	35.7143	38.9049	34.0909	75.57	78.5479	81.4935	77.5578	70.903	75.8278
4	VVB	4.7521	7.7088	12.8603	23.4624	18.6207	30.9179	16.2907	10.8374	12.1212	9.7257	19.898	10.5911
5	BVB	27.6042	44.2623	36.3636	38.7701	44.6866	26.972	42.3773	43.2642	25.7985	26.6667	46.4	26.5207
6	RAH	47.1471	42.2018	35.7357	30.8824	50.9494	40.1163	14.5882	30.5288	14.6853	21.1401	33.995	26.8116
7	HAR	19.3622	19.0805	31.9809	18.0974	16.8224	33.8308	0	0.6329	0	0.2079	1.5351	5.0773
8	FTR	0	0	0	0	0.3091	0.4566	56.8047	38.843	44.8179	49.6933	55.5556	55.6923
9	SEY	3.0848	2.2901	0.7895	4.2328	6.1995	10.986	16.9863	23.8764	21.6292	35.503	34.2029	37.9822
10	JHU	5.3364	1.3761	1.8141	1.8692	1.8735	0.6787	0.7692	1.7677	1.0025	0	0.7772	2.0833
11	KJU	36.7397	42.9975	45.0882	49.6124	50	53.4211	40.3361	50.2976	47.6331	36.9146	33.7838	42.8169
12	GYU	45.3581	43.6224	54.1555	55.1247	50.7979	50.6596	2.6432	1.7544	5.6561	0.6579	12.4122	12.2931
13	MNN	0.8048	0	0.1957	1.1765	0.8016	0	17.4779	28.8684	29.4253	27.5058	33.5697	27.8037
14	ABH	28.9544	30.4	21.6146	20.7792	22.3919	26.5092	4.4289	2.5057	3.1461	5.3571	4.186	3.0303
15	SRS	3.7135	3.125	3.4031	3.9267	7.1053	4.7493	35.1759	32.0197	31.3433	35.8396	29.078	40.1003

16	NMN	0.2315	0	1.6706	7.4442	5.75	7.6733	1.5228	1.5385	5.1546	7.8534	42.3188	35.1585
17	PKU	13.4328	17.8824	22.5316	15.4412	9.5012	15.0259	0.4525	0.4673	6.9825	14.2857	15.4242	2.5701
18	PIN	1.7544	0.1984	2.4742	4.3933	6.4718	7.2917	13.6709	13.4715	12.9534	19.8391	36.9628	34.2776
19	RAC	2.0642	1.1312	2.5701	2.8436	2.381	5	46.7787	53.5294	44.1926	44.2577	41.4365	26.3959
20	RAJ	27.5204	23.3596	25.8486	20.3125	15.8291	15.1899	0.3992	8.316	10.9705	7.0686	22.4891	20.6972
21	RUB	25.6281	15.9905	33.7629	42.5414	38.0556	29.0909	31.9693	32.9949	42.2164	16.8478	17.5342	34.6369
22	SAT	6.4854	3.125	4.6316	9.9783	16.2996	28.4065	38.3234	33.1361	35.0575	31.4607	30.6306	32.1839
23	SHI	40.274	42.8969	40.5028	36.2903	30.9973	43.1373	42.5134	34.7709	23.4536	44.5652	50	46.3215
24	SPO	28.9855	35.9649	46.0177	37.8223	48.8764	49.4318	22.9651	28.0453	31.2139	38.024	28.4884	50
25	SUR	15.9145	10.3286	6.338	14.5585	25.9169	26.8657	70.405	70.679	71.987	69.7068	69.1803	65.8863
26	SWE	24.8705	19.6429	24.7423	26.2211	22.2785	51.9231	8.7719	6.6667	13.7845	12.1588	15.25	14.7059
27	TEJ	18.314	22.1574	28.9552	33.8369	40.4192	35.6725	25.9709	23.7288	24.6377	22.7818	22.4057	23.1504
28	VIV	8.2873	9.2958	17.2619	19.3548	19.3642	15.3409	24.5146	14.5882	29.4554	30.1266	38.3459	35.8911
29	YAJ	12.0219	23.2804	22.1607	29.2614	39.7143	22.191	17.75	28.4615	32.0856	32.7177	34.0426	27.5325
30	THJ	46.8912	37.5635	41.3437	45.8886	45.6233	51.4905	27.3973	14.3603	12.6904	15.2745	10.9453	9.7902
Mean		**19.28043**	**19.32097**	**21.12071**	**22.35382**	**24.10488**	**25.51168**	**25.20944**	**25.34285**	**25.40041**	**26.23205**	**30.58476**	**29.33406**
Std.Dev		**15.52016**	**16.15347**	**16.36325**	**15.78502**	**16.859**	**16.58968**	**21.27112**	**20.89191**	**19.96047**	**19.60362**	**18.80998**	**18.938**

Table 30: SD1 recorded at pre, during and post following Experimental and control sessions

Sl.No	Name	Trataka_SD1						Eye exercise_SD1					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	21.1294	19.62536	19.37487	19.85953	24.18949	25.63107	14.08446	10.83498	10.94769	14.34234	15.90928	15.15666
2	AHV	42.44148	40.63202	36.35212	35.58822	37.36852	35.55965	49.3025	46.63993	44.49934	45.78444	55.79131	46.2428
3	BBV	17.20087	21.22139	23.42528	30.92868	35.68897	43.71436	77.30697	79.097	80.777	76.74833	76.48774	76.48707
4	VVB	31.7324	40.54669	35.82898	37.63487	43.83525	31.45251	25.61104	22.50401	23.60025	23.13521	28.43387	22.61575
5	BVB	38.28043	39.05216	34.24798	34.64798	44.3243	45.16749	39.77471	42.10434	30.30669	34.47715	48.18541	49.75087
6	RAH	27.4865	27.09595	33.27716	25.71491	25.28179	36.81023	25.08018	33.58555	24.52279	27.74354	35.44443	31.33864
7	HAR	5.835702	5.121755	4.535868	4.976654	6.922461	7.797736	9.10727	9.911394	8.469985	8.842988	14.65006	18.63671
8	FTR	16.59519	14.8002	15.32999	16.967	19.65147	25.24	53.69071	40.29993	50.34873	60.51935	69.85578	73.90373
9	SEY	17.90166	13.62779	13.20256	15.2067	14.43491	13.24949	25.96281	30.52578	30.75664	38.53523	36.79835	39.01602
10	JHU	66.87235	63.97464	62.74615	74.41379	83.43575	96.06053	12.39523	14.04866	13.13058	11.01271	14.50978	15.16564
11	KJU	58.40777	45.07118	56.06181	65.56382	56.33984	61.44609	35.53315	43.94276	43.26344	37.02941	34.72206	41.01721
12	GYU	10.48521	8.557339	9.137458	10.84911	10.62904	9.358394	15.77788	14.99899	18.72143	12.23944	23.21198	23.81898
13	MNN	33.18564	32.28918	27.90653	27.29412	28.51433	32.1501	32.16641	52.84293	41.51838	52.92739	60.44978	53.62749
14	ABH	18.75858	18.17563	18.59018	18.72244	20.13177	18.28356	51.25039	40.2856	41.31775	58.52979	64.8452	50.27755
15	SRS	14.04268	13.02748	16.57223	20.34106	20.25288	20.54132	37.07838	15.74807	16.09677	17.30866	16.43997	16.0906

16	NMN	24.3528	32.43264	31.76332	26.26188	37.15944	25.36388	35.88504	32.48838	33.50185	35.75327	31.28333	37.46225
17	PKU	26.18662	9.762335	14.33978	16.86432	18.71327	19.15289	16.43537	16.89404	19.43539	20.3917	39.87971	41.04874
18	PIN	15.94944	12.1232	16.33153	17.15898	15.27537	17.3892	13.68589	13.94633	19.97645	23.82824	24.69506	16.60912
19	RAC	30.8454	28.73772	28.5483	28.19407	25.03567	25.38453	23.42403	24.14586	22.73601	27.84131	34.74096	34.7119
20	RAJ	30.38726	25.14589	34.46006	38.34635	38.67742	33.78977	39.36939	45.31953	40.52329	38.86886	38.58664	31.08508
21	RUB	17.88626	16.0592	17.97445	21.27451	26.96521	33.70521	12.33065	21.06227	23.25658	19.17038	32.28951	33.37912
22	SAT	37.94818	39.81302	38.17282	36.3167	33.89226	38.12232	55.68234	36.0282	40.33653	27.58932	26.51239	36.45248
23	SHI	32.19633	35.25468	38.78008	37.97645	41.44487	40.35531	41.93915	37.04416	37.82742	35.27916	35.31701	34.89087
24	SPO	31.19886	37.80823	42.87881	41.75638	45.90954	52.99099	37.50987	35.49909	32.32848	43.74128	48.21326	47.26575
25	SUR	24.83224	25.60558	21.16694	24.61573	30.07967	32.0355	30.34563	31.12481	34.77793	39.38642	35.15263	53.00215
26	SWE	30.8116	27.21426	28.96786	30.2772	29.13318	51.89237	65.85292	65.39081	68.86242	69.26919	74.55339	77.59378
27	TEJ	27.97398	30.62869	33.29192	35.02189	38.5165	37.84977	21.69273	21.1925	24.57726	23.30987	25.4979	25.05571
28	VIV	21.22948	43.28051	31.3129	29.36013	29.40604	41.39577	29.45568	31.32447	30.21574	30.057	29.65933	30.10583
29	YAJ	24.22018	29.77865	30.26042	31.74231	37.38414	30.72809	29.16427	24.85134	38.80516	34.72861	37.52183	57.07654
30	THJ	48.03141	47.49935	44.47175	50.67427	46.55265	71.21441	26.44999	31.87529	33.32176	34.08839	34.84201	31.90297
Mean		**28.14686**	**28.13209**	**28.64367**	**30.15167**	**32.17153**	**35.12775**	**32.77817**	**32.18523**	**32.62532**	**34.08263**	**38.14933**	**38.69293**
Std.Dev		**13.10026**	**13.46175**	**12.99251**	**14.49902**	**14.94966**	**18.21877**	**16.31896**	**15.71131**	**15.48521**	**16.56353**	**16.94321**	**17.14266**

Table 31: SD2 recorded at pre, during and post following Experimental and Control sessions

Sl.No	Name	Trataka_SD2						Eye exercise_SD2					
		Pre	D1	D2	D3	D4	Post	Pre	D1	D2	D3	D4	Post
1	ASV	55.6157	48.57328	51.27103	68.36503	93.09764	73.19598	57.63334	36.147	42.02295	41.7612	48.70465	49.99486
2	AHV	69.82274	72.11195	73.2307	62.99324	75.79601	70.62571	68.77539	97.89856	84.71063	68.65822	67.31292	83.14688
3	BBV	45.36741	60.87335	57.53776	70.6087	89.70731	88.28927	88.73583	89.50271	96.27708	86.30562	102.2672	92.73714
4	VVB	71.77397	71.22881	63.74981	79.61249	88.19291	70.69692	46.86577	39.55544	30.23576	43.75961	47.59442	53.3438
5	BVB	39.44981	51.89481	62.5784	85.02533	53.71192	122.9353	63.50661	75.85213	65.86888	73.90975	89.06783	99.53733
6	RAH	65.84923	50.85422	66.16672	60.96928	57.59878	89.21316	62.35742	57.4758	50.51027	55.32899	70.04258	82.3391
7	HAR	25.55556	24.10856	24.72246	24.64978	32.14933	36.79901	25.64539	24.90587	24.81635	25.04758	38.08269	45.98276
8	FTR	41.96369	42.59103	35.69992	41.27479	55.62222	63.8888	101.621	90.28942	102.595	135.0217	145.0068	158.8763
9	SEY	54.41953	35.53585	37.5088	36.76576	45.13413	62.17749	71.7581	89.22144	74.03659	95.11555	93.16978	88.06457
10	JHU	93.10689	85.39526	76.93038	95.71893	104.2562	112.417	35.90536	46.4051	35.65524	39.57855	41.29264	49.40991
11	KJU	126.906	93.91207	101.1669	103.119	102.0423	124.8811	77.54225	97.20503	81.03163	97.48073	93.717	93.87002
12	GYU	43.69077	29.91023	37.37648	46.39152	44.35852	49.85972	42.1599	41.30349	48.35209	32.14627	53.22431	58.00769
13	MNN	74.13335	71.31648	59.59353	73.35584	78.02061	98.06483	57.14656	80.36823	70.23515	78.24051	76.16353	80.72265
14	ABH	41.4485	42.51369	38.00425	45.7922	77.11345	59.27494	129.5049	92.76366	92.75592	149.0211	150.3122	141.5495
15	SRS	26.40446	24.54148	47.21506	60.54301	56.58051	69.30601	77.11336	43.9268	57.12447	61.10629	54.65572	52.77864

16	NMN	93.97299	105.7718	97.60547	100.037	91.48043	102.7673	71.75811	77.34112	74.33536	91.91223	68.69536	75.6147
17	PKU	46.04792	29.5804	44.2812	45.12307	64.78187	70.67584	37.00594	33.58059	36.97398	54.15095	86.02169	119.7049
18	PIN	53.49841	44.06271	54.98005	49.11559	52.84568	45.9937	37.531	37.36494	59.8016	68.65724	66.33346	50.16114
19	RAC	55.0684	63.38266	59.15772	62.41874	60.95411	71.00567	64.78732	56.39725	56.25197	63.15195	63.03166	90.25351
20	RAJ	61.52768	57.96488	85.1873	72.23416	108.1329	93.51745	73.83863	78.8975	68.16805	91.15626	96.64649	71.22826
21	RUB	35.74918	28.87145	28.79403	34.25713	43.3659	61.53181	31.3976	39.48943	42.21	32.60915	58.46659	70.59146
22	SAT	59.47284	64.82579	66.53194	69.51798	67.11844	76.98475	75.8681	66.70039	92.67968	57.05582	47.22404	73.59674
23	SHI	61.86212	66.2743	72.31785	81.35613	86.26631	79.82104	112.0639	107.4202	104.2524	104.3586	98.8361	110.9588
24	SPO	80.38908	81.74099	81.23085	70.20812	75.75084	115.6988	52.87686	49.35718	58.04009	89.21733	79.26721	88.73999
25	SUR	59.3419	64.64782	52.32176	54.6594	50.53511	56.33121	61.52638	62.41056	72.60744	82.92422	91.94494	111.2216
26	SWE	49.67656	45.80637	45.57768	63.60946	65.47626	82.87023	90.45346	92.59792	91.96568	86.87985	108.8287	96.09432
27	TEJ	58.04503	67.89328	61.92101	58.37219	78.50013	70.12434	44.13057	34.3986	38.17642	36.25965	39.82126	46.93542
28	VIV	41.38017	60.27841	70.26231	70.08028	82.46197	71.6351	48.58337	61.62086	49.89392	54.98043	64.44834	56.13542
29	YAJ	51.48831	63.60729	69.81635	77.057	71.0998	86.61761	56.88818	48.54472	65.47905	70.74954	76.34235	93.02688
30	THJ	89.76864	91.01454	89.32006	94.8416	85.08821	124.3233	60.74199	58.74391	61.2813	73.39867	79.92282	73.30407
Mean		**59.09323**	**58.03613**	**60.40193**	**65.26909**	**71.24133**	**80.05078**	**64.19075**	**63.58953**	**64.27817**	**71.33145**	**76.54818**	**81.93095**
Std.Dev		**21.44425**	**20.87555**	**19.20518**	**19.38547**	**19.37325**	**23.02122**	**23.45267**	**23.38157**	**21.81049**	**28.56944**	**27.27839**	**27.4392**

Table 32: Simple Visual Reaction Time task at Baseline, Following Experimental and Control Sessions

Sl.No	Name	Trataka		Eye exercise	
		Pre	Post	Pre	Post
1	ASV	416	387	465	426
2	AHV	273	253	415	339
3	BBV	421	287	314	301
4	VVB	278	284	330	322
5	BVB	278	245	256	238
6	RAH	347	274	285	244
7	HAR	325	291	287	283
8	FTR	263	257	286	364
9	SEY	300	276	277	306
10	JHU	277	265	268	261
11	KJU	263	245	271	275
12	GYU	318	293	311	292
13	MNN	266	293	257	271
14	ABH	321	280	261	252
15	SRS	263	263	274	275
16	NMN	277	250	245	312
17	PKU	313	284	482	493
18	PIN	319	303	261	289
19	RAC	284	227	267	229
20	RAJ	309	273	364	308
21	RUB	426	291	293	317
22	SAT	311	292	299	306

23	SHI	349	313	314	320
24	SPO	304	252	285	221
25	SUR	303	292	301	268
26	SWE	314	250	332	251
27	TEJ	308	266	292	310
28	VIV	274	278	319	292
29	YAJ	293	285	287	274
30	THJ	351	334	342	311
Mean		**311.47**	**279.43**	**308.00**	**298.33**
Std.Dev		**44.21**	**29.92**	**56.40**	**54.51**

Appendix 6

Data of Visual Strain & Psychological Variables

Table 33: MWQ at baseline and following trataka and eye exercise group

	Experimental group			Control group		
Sl.No	**Subject Code**	**PRE**	**POST**	**Subject Code**	**PRE**	**POST**
1	HJK	1.8	1.4	KKS	2.2	2.8
2	BJL	4.8	2.4	SPK	4.8	3.6
3	NMK	2.6	1.4	LDM	1.8	2.8
4	PGG	2.6	1.6	BJU	2.2	2.2
5	YHP	2.6	2.2	SJH	3	2.2
6	GUC	1.6	1.6	OPK	5.2	4
7	FUB	4.2	3.6	ANI	3.2	2.2
8	QKO	2.4	2.8	GAU	4	4.2
9	FKP	4.2	2.6	THU	2.8	1.8
10	HLB	2.2	1.6	HEM	4.2	4
11	FDN	4	2.8	IHY	4	3.2
12	RPJ	5.2	3.6	THK	1.6	1.4
13	XUP	3.2	2.6	FGH	4.2	4.6
14	FWU	3.8	2.8	KJU	2.6	2.4
15	DSR	1.6	1.4	HNB	3	1.8
16	WPM	3.4	1.6	KOP	3.4	3.2
17	APJ	2.4	1.8	DDT	3	3.2
18	DSY	1.4	1.2	RTH	2	2
19	CHP	1.6	1.2	SER	3.8	2.8
20	KQP	2.8	2.2	TGH	3	2.4
21	APG	4	3	XRR	2	1.6

22	CYF	3	1	FSE	2	2.2
23	FLP	3	2.2	TGW	3.2	3.4
24	MAF	2	1.4	YUP	1.6	1.4
25	RTU	3	2	RET	2.4	2.4
26	VSD	3	1.4	TES	2.6	2.4
27	PLH	3	2.4	NBY	2.2	2
28	CUH	3.8	1.8	WET	1.4	2
29	BUC	3	1.4	IGF	4.4	4.8
30	MUI	4	2.8	LMJ	2	1.8
31	CYL	3	3.8	UHB	3.2	2.8
32	SPP	2	1.4	QUJ	3.4	3.2
33	PGH	2	1.2	OLP	2	2
34	VYJ	1.6	1.2	EYH	1.8	2
35	LPI	2.2	1.8	GUN	1.6	1.2
36	WUI	3.2	1.4	CMN	2.2	2.2
37	ONG	1.6	1.4	TYU	2.6	2
38	DLG	2.2	1.4	UPL	2.8	2.8
39	BPC	2.2	1.8	FIL	2.4	1
40	APH	2.2	1.6	SWY	1	1
41	CUM	2.4	1.4	DRD	1.2	1
42	WON	2.2	1.4	POP	1.6	1
43	BET	3.4	2.4	GHO	1.6	1
44	CUU	2.6	1.2	PKO	4.2	4.2
45	BYH	2.2	1.2	PKB	2	2.6

46	GMK	1.4	1.2	VIR	3	1.6
47	BUK	4.4	2.6	TYJ	1.8	1.4
48	NGK	2.8	1.2	QJO	2.4	2
49	FPL	1.6	1	BUG	4.2	3.2
50	WUD	4.6	2.4	TUH	3.4	2.2
51	LVE	5	4.2	UJK	1.4	1.4
52	SHA	3.6	2.4	LOV	2.8	2.4
53	VID	4.6	1	HJU	2	1.8
Mean		**2.89**	**1.93**		**2.69**	**2.39**
Std.dev		**1.01**	**0.78**		**0.99**	**0.95**

Table 34: VFS at baseline and following trataka and eye exercise group

	Experimental group			Control group		
Sl.No	**Subject Code**	**PRE**	**POST**	**Subject Code**	**PRE**	**POST**
1	HJK	1.33	0.83	KKS	4.83	5.33
2	BJL	0.83	1.17	SPK	0.83	1.17
3	NMK	1.67	0.83	LDM	1.33	2.50
4	PGG	3.17	1.50	BJU	2.50	1.83
5	YHP	1.17	1.17	SJH	1.33	0.83
6	GUC	1.67	0.83	OPK	5.67	4.67
7	FUB	7.50	2.17	ANI	4.83	5.17
8	QKO	1.83	0.83	GAU	3.17	2.33
9	FKP	5.33	3.83	THU	0.83	0.83
10	HLB	2.50	0.83	HEM	7.50	7.17
11	FDN	2.67	0.83	IHY	4.00	4.83
12	RPJ	5.67	1.33	THK	1.83	1.67
13	XUP	4.83	3.33	FGH	5.33	4.67
14	FWU	1.17	1.67	KJU	4.50	3.00
15	DSR	1.83	1.33	HNB	2.17	1.17
16	WPM	5.67	2.50	KOP	5.67	4.50
17	APJ	1.33	1.00	DDT	3.17	2.67
18	DSY	1.00	1.33	RTH	1.50	1.17
19	CHP	3.17	1.83	SER	1.33	1.33
20	KQP	6.17	5.33	TGH	6.00	5.33

21	APG	3.17	1.83	XRR	0.83	0.83
22	CYF	2.17	0.83	FSE	4.67	4.83
23	FLP	3.17	0.83	TGW	1.67	1.67
24	MAF	1.50	0.83	YUP	1.17	2.33
25	RTU	1.50	1.33	RET	2.67	2.33
26	VSD	2.67	1.33	TES	3.67	4.17
27	PLH	0.83	1.00	NBY	2.33	2.50
28	CUH	1.33	0.83	WET	1.00	1.17
29	BUC	6.00	4.33	IGF	2.67	3.17
30	MUI	5.00	1.50	LMJ	1.83	3.17
31	CYL	3.67	3.33	UHB	2.33	1.67
32	SPP	4.67	1.00	QUJ	2.33	2.83
33	PGH	0.83	1.17	OLP	1.67	1.17
34	VYJ	1.00	1.00	EYH	1.67	2.00
35	LPI	1.50	1.00	GUN	0.83	0.83
36	WUI	1.67	0.83	CMN	3.00	5.33
37	ONG	1.17	1.67	TYU	1.00	0.83
38	DLG	4.83	2.33	UPL	3.50	4.33
39	BPC	1.00	0.83	FIL	0.83	0.83
40	APH	1.50	0.83	SWY	1.00	1.00
41	CUM	2.67	1.00	DRD	0.83	0.83
42	WON	2.00	1.33	POP	1.50	1.00
43	BET	3.00	1.50	GHO	1.33	1.17
44	CUU	3.67	1.50	PKO	5.17	3.33

45	BYH	2.33	1.17	PKB	3.50	2.50
46	GMK	1.00	1.00	VIR	1.67	1.17
47	BUK	2.67	1.83	TYJ	0.83	1.00
48	NGK	1.67	1.33	QJO	2.00	1.83
49	FPL	1.33	0.83	BUG	2.50	3.17
50	WUD	2.67	0.83	TUH	1.50	0.83
51	LVE	5.83	6.33	UJK	2.33	1.17
52	SHA	4.33	1.00	LOV	1.33	1.17
53	VID	2.00	0.83	HJU	2.00	1.33
Mean		**2.73**	**1.58**		**2.56**	**2.45**
Std.dev		**1.70**	**1.15**		**1.63**	**1.61**

Table 35: VSC at baseline and following trataka and eye exercise group

	Experimental group			Control group		
Sl.No	**Subject Code**	**PRE**	**POST**	**Subject Code**	**PRE**	**POST**
1	HJK	1.33	1.50	KKS	3.00	3.33
2	BJL	2.00	2.00	SPK	2.00	1.33
3	NMK	1.33	1.17	LDM	1.33	2.17
4	PGG	1.50	1.33	BJU	2.33	2.00
5	YHP	1.50	1.33	SJH	1.33	1.17
6	GUC	1.67	1.17	OPK	3.33	2.33
7	FUB	4.00	1.83	ANI	3.17	2.67
8	QKO	2.17	1.33	GAU	2.67	1.83
9	FKP	3.67	2.00	THU	1.17	1.17
10	HLB	2.33	1.17	HEM	4.00	3.83
11	FDN	2.00	1.17	IHY	3.50	4.33
12	RPJ	3.33	1.50	THK	2.17	2.17
13	XUP	3.17	2.67	FGH	3.67	3.00
14	FWU	2.33	1.67	KJU	3.33	3.00
15	DSR	2.17	1.67	HNB	2.33	1.17
16	WPM	3.33	1.83	KOP	3.33	2.17
17	APJ	1.67	2.33	DDT	1.83	2.17
18	DSY	1.33	2.00	RTH	1.50	1.67
19	CHP	2.83	1.67	SER	1.83	1.50
20	KQP	2.83	2.83	TGH	3.00	3.33
21	APG	2.67	1.83	XRR	1.17	1.33

22	CYF	2.33	1.17	FSE	3.33	3.17
23	FLP	1.83	1.17	TGW	1.50	2.17
24	MAF	1.50	1.33	YUP	1.67	1.67
25	RTU	1.83	1.50	RET	2.50	2.00
26	VSD	1.67	1.33	TES	2.83	2.33
27	PLH	1.33	1.17	NBY	1.67	5.83
28	CUH	1.83	1.17	WET	1.50	1.67
29	BUC	3.00	2.17	IGF	2.00	2.33
30	MUI	2.83	1.67	LMJ	2.50	2.50
31	CYL	2.50	4.00	UHB	2.50	1.83
32	SPP	3.33	1.67	QUJ	2.33	2.17
33	PGH	1.17	1.33	OLP	2.83	1.67
34	VYJ	1.33	1.33	EYH	2.33	3.17
35	LPI	1.50	1.50	GUN	1.50	1.17
36	WUI	1.50	1.33	CMN	1.50	2.33
37	ONG	1.67	2.00	TYU	1.33	1.67
38	DLG	3.00	1.33	UPL	2.83	2.67
39	BPC	1.50	1.17	FIL	2.00	1.17
40	APH	1.50	1.17	SWY	1.17	1.33
41	CUM	2.50	1.33	DRD	1.17	1.17
42	WON	3.33	1.50	POP	1.17	1.17
43	BET	2.17	1.33	GHO	1.33	1.33
44	CUU	2.83	1.33	PKO	2.00	1.67
45	BYH	1.67	1.17	PKB	3.17	2.83

46	GMK	1.50	1.17	VIR	2.17	1.67
47	BUK	2.00	1.67	TYJ	1.83	1.33
48	NGK	1.67	1.67	QJO	2.00	1.83
49	FPL	1.33	1.17	BUG	1.17	1.17
50	WUD	1.33	1.17	TUH	3.17	1.50
51	LVE	3.33	4.33	UJK	1.50	1.33
52	SHA	2.00	1.33	LOV	1.50	1.33
53	VID	1.83	1.33	HJU	2.33	1.33
Mean		**2.15**	**1.62**		**2.19**	**2.08**
Std.dev		**0.73**	**0.63**		**0.78**	**0.91**

Table 36: SMAAS at baseline and following trataka and eye exercise group

	Experimental group			Control group		
Sl.No	**Subject Code**	**PRE**	**POST**	**Subject Code**	**PRE**	**POST**
1	HJK	5.4	5.4	KKS	4.8	4.2
2	BJL	3.8	5	SPK	3.8	4.4
3	NMK	4.4	6	LDM	5.4	4.6
4	PGG	5.2	5.2	BJU	3.4	5.2
5	YHP	4.8	5	SJH	4.8	4.4
6	GUC	5.4	5.6	OPK	4	5.4
7	FUB	4.6	5	ANI	4.8	5.4
8	QKO	4.4	5.8	GAU	4	4.4
9	FKP	4.4	4.2	THU	5.6	5.8
10	HLB	3.4	5.6	HEM	4.6	5
11	FDN	4.2	5.6	IHY	3.4	4.6
12	RPJ	4	4.6	THK	5.6	5.4
13	XUP	4.8	4.8	FGH	4.4	4.4
14	FWU	4.4	5.2	KJU	4.2	5
15	DSR	5.6	5.8	HNB	4.8	4.6
16	WPM	5	5.8	KOP	5	4.4
17	APJ	5.4	5.8	DDT	3.4	4.6
18	DSY	6	6	RTH	5.4	5.6
19	CHP	5.8	6	SER	4	3.6
20	KQP	4.2	4.2	TGH	4.8	4.8
21	APG	4	4	XRR	5.8	5.8

22	CYF	4.8	4.8	FSE	4.2	5
23	FLP	3.4	5.2	TGW	5	4.8
24	MAF	5.4	5.6	YUP	5.4	5.6
25	RTU	5	5.8	RET	4.4	4.4
26	VSD	5	5.6	TES	4.8	3.8
27	PLH	5	6	NBY	4.4	5
28	CUH	4	3.4	WET	5.8	5.8
29	BUC	4.8	5.6	IGF	4	5
30	MUI	4.2	5.6	LMJ	4	5.4
31	CYL	4	4.2	UHB	3.6	5
32	SPP	4.2	5.8	QUJ	4.2	3.4
33	PGH	5.8	5.8	OLP	5.2	4
34	VYJ	5	5.4	EYH	3.6	3.2
35	LPI	5	5.4	GUN	5.8	5.8
36	WUI	5	5.8	CMN	5.6	5.2
37	ONG	5.4	6	TYU	5	5
38	DLG	4.8	4.6	UPL	3.8	5.2
39	BPC	5.8	6	FIL	5.8	6
40	APH	5.6	5.6	SWY	5.8	5.6
41	CUM	4.4	5.8	DRD	5.8	6
42	WON	5.8	5.4	POP	5.6	6
43	BET	4.6	4.6	GHO	6	6
44	CUU	4.8	5.6	PKO	5	3.4
45	BYH	4.4	6	PKB	3.2	4.6

46	GMK	5.8	5.8	VIR	4.6	5.8
47	BUK	4	3.8	TYJ	5.6	5.8
48	NGK	3	5.6	QJO	4.8	5.2
49	FPL	6	6	BUG	3.8	5.2
50	WUD	4	4.4	TUH	5	5.6
51	LVE	3	4.6	UJK	3.6	5.4
52	SHA	3.2	5.8	LOV	5.2	5.2
53	VID	3.8	5.8	HJU	4.4	5.6
Mean		**4.68**	**5.32**		**4.70**	**4.99**
Std.dev		**0.78**	**0.65**		**0.78**	**0.72**

Appendix 6

Data of Cosi Block Tapping Task

Table 37: Forward Span at Baseline, Following Experimental and Control Sessions

Sl No	Subject Name	Baseline	Trataka Session	Experimental Session
1	ASV	5	4	5
2	AHV	6	7	6
3	BBV	7	8	7
4	VVB	5	6	6
5	BVB	5	6	5
6	RAH	5	7	8
7	HAR	5	5	5
8	FTR	5	5	4
9	SEY	5	5	6
10	JHU	5	5	4
11	KJU	6	6	6
12	GYU	5	6	4
13	MNN	5	5	5
14	ABH	5	7	5
15	SRS	5	5	5
16	NMN	7	6	7
17	PKU	5	6	5
18	PIN	5	5	5
19	RAC	5	5	5
20	RAJ	7	7	7
21	RUB	5	5	5
22	SAT	5	6	7

23	SHI	5	6	7
24	SPO	6	7	6
25	SUR	5	6	4
26	SWE	5	7	7
27	TEJ	5	6	6
28	VIV	8	6	7
29	YAJ	5	6	6
30	THJ	7	7	7
31	VIDYA	7	6	5
32	ADY	5	7	7
33	KAV	5	6	6
34	SWT	5	7	6
35	PRE	5	6	5
36	ANN	4	7	4
37	SAR	5	6	6
38	HIT	7	7	6
39	ARU	6	8	7
40	SRI	7	8	5
41	CHI	6	7	6
Mean		**5.512195**	**6.170732**	**5.731707**
Std.dev		**0.886813**	**0.9345**	**1.036514**

Table 38: Forward Total at Baseline, Following Experimental and Control Sessions

Sl No	Subject Name	Baseline	Trataka	Experimental Session
1	ASV	30	24	35
2	AHV	60	77	54
3	BBV	70	96	77
4	VVB	35	54	60
5	BVB	35	48	30
6	RAH	35	70	80
7	HAR	35	35	40
8	FTR	25	40	24
9	SEY	30	40	48
10	JHU	35	35	20
11	KJU	54	48	48
12	GYU	35	48	24
13	MNN	40	40	40
14	ABH	40	70	40
15	SRS	30	40	40
16	NMN	63	54	70
17	PKU	35	54	40
18	PIN	40	40	40
19	RAC	30	35	35
20	RAJ	70	70	84
21	RUB	35	30	35

22	SAT	40	54	70
23	SHI	35	54	70
24	SPO	54	77	48
25	SUR	35	48	20
26	SWE	35	70	77
27	TEJ	35	60	48
28	VIV	80	54	77
29	YAJ	40	54	54
30	THJ	70	77	77
31	VIDYA	77	48	40
32	ADY	40	63	77
33	KAV	40	54	42
34	SWT	40	77	60
35	PRE	40	48	30
36	ANN	20	63	20
37	SAR	30	54	54
38	HIT	70	77	60
39	ARU	54	96	63
40	SRI	70	96	40
41	CHI	48	63	54
Mean		**44.26829**	**56.95122**	**49.87805**
Std.dev		**15.40355**	**17.55681**	**18.37309**

Table 39: Backward Span at Baseline, Following Experimental and Control Sessions

Sl No	Subject Name	Baseline	Trataka	Experimental Session
1	ASV	5	6	6
2	AHV	6	6	6
3	BBV	6	7	3
4	VVB	6	6	7
5	BVB	6	6	5
6	RAH	6	6	6
7	HAR	5	5	5
8	FTR	4	6	5
9	SEY	6	6	6
10	JHU	5	5	5
11	KJU	6	6	6
12	GYU	6	6	6
13	MNN	6	6	6
14	ABH	6	6	7
15	SRS	6	6	6
16	NMN	6	7	6
17	PKU	6	6	6
18	PIN	6	6	6
19	RAC	6	6	6
20	RAJ	7	6	6
21	RUB	6	7	6
22	SAT	6	7	6

23	SHI	6	7	6
24	SPO	6	6	7
25	SUR	6	6	6
26	SWE	6	6	6
27	TEJ	6	7	7
28	VIV	6	7	7
29	YAJ	7	6	6
30	THJ	6	6	6
31	VIDYA	6	6	7
32	ADY	6	6	4
33	KAV	6	6	6
34	SWT	6	7	6
35	PRE	6	6	5
36	ANN	5	6	6
37	SAR	6	6	6
38	HIT	6	6	6
39	ARU	6	7	6
40	SRI	6	6	6
41	CHI	6	6	5
Mean		**5.902439**	**6.170732**	**5.878049**
Std.dev		**0.484133**	**0.489023**	**0.771287**

Table 40: Backward Total at Baseline, Following Experimental and Control Sessions

Sl No	Subject Name	Baseline	Trataka	Experimental Session
1	ASV	35	48	48
2	AHV	60	60	60
3	BBV	60	77	48
4	VVB	48	54	70
5	BVB	54	48	35
6	RAH	54	54	48
7	HAR	35	30	35
8	FTR	24	48	35
9	SEY	42	60	54
10	JHU	25	40	40
11	KJU	54	54	54
12	GYU	54	48	42
13	MNN	54	54	60
14	ABH	48	42	63
15	SRS	48	48	48
16	NMN	54	70	60
17	PKU	48	54	48
18	PIN	54	60	54
19	RAC	60	54	54
20	RAJ	70	60	60
21	RUB	54	70	54
22	SAT	48	77	54

23	SHI	60	77	54
24	SPO	42	60	70
25	SUR	54	48	54
26	SWE	60	54	60
27	TEJ	48	63	70
28	VIV	60	77	77
29	YAJ	77	54	54
30	THJ	60	60	60
31	VIDYA	48	60	77
32	ADY	60	48	24
33	KAV	54	48	54
34	SWT	54	70	60
35	PRE	54	54	35
36	ANN	30	48	48
37	SAR	54	60	60
38	HIT	54	54	54
39	ARU	60	77	54
40	SRI	42	54	48
41	CHI	54	48	35
Mean		**51.41463**	**56.68293**	**52.97561**
Std.dev		**10.5437**	**10.77811**	**11.52831**

Appendix 7

List of Publications from the Doctoral Work

1. **Swathi, P. S.**, Raghavendra, B. R., & Saoji, A. A. (2021). Health and therapeutic benefits of Shatkarma: A narrative review of scientific studies. Journal of Ayurveda and integrative medicine, 12(1), 206-212. DOI: 10.1016/j.jaim.2020.11.008
2. **Swathi, P. S.,** Saoji, A. A., & Bhat, R. (2022). Role of Trataka in ameliorating visual strain and promoting psychological well-being during prolonged use of digital displays: randomized controlled trial. WORK, 71(2):327-333. DOI: 10.3233/WOR-210834**. [IF: 1.8]**
3. **Swathi, P. S.**, Bhat, R., & Saoji, A. A. (2021). Effect of Trataka (Yogic Visual Concentration) on the Performance in the Corsi-Block Tapping Task: A Repeated Measures Study. Frontiers in psychology, 12, 773049-773049. DOI: 10.3389/FPSYG.2021.773049 **[IF: 4.232]**

Journal of Ayurveda and Integrative Medicine 12 (2021) 206e212

Contents lists available at ScienceDirect

Journal of Ayurveda and Integrative Medicine

journal homepage: http:// elsevier. com/locate/jaim

Review Article

Health and therapeutic benefits of *Shatkarma*: A narrative review of scientific studies

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a r t i c l e i n f o

Article history:
Received 7 May 2020
Received in revised form
20 October 2020
Accepted 24 November 2020
Available online 13 January 2021

Keywords:
Shatkarma
Shatkriya
Yoga
Yogic cleansing technique
Physiological effects

a b s t r a c t

Shatkarma, also known as ***Shatkriya*** are a set of six yogic cleansing techniques described in the ***Hatha Yoga*** texts. Several health benefits of these procedures are indicated in the traditional texts of ***Yoga***. However, there is no comprehensive literature about the scientific evidence on ***Shatkriya***. Hence, we searched in PubMed, PubMed Central and Google Scholar databases to review relevant articles in English. The search yielded a total 723 references, published from 1976 to April 2020. Based on the inclusion and exclusion criteria, 37 articles were included in this review. We found scientific studies on four out of six cleansing techniques. The limited evidence on ***Shatkriya*** suggests positive effects on various physiological and clinical domains. The practice of ***dhauti*** was found to enhance respiratory functions and was useful in digestive disorders. Nasal cleansing, ***neti*** was particularly found beneficial in managing the rhinosinusitis in age groups ranging from children to adults. Although ***trataka*** practice was found to enhance cognition and bring a state of relaxation, but there was no evidence supporting its role in eye disorders. ***Kapalabhati*** practice appears to have a beneficial role in the activation of sympathetic nervous system, enhance cognition, and improve overall metabolism. Further large-scale clinical trials with robust designs are warranted to evaluate the effects of ***Shatkriya*** in health and disease.

1. Introduction

Cleansing practices are part of most indegenous health sys- tems, be it *Yoga*, Naturopathy, Ayurveda, or Chinese Medicine. In *Yoga*, six cleansing practices are described in the *Hatha Yoga* tradition, which are known to balance the constitution of an in- dividual. These six cleansing practices in *Yoga* are known as *Shatkarma* or *Shatkriya*, which are said to promote health and well-being by purifying the whole body. *Hatha Yoga Pradipika* (ch: 2, v. 21 and 22) of Swatmarama recommends the practice *Shatk- riya* prior to practice of *pranayama* (yogic breath regulation). The *Shatkriya* techniques include *dhauti* (internal cleansing), *basti* (yogic enema), *neti* (nasal cleansing), *trataka* (concentrated ga- zing), *nauli* (abdominal massaging) and *kapalabhati* (frontal sinus cleansing) [1]. Although several health benefits of *Shatkriya* are narrated in *HathaYoga* texts, there is a lack of comprehensive literature on scientific studies in the subject matter. Thus, the current review was undertaken to summarize the scientific evi- dence on the physiological and therapeutic effects of the *Shatkriya*.

1.1. Traditional references for Shatkriya

There are four major texts of *Hatha Yoga* tradition viz. *Hatha Yoga Pradipika*, *Gheranda Samhita*, *Shiva Samhita* and *Hatharatnavali*. Among them *Gheranda samhita* and *Hatha Yoga Pradipika* describe the purification of the body, with reference to six variants of the cleansing procedures [1,2]. *Gheranda Samhita* has an elaborate description of the sub-types and benefits of the *Shatkriya*. *Hathar- atnavali*, which is the latest among the *Hatha Yoga* texts, narrates eight variants of cleansing techniques [3]. However, the six cleansing techniques described in the *Hatha Yoga Pradipika* of Swami Swat- marama are most popular among the *Yoga* practitioners. The main objective of *Shatkriya* is to balance the three humours (*tridosha*) in the body, mucus (*kapha*), bile (*pitta*) and wind (*vata*) [1].

Though there are a few similarities in the cleansing procedures described in *Yoga* and *Ayurveda* (such as *basti* and *vamana dhauti*),

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Peer review under responsibility of Transdisciplinary University, Bangalore.

https://doi.org/10.1016/j.jaim.2020.11.008

the yogic cleansing methods are unique for multiple reasons. The yogic cleansing is done by the practitioner himself under the guidance of *Yoga* teacher and without administration of any medicine.

2. Methodology

A comprehensive literature search in PubMed, PubMed Central, and Google Scholar databases was carried out for the keywords "*shatkriya*, *shatkarma*, *dhauti*. yogic stomach wash, b*asti*, yogic enema, neti, yogic nasal cleansing, nasal irrigation, *trataka*, yogic visual concentration, *nauli*, yogic abdominal massage, *kapalabhati*, yogic frontal sinus cleansing, high frequency *Yoga* breathing". The search yielded a total number of 665 references from the year 1976 till April 2020 for the above-mentioned keywords. Experimental and quasi-experimental studies and case reports in English, with yogic cleansing techniques as an intervention were included in the review. The studies that had combination of *Yoga* practices were excluded. After applying the inclusion and exclusion criteria and removing the duplicates, a total of 37 studies were selected for the final review. The studies are presented based on the cleansing techniques.

3. Summary of scientific evidence on yogic cleansing techniques

3.1. Dhauti

A literal meaning of *dhauti* is internal cleansing. Four major forms of *dhauti kriya* as described in the *Gheranda Samhita* viz. *antar* (internal), *danta* (teeth), *hrid* (cardiac) and *moola shodhana* (purification of the anus) [1,2]. The most popular forms of *dhauti* include *vamana dhauti*, also known as *kunjala kriya*, *vastra dhauti* and *shankha prakshalana*. *Kunjala kriya* includes drinking warm saline water and voluntarily inducing vomiting to clear the contents of stomach. In *vastra dhauti*, the practitioner swallows a soft cotton cloth of about 2 m length and 4 cm width and removes the same. The practice of *shankha prakshalana* includes drinking warm saline water and passing it in the bowels by inducing peristalsis through certain postures [1]. It aids in reducing ailments of the digestive system like constipation, biliousness, indigestion, chronic gastritis, reflux acts. It even helps to reduce accessory organ ailments of digestive systems like torpid liver, sluggish pancreas, urinary elimination, renal complaints, and dyspeptic condition. Indirectly it strengthens the heart and respiratory systems like cough, asthma, tonsillitis and teeth problems. It even benefits in arthritis, diabetes, and loosening of weight [4].

3.1.1. Effects of dhauti on respiratory system

A study was conducted to assess the effect of *kunjala kriya* on the pulmonary functions in healthy volunteers. The authors found the practice to play a role in enhancing pulmonary functions along with increased vagal tone. These findings were based on the increase in slow vital capacity, forced inspiratory volume along with a reduction in expiratory reserve volume and respiratory rate. The findings also indicate a possible increase in endurance of the respiratory muscles, decreased airway resistance, better emptying of lungs, which may play a role in restrictive lung disorders [5].

3.1.2. Effect of dhauti on bowel health

A recent randomized controlled study done on 60 healthy individuals, demonstrated beneficial effects of *laghu shankha prakshalana* in bowel health. Thirty volunteers who received the intervention once in a week for 4 weeks demonstrated better scores in the Cleveland clinic constipation scale. The control group showed no significant change during the follow-up period [6].

3.1.3. Effect of dhauti in chronic low back pain

A self as controlled study was conducted in 40 in-patients, randomly assigned to receive *laghu shankha prakshalana* and back pain yogic special technique on specific days. Assessments were performed before and immediately after the sessions. Pain and disability were assessed using Oswestry disability index, state anxiety using the state subscale of Spieldberger's state and trait anxiety inventory, spinal flexibility, and straight leg raising tests using Leighton type goniometer and caliper type goniometer respectively. Both *Yoga* sessions were found to beneficial to the patients, but the magnitude of change was higher following the *laghu shankha prakshalana* session. Thus, *laghu shankha prakshalana* practice was found to reduce pain, disability, anxiety, and help to increase in flexibility [7].

3.1.4. A complication of dhauti

Practice of *dhauti* is generally considered safe when it is done under the guidance of a teacher. One case study was found to report the adverse effect of *dhauti* during the literature review. A case of dental erosion diagnosed using the Tooth Wear Index was reported by Meshramkar and Patil (2007) which they had attributed to the regular practice of *kunjala kriya* for 12 years [8].

Thus, from the limited evidence available on *dhauti kriya*, it was found useful as a therapeutic modality in the management of respiratory and digestive disorders. The practice should be done under the guidance of a trained teacher, which may help to avoid possible complications. Further large-scale clinical trials are required to establish the usefulness of *dhauti* as therapeutic modality. We have summarized the studies on *dhauti* in Table 1.

3.2. Neti (yogic nasal cleansing)

The practice of *Neti* is advised in *Hatha Yoga* to clean the nasal passage. In classical reference of *Hatha Yoga Pradipka* only *sutra neti* is explained however in general four variations of *Neti* practiced, which includes *jala* (water), *sutra* (thread), *dugdha* (milk), and *ghritha* (ghee) [1,9]. The most popular forms of *Neti* practice are *jala* and *sutra neti*. In *Jala neti*, saline warm water is passed from one nostril to another using a specially designed pot. The classical practice of *sutra neti* involves inserting a thread in the nostril and removing it from the mouth. In modern times instead of thread, a sterile catheter is used. *Neti* removes mucus from nostrils, sinuses which helps to allow the air easily without obstruction. This help in reducing allergic rhinitis, tonsillitis and to prevent cough, cold and tension headache due to eye strain.

3.2.1. Use of Neti for rhino-sinusitis

A study done on 150 subjects with chronic sinusitis assigned them in 3 treatment groups: nasal irrigation with a bulb syringe or *jala neti*, or reflexology massage. The follow-up duration was for 2 weeks. All three groups demonstrated improvement in rhinosinusitis outcome measures [10]. More than 70 percent of the participants wanted to continue practicing nasal irrigation even after completion of the study. The study also depicted that the improvements in the symptoms were better in male population. Smokers in the study did not show improvement in the symptoms. Sinusitis is a common problem among children. Shoseyov et al. (1998) conducted a double blind RCT to illustrate the efficacy of normal water verses *jala neti* in children with chronic sinusitis. The outcome measures used were cough, nasal secretion and radiological assessment tools. They found significant improvements in four-weeks in the group which used *jala neti*, when compared to

Table 1
Evidence summary on *Dhauti*.

Author	Sample size	Study type and Duration of Intervention	Variables studied	Findings
Kiran et al., 2019 [6]	60 (Experimental ¼ 30, Control ¼ 30)	RCT Once a week for 4 weeks for study group & control group did not receive intervention	Cleveland Clinic Constipation Score	Four sessions of *laghu shanka prakshalana* reduced constipation score
Balakrishnan et al., 2018 [5]	18 (Experienced ¼ 9, naïve ¼ 9)	Comparative Study between naïve and experienced practitioners. Single session	Slow & forced vital capacity, Inspiratory & expiratory reserve volume, Respiratory rate & tidal volume	Improved respiratory functions were observed after *Kunjal kriya* practice.
Haldavenkar et al., 2014 [7]	40	Self as control study Single sessions of *laghu shanka prakshalana* and back pain specific yoga techniques were compared after 3 days of training	Pain & disability, state anxiety, spine flexibility and straight leg raising	A single session of *Laghu shanka prakshalana* was found better than back pain specific yoga session in reducing disability, anxiety & improved spine flexibility in patients with chronic low back
Meshramkar et al., 2007 [8]	1	Single case report	Tooth wear index of Smith & Knight	The regular practice of *kunjal kriya* for a prolonged time led to dental erosion

normal saline. The effects were sustained for a follow-up period of one month after the conclusion of the trial [11].

A case series was conducted to report effects of *jala neti* in 10 cases of sinusitis among children (age range: 3e9 years). The authors found improvement in the disease-related Quality of life and in symptom management [12].

An early study assessed the inflammatory markers in thirty symptomatic patients with active perennial allergic rhinitis. The three interventions compared were nasal heated water particles at 43 degrees C for 20 min, heated molecular water vapor at 41°C for 20 min, and simple *jala neti* at 39°C solution for 15 min at weekly intervals. Nasal washes were done before and immedi- ately after the treatments, at 30 min, 2 h, 4 h, 6 h. Inflammatory mediators such as histamine, prostaglandin D2, leukotriene C4 concentrations were assessed using a competitive radioim- munoassay. Inflammatory mediators in nasal secretions decreased substantially after *jala neti*. It reduced histamine for a period of 6 h, after a single 15 min treatment, illustrating the beneficial effect of *jala neti* in reducing allergic response and inflammation [13].

A study (SNIFS Trial) assessing the efficacy of self-management tools for recurrent sinusitis compared *jala neti* with steam inhalation. The investigators of the study followed 32 participants for a period of six months. They concluded both interventions were acceptable to the patients, but *jala neti* was found to be effective in symptom management [14]. A large scale RCT involving 871 participants indicated that *jala neti* being better in managing symptoms of rhino-sinusitis and being acceptable to participants than steam inhalation [15].

A randomized control trial with seventy-six subjects followed patients with sinusits for a period of six months. The investigators found improved quality of life, reduced symptoms, and need for medications in patients who performed *jala neti* daily for six-months [16].

3.2.2. Neti for post-irradiation rhinosinusitis in nasopharyngeal carcinoma

Sinusitis and nasopharyngeal irritation are common following radiotherapy for nasopharyngeal carcinoma. A five-year follow-up study demonstrated that long term nasal irrigation helped in improving quality of life (QoL) of patients affected with nasopharyngeal carcinoma within a one year of intervention there was a relief in nasal symptoms [17]. Similar observation of improved quality of life and reduced symptoms were observed in a trial involving 107 nasopharyngeal carcinoma patients after irradiation. The follow-up duration for the study was six months [18].

3.2.3. Complication of Sutra neti

There was a case of 67 year old man presenting with change of voice, loss of sensation of smell, nose blockage and mouth breathing after regular practice of *Sutra neti*. He had to undergo a controlled ablation for release of the nostrils. The investigators suggested to avoid vigorous practice of *sutra neti* [19].

Thus, *Neti,* being one of the easiest cleansing procedures in *Yoga,* plays advantageous role in management of rhino-sinusitis. A case study also indicates beneficial effect of *sutra neti* on obstructive sleep apnea and snoring. The results indicate that the traditional explanation from *Hatha Yoga Pradipika* stating *neti* can help to cure disease above the throat appear to be supported with scientific evidence. The evidence based effects of *neti kriya* are summarized in Table 2.

3.3. Trataka (yogic visual concentration)

The practice of *trataka* involves concentrated gazing on a small object (usually a candle flame). The classical explanation of the practice involves gazing at an object without blinking the eyes, till tears roll out. The technique is said to reduce the eye disorders and to reduce the laziness [1]. The scientific studies on *Trataka* used cognitive functions and vision as their outcome measures.

3.3.1. Effect of trataka on attention and cognition

A self as control study assessed effect of *trataka* on critical flicker fusion (CFF). CFF is defined as the frequency at which a flickering stimulus perceived to be continuous. Thirty subjects were recruited for the study who were conditioned for the prac- tice through five sessions on different days before the commencement of assessments. Subjects were assessed individ- ually for CFF immediately before and after the *trataka* or control sessions. The *trataka* session involved eye exercise followed by gazing at the candle flame whereas control session had only eye exercise. The CFF was assessed with increasing and decreasing frequencies. The *trataka* group shown a significant increase in CFF, and there was a nonsignificant reduction in CFF following the control session [21].

Another study with similar sample size (n¼ 30) and design evaluated the cognitive performance using the adult version of the Stroop-color-word test. *The results indicated improvement* in

Table 2
Evidence summary of *Neti*.

Author	Sample size	Study type and duration of Intervention	Variables studied	Findings
Tiwana et al., 2019 [19]	1	Single case report	Nasal endoscopy	Vigorous practice of *sutra neti* led to velopharyngeal stenosis requiring surgical intervention.
Leydon et al., 2017 [14]	32	Qualitative semi-structured interview study Six months	Medication score, symptom checklist	*Neti* was found better than steam inhalation in reducing symptoms of rhinosinusitis.
Little et al., 2016 [15]	871 (Usual care ¼ 210, Nasal irrigation ¼ 219, Steam inhalation ¼ 232, Combined ¼ 210)	RCT Six months	Rhinosinusitis Disability Index (RSDI)	*Neti* was found better than steam inhalation in reducing symptoms of rhinosinusitis.
Lin et al., 2015 [12]	10	Pre and Post study Daily for one month of nasal irrigation	Sinus & Nasal Quality of Life survey, Overall Nasal Quality of Life	*Neti* helped to reduce chronic nasal symptoms and improved quality of life
Luo et al., 2014 [17]	1134 (GroupA ¼ Nasal irrigator, Group B ¼ homemade nasal irrigation connector combined with enemator, Group C used nasal sprayer)	Follow up study Five years	Sinus & Nasal Quality of Life survey	Long term use of *neti* helped in improvement of quality of life in nasal sinusitis patients
Liang et al., 2008 [18]	107 (Nasal irrigation ¼44, Non irrigation ¼ 63)	RCT Once daily upto six months of nasal irrigation	Questionnaire and radiological assessment of rhinosinusitis	The 6 months of follow up study of *neti* after radiotherapy, *neti* seems to improve the quality of life and symptoms.
Rabago et al., 2002 [16]	76 (Experimental ¼ 52, Control ¼ 24)	RCT Daily hypertonic saline nasal irrigation upto six months and control group didn't receive intervention	Medical outcome survey short form, Rhinosinusitis Disability Index, Single- Item- Sinus Symptom Severity assessment	*Neti* helped in reduction of symptoms and medication, even improved in quality of life in sinusitis patients.
Heatley et al., 2001 [10]	150 (Nasal irrigation with bulb syringe ¼ 43, nasal irrigation with irrigation pot ¼ 39, & reflexology massage ¼ 46)	RCT Each group underwent 2 weeks of intervention	Rhinosinusitis outcome measures, Daily medication use	*Neti* was found equally effective for the management of rhinosinusitis, when compared with reflexology massage and nasal irrigation using bulb syringe.
Shoseyov et al., 1998 [11]	30 (Hypertonic saline ¼ 15, Normal saline ¼ 15)	Randomized double blind study Four weeks of hypertonic saline and nasal saline	Radiology score & nasal secretion, cough or postnasal drip for rhinosinusitis	There was significant reduction in nasal secretions, cough & postnasal drip in hypertonic solution group than *neti* group
Georgitis; 1994 [13]	30	Self as control study	Nasal secretions - histamine, prostaglandin D2, leukotriene C4	*Neti* and large particle water vapour reduced nasal histamines & leukotriene C4 indicative of reduced nasal inflammation.
Ramalingam and Smith; 1990 [20]	1	Single case report	Self-assessment of symptoms	Practice of *sutra neti* helped person to reduce snoring and obstructive sleep apnea

selective attention, response inhibition, cognitive flexibility following *trataka* session [22].

A randomized controlled trial done in elderly population evaluated the effect of *trataka* on cognitive function. There was improvement in the performance in the cognitive tasks such as digit span, six-letter cancellation test, and tail making test following a 26-day intervention compared to the baseline. This study indicates a possible role of *trataka* in preventing cognitive decline in elderly [23].

332. *Effect of trataka in autonomic functions*

A study assessed the immediate effect of *trataka* on heart rate variability (HRV) and breathing rate following two sessions on two different days. The investigators found an increased in vagal tone following *trataka* depicted by a decrease in heart rate and breath rate, low frequency component of HRV and increase in high frequency component. No changes were observed following the control session [24].

333. *Clinical trials on trataka and eye disorders*

A study assessing outcomes of ametropia and presbyopia compared the effects of two forms of eye exercises viz. Bates

method and *trataka*. The investigators reported subjective improvements in the vision without any change in objective assessment tools following both forms of eye exercises [25,26]. Table 3 illustrates the studies on *trataka*. Although, traditional texts quote *trataka* can be used to treat eye disorders, but not many studies have evaluated the role of *trataka* in eye disorders. The limited evidence does not support role of *trataka* in eye disorders, thus there is scope for further scientific evaluation in the subject area The studies also demonstrat enhanced cognitive functions and autonomic relaxation immediately following the practice. Thus, there is a need to explore long term effects of *trataka* in physio- logical and clinical settings.

Table 2

3.4. Kapalabhati (yogic frontal brain cleansing)

Kapalabhati is a combination of two syllables, *kapala* means forehead and *bhati* means shining. The practice of *kapalabhati* involves breathing out at a rapid pace (~1–2 Hz) by flapping the abdomen. Classical texts indicate beneficial role of *Kapalabhati* in respiratory disorders [1] It is also known as high frequency *Yoga* breathing due to the nature of practice. Generally the practice of

Table 3
Evidence summary of *Trataka*.

Author & Year	Sample size	Study type and duration of Intervention	Variables studied	Findings
Tiwari et al., 2018 [26]	48 (Trataka yoga kriya ¼ 24, Eye exercise ¼ 24)	Comparative study Eight weeks of either *trataka* or eye exercise group	Snellen's Chart	*Trataka* and eye exercise did not show any significant changes in refractive errors
Raghavendra and Singh; 2016 [22]	30	Self as control study After 15 days of orientation programme in *trataka,* immediate effect of 25 min assessed for *trataka* & control session	Stroop colour-word test	Improvement in selective attention, cognitive flexibility, and response inhibition was found following *trataka* session
Talwadkar et al., 2014 [23]	60 (Trataka group ¼ 36, control group ¼ 24)	RCT One month (26 days) of *trataka* or control group	Digit span test, six letter cancellation test, trail making test	*Trataka* session in elderly population shown significant increase in cognitive levels compare to control group
Raghavendra and Ramamurthy; 2014 [24]	30	Self as control study After 15 days of orientation programme in *trataka,* immediate effect of 25 min assessed for *trataka* & control session	Heart rate variability (HRV) & respiration rate	*Trataka* group shown decrease in heart rate, breath rate, low frequency component of HRV and increase in high frequency component of HRV
Gopinathan et al., 2012 [25]	66 (Eye exercise ¼ 32, *trataka yoga kriya* ¼ 34)	RCT Once daily for three weeks of eye exercise or *trataka*	Signs and symptoms of presbyopia, retinoscopy, autorefractometer, keratometer	Both *Trataka* and eye exercise improve subjective signs and symptoms, but no change in both groups on objective assessments
Mallick and Kulkarni; 2010 [21]	30	Self as control study Five practice session of *trataka* (30 min) introduced before the immediate assessment.	Critical Flicker fusion	After the practice of *trataka* there was a significant increase in critical flicker fusion compare to eye exercise group

Kapalabhati is done prior to practice of *pranayama* (*yogic* breathing practices). Some masters categorize the practice of *kapalabhati* as one of the *pranayama* itself. However, the practice is classified as one of the *Shatkriya* as per the traditional *Yoga* texts [27].

3.4.1. Effect of kapalabhati on metabolism

One of the earliest studies on *kapalabhati* showed a decrease in blood urea with an increase in creatinine and tyrosine following one minute of practice in twelve healthy subjects. These changes were attributed to a possible promotion of decarboxylation and oxidation [28].

3.4.2. Effect of kapalabhati on respiratory and cardiovascular changes

Stancak and colleagues conducted a group of experiments to determine physiological changes associated with *kapalabhati* as early as in 1991. Their experiments demonstrated reduction in baroreflex sensitivity and vagal tone, associated with increase in blood pressure and heart rate following *kapalabhati*. They could also demonstrate slower brain waves in the EEG topography which were attributed to the subjective relaxation in the participants [29e31].

Series of studies were conducted by Telles et al. on the effects of *kapalabhati*. They found *kapalabhati* improves cognitive performance and attention assessed through event related potentials [32], associated with decreased anxiety [33]. Similar positive outcomes were found with motor performance [34] and finger dexterity [35] and spatial and working memory tasks [36] following *Kapalabhati*. They also observed sympathetic arousal [37,38], and metabolic activation [39], during *kapalabhati* however, the practice does not cause increase in the prefrontal cerebral circulation [40].

A study conducted on effect of *kapalabhati* on cognitive functions demonstrated improvements in the cognitive tasks [41].

Transcranial doppler was used to assess the cerebral blood flow changes during practice of *kapalabhati*. There was a reduction noted in the end diastolic velocity and mean flow velocity indicating a decrease in cerebral blood flow. Such change could be due to reduction of partial pressure of CO2 during the practice which involves breathing at a high frequency [42].

An RCT performed on 60 mild to moderate asthma patients demonstrated 10 min of practice of *kapalabhati* can enhance the forced vital capacity, forced expiratory volume in one second and their ratio. These finding indicate a possible role of *kapalabhati* in management of bronchial asthma [43].

3.4.3. The complication of kapalabhati

A case report presented a 29-year-old healthy woman, who developed the spontaneous pneumothorax caused due to extreme practice of *kapalabhati*. The investigators attributed such complication to pushing the practice to physiological extreme limits [44].

Thus, the studies on *kapalabhati* illustrate the beneficial effects of the technique in enhancing cognitive and respiratory functions and leading to a state of physiological arousal. Such changes can be used in clinical situations such as bronchial asthma. However, one should be careful not to strain while performing the practice of *kapalabhati*, which may also lead to complications. The evidence summary on *kapalabhati* is summarized in Table S1.

3.5. Basti (yogic enema)

There are two forms of *Basti* described in *Hatha Yoga*, *jala* (water) and *sthala* (dry). Both *basti* practices involve the cleansing of the colon. Swami Swatmarama considers the practice of *basti* beneficial for balancing *tridosha* and *dhatus* and to purify mind and senses [1]. According to sage *Gherenda*, *basti* reduces the disorders of *vata* and is beneficial in urinary and digestive problems. It is also known to improve digestion [2].

3.6. Nauli (yogic abdominal massaging)

Nauli is a practice of contracting and isolating the rectus abdominis muscle and churning the abdominal muscles. There are three variations based on the position of isolation of the muscles, namely *dakshina nauli* (right), *vama nauli* (left), *madhyama* (center). This practice is said to strengthen the secretion of gastric juice including endocrine and exocrine functions of the pancreas [1,9]. Since the practices of *basti* and *nauli* are considered to be an advance practice, we could not find any scientific study on the practice of *nauli* during our literature review.

4. Conclusion

The practice of *shatkriya* or *shatkarma* is recommended in the *Hathayoga* tradition. Studies exploring the effects of four out of six cleansing procedures were found in physiological as well as clinical settings. No studies were available on *basti and nauli* which could be due to the difficult nature of the practice. The practice of *dhauti* was found to enhance respiratory functions and was useful in digestive disorders. Nasal cleansing, *neti* was particularly found beneficial in managing the rhinosinusitis in age groups ranging from children to adults. Although *trataka* practice was found to enhance cognition and bring a state of relaxation, but there was no evidence supporting its role in eye disorders. *Kapalabhati* was the most studies among the *Shatkriya* practices. The ranges of studies on *kapalabhati* included assessing the neurocognitive assessments, autonomic, and metabolic activity. The practice appears to have a beneficial role in the activation of sympathetic nervous system, enhances cognition, and improves overall metabolism. It was also found to enhance the respiratory functions in patients with asthma. Single case reports (one each) were also found for practices of *dhauti, neti* and *kapalabhati* and it was attributed to pushing the body to the physiological extreme.

This literature review was limited to online free databases only and due to the keywords chosen. Although we tried, including a variety of key-words related to *shatkriya*, there may have been studies that were missed in the current review because of exclusion through the keywords and databases.

The beneficial role of *shatkriyas* narrated in both traditional texts and evident from the small body of empirical work warrants further rigorous scientific exploration. From the available literature, we found the practice of yogic cleansing technique safe, when practiced under the guidance of a trained teacher and has a po- tential role in health and disease.

Source(s) of funding

None.

Conflict of interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jaim.2020.11.008.

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Work xx (2021) x–xx
DOI:10.3233/WOR-210834
IOS Press

The role of trataka in ameliorating visual strain and promoting psychological well-being during prolonged use of digital displays: A randomized controlled trial

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Received 22 May 2021
Accepted 18 August 2021

Abstract.
BACKGROUND: The prolonged usage of digital displays leads to visual strain and, in turn, impairs psychological well-being. The practice of Yoga is said to enhance psychological functions and reduce visual strain.
OBJECTIVE: The present study assessed the effect of the trataka (Yogic visual concentration) practice on the visual strain, mind-wandering, and mindfulness.
METHODS: One hundred six volunteers equally distributed in the experimental and control groups completed the study. Visual Fatigue Scale (VFS), visual symptoms checklist (VSC), mind-wandering questionnaire (MWQ), and State Mindfulness Attention Awareness Scale (SMAAS) were administered at baseline and at the end of two weeks.
RESULTS: All variables were similar at the baseline in both groups, and significant differences were noted at the end of two weeks between both groups. There was a significant reduction in VFS and VSC scores, MWQ, along with an increase in SMAAS scores in the experimental group. Although there were significant changes in VFS, MWQ, and SMAAS in the control group, the magnitude of change was minimal.
CONCLUSIONS: The practice of trataka was found to reduce the visual strain, mind wandering while improving the state mindfulness. The practice can be implemented to mitigate visual strain and associated psychological implications due to prolonged exposure to digital displays, which has increased during the COVID-19 pandemic.

Keywords: Mindfulness, mind-wandering, psychology, visual strain, yoga, yogic visual concentration

1. Introduction

With the dawn of technological advancement, the use of digital displays in the form of computer screens, smartphones have become common. After the initial years, where digital displays were lim- ited for professional purposes, it has now percolated personal and social lives. With the thrust on digital/e-learning, users from all age groups are using the digital displays extensively. The use of such displays has increased rapidly due to the current COVID19 pandemic, where a large number of people were confined to working/learning from home [1, 2].

Although the use of technology has many advantages, such prolonged usage leads to health implications. Visual strain or eye strain is a subjective symptom of ocular fatigue, discomfort, lacrimation and headache, blurry vision, sensitivity to light [3]. Prolonged and improper usage of visual displays leads to irritation, dryness, eye strain, tiredness, burning sensation, redness, and blurred vision [4]. Visual

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ISSN 1051-9815/$35.00

fatigue and discomfort are associated with the usage of smartphones [5]. There was a significant correlation between ocular pain and tiredness, eye-related tiredness, eye-related pain with increased orbicularis oculi muscle load blood flow during computer work [6]. Prolonged computer or smartphone usage can also lead to musculoskeletal discomfort of the neck, lower back, and upper limbs, as well as psychosocial problems [7, 8]. Increased digital screen time, near work, and limited outdoor activities were associated with myopia's onset and progression [9]. Besides, prolonged use of digital screens has a negative impact on psychosocial well-being and decreases performance in adolescents [10, 11]. The usage of smartphones is known to affect learning, memory, and recalling [12].

There is a tendency for mind-wandering due to prolonged usage of digital displays [13]. Studies indicate role of mind-wandering in impairment in task performance [14], unpleasant emotions, negative mood, depression [15]. Stress, anxiety and mind-wandering are interconnected and are known to impact cognitive functions [16, 17]. It also leads to poor scholastic performance among students [18].

Due to the digital revolution, it is not possible to skip the usage of screen time. Thus, strategies for reducing the effects of digital display usage need to be emphasized. A review on visual discomfort management stated that 90% of display device users experience digital eye strain symptoms. The study suggested few strategies to overcome the symptoms and enhance productivity at work, such as intermittent blinking and eye exercises, lubricant eye drops, digital color filters, etc. [19]. However, there is a need for a holistic approach to reduce visual strain.

In recent years, Yoga has evolved as multidisciplinary holistic mind-body practice, positively impacting health and disease [20, 21]. There are very few studies evaluating the effects of yoga practices on vision. A study evaluated a combination of yoga practices on visual discomfort using a self-rated questionnaire. After sixty days of intervention, the yoga group showed a reduction in visual discomfort than the waitlisted group [22]. The nursing and optometry students showed decreased eye fatigue scores after 30–60 min practice of yogic eye exercise [23, 24]. The eye movements can bring a state of relaxation and a level of wakefulness [25]. Yoga-based meditation and yogic breathing also were beneficial in reducing mind wandering and anxiety and increasing attention [26, 27]. Mindfulness practices are effective and efficient techniques to improve cognitive function and reduce mind wandering [28]. Thus, yoga practices might have a potential role to play in managing visual strain and its consequences.

Trataka, a practice described in Hatha Yoga texts, involves fixing the gaze on a steady object until tears are shed. Traditional texts narrate the practice to be useful for eye disorders, fatigue, and insomnia [29]. A recent study indicated a beneficial role of trataka in improving sleep quality and reducing insomnia [30]. Studies done on trataka report a beneficial role in eye disorders but failed to elicit objective changes in refractive errors [31, 32]. There is a paucity of scientific studies on trataka in visual strain, for which it may potentially have a positive impact. Thus, we undertook the current study to evaluate the effect of trataka in reducing visual strain and promoting psychological well-being in participants subjected to prolonged use of digital displays due to studying from home due to the COVID-19 pandemic.

2. Materials and methods

2.1. Trial design

This study followed a single-center randomized, parallel-group trial. The subjects were divided into the experimental and control groups with an allocation ratio of 1:1.

2.2. Participants

Three hundred healthy volunteers from a university in South India were briefed about the study protocol, out of which 219 provided consent to participate in the study. The inclusion criteria were normal vision (6/6) on Snellen's chart, regular physical and psychological health assessed by a physician who otherwise had no role in the study. We included participants who used digital displays for more than 4 hours/day. We excluded volunteers who had any known eye disorders, including refractive errors, color blindness, glaucoma, cataract, or any history of ophthalmological surgeries. Participants with a known history of cognitive or neurological disorders, respiratory or cardiac, and sensory abnormalities were also excluded. We also did not include participants who had a habit of smoking or alcohol consumption. Finally, 110 subjects were recruited for the study and were randomly assigned to the experimental or control groups. In total, 106 participants completed the trial.

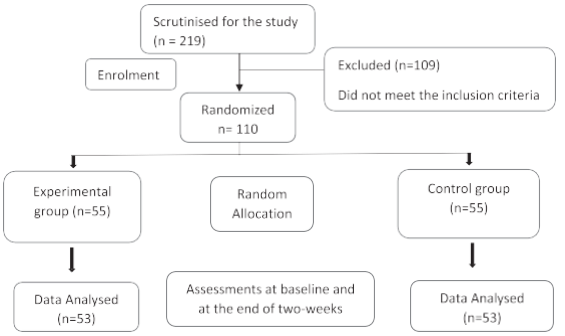

Fig. 1. Trial profile.

The schematic representation of the flow of the trial profile is presented in Fig. 1.

2.2.1. Sample size calculation

The sample size was calculated using G*Power computer program [33]. Recommended sample size in each group was 48 participants, considering a previous study on the effect of Yoga breathing on mind-wandering and mindfulness [27]. Alpha was 0.05, and the power was 0.8, and the effect size was found to be 0.58. Considering the possible attrition, we decided to take 55 participants in each group.

2.2.2. Randomization

The eligible participants were stratified based on gender before randomization. The random number sequences were generated using a web-based computer program (https://www.randomizer.org/). The allocation sequence was concealed using sequentially numbered, sealed, opaque envelopes. The study investigators and outcome assessor were blinded.

2.2.3. Ethical consideration and trial registration

The university's Institutional Ethics Committee approved the study. Written informed consent was obtained from individual participants before their recruitment to the study. The study was registered with the Clinical Trial Registry of India (https://ctri.nic.in). Trial number: CTRI/2021/01/030737

2.3. Intervention

2.3.1. Experimental group

The study was carried out for two weeks. The experimental group performed trataka for 20 min/day, six days/week, for two weeks. Throughout the practice, the participants were seated comfortably on the floor in the cross-legged position. The practice consists of 2 distinct stages. As a preparatory stage of trataka practice, eye exercises were done, including eyeball movements in the horizontal, vertical, and diagonal, and circular directions. These were performed with eyes open in a well-lit room. The duration of this stage of practice was 5 min. The second stage is the practice of gazing at the candle flame in a dark room, where the candle was placed at the participant's eye level at a distance of 2 meters. The participants were asked to fix their gaze on the candle's flame for about 2 to 3 minutes without blinking eyes. Then they were asked to visualize the candle flame between the eyebrows with closed eyes. This process was repeated for three rounds. Later, subjects were asked to defocus and practice concluded in silence with the prayer. This stage lasted for a total duration of 15 min. The instructions for the practice were played through a pre-recorded audio to maintain uniformity of the practice. Daily attendance was taken following the practice.

2.3.2. Waitlist control group

The control group participants were asked to continue their routine daily activities for the follow-up duration of two weeks. Following the two weeks, they were offered the same intervention as trataka.

2.4. Assessments

The impact of digital displays was assessed using the self-report measures as primary and secondary outcome variables. The primary outcome variable was a mind-wandering questionnaire (MWQ). The secondary outcome variables were a visual fatigue scale, self-reported fatigue, a symptom assessment checklist, and a State Mindfulness Attention Awareness Scale (SMAAS).

2.4.1. Visual Fatigue Scale (VFS)

The scale consists of six items: 1) I have difficulties in seeing; 2) I have a strange feeling around the eyes; 3) My eyes feel tired; 4) I feel numb; 5) I have a headache; 6) I feel dizzy looking at the screen. Each item was rated on a 10-point Likert scale [34].

2.4.2. Self-reported visual strain using a fatigue and symptom assessment checklist (VSC)

A specially designed checklist of the visual strain and fatigue symptoms was administered to the participants before and after two weeks of the practice of trataka and control groups.

2.4.3. Mind-wandering questionnaire (MWQ)

A reliable and validated five-item self-rated questionnaire, in which subjects were asked to fill up responses on a scale of 1 (almost never) to 6 (almost always); Cronbach's alpha = 0.850 [28]

2.4.4. State Mindfulness Attention Awareness Scale (SMAAS)

A reliable and validated tool to assess state mindfulness was administered to subjects. The questionnaire contains five questions to be answered on a scale of 1 (not at all) to 6 (very much); Cronbach's alpha = 0.92 [35].

2.4.5. Data extraction

For VFS, VSC, and MWQ, an average of all scores on the Likert scale was calculated and reported. For SMAAS: reverse scoring was performed for all items, and an average of all five values calculated for the final score.

2.4.6. Data analysis

The data were extracted using questionnaire manuals and organized in Microsoft Excel version 2016. Data analysis was done in JASP statistical package version 0.14.1 [36]. Data were analyzed for normality using Shapiro Wilk's test and were found to be not normally distributed. Thus, the Mann-Whitney U test was performed to compare the differences between groups. Wilcoxen Signed Rank test was performed for the within-group changes, and Spearman's rho was evaluated to determine correlations between the variables.

3. Results

Hundred and ten participants with a mean (SD) age 21.75 (2.48) years took part in the study with an allocation ratio of 1:1. Two participants each were lost to follow up from experimental and control groups. Finally, the data for 106 participants were analyzed. The demographic data are represented in Table 1.

Table 1
Demographic characteristics of the participants at baseline

	Experimental group	Control group	Total
Sample size	53	53	106
Male	10	11	21
Female	43	42	85
Age [mean (SD)]	20.85 (1.45)	22.64 (2.94)	21.75 (2.48)

3.1. Between group changes

The two groups did not significantly differ for all the variables at the baseline. There was a signifi- cant difference noted in the post values of MWQ scores ($p = 0.01$), VFS scores ($p = 0.002$), VSC scores ($p = 0.002$) and SMAAS scores ($p = 0.01$).

3.2. Within group changes

There was a reduction noted in MWQ, VFS, and VSC scores ($p < 0.001$) in the experimental group, along with an increase in SMAAS scores ($p < 0.001$). Significant reduction in the MWQ scores ($p < 0.001$) and VSC scores ($p < 0.05$), along with an increase in SMAAS scores ($p < 0.05$) were noted even in the control group. However, the magnitude of change was lower in the control group. The changes within and between-group are summarized in Table 2.

3.3. Correlations between the variables

Significant positive correlations were found between MWQ in VFS (Spearman's rho = 0.546; $p < 0.001$) and VSC (Spearman's rho = 0.508; $p < 0.001$). SMAAS scores were negatively correlated to MWQ scores (Spearman's rho = –0.675; $p < 0.001$) as well

Table 2
Summary of the results

Dependent variables	Experimental group ($n = 53$)		Control group ($n = 53$)		Between group p-values		Effect size
	Pre	Post	Pre	Post	Pre	Post	Between groups post values
MWQ	2.89 (1.02)	1.93 (0.78)***	2.69 (0.99)	2.39 (0.96)***	0.312	0.010	0.29
VFS	2.73 (1.72)	1.58 (1.16)***	2.56 (1.65)	2.45 (1.62)	0.535	0.002	0.35
VSC	2.15 (0.74)	1.62 (0.64)***	2.19 (0.79)	2.08 (0.92)*	0.842	0.002	0.35
SMAAS	4.68 (0.78)	5.32 (0.66)***	4.70 (0.79)	4.99 (0.72)*	0.982	0.010	0.29

Note: Within group changes were compared using the Wilcoxon paired rank test; between group changes werecompared using the Mann-Whitney U test; Effect size reported for between group changes for the post values. * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 3
Pairwise correlation between the dependent variables

Variable	MWQ	VFS	VSC	SMAAS
MWQ	–	0.546***	0.508***	–0.675***
VFS	0.546***	–	0.830***	–0.516***
VSC	0.508***	0.830***	–	–0.456***
SMAAS	–0.675***	–0.516***	–0.456***	–
Mean (SD)	**2.162 (0.903)**	**2.645 (1.677)**	**1.851 (0.823)**	**5.157 (0.708)**

Note: The values reported are for the Spearman's rho. *** = $p < 0.001$.

as VFS (Spearman's rho = –0.516; $p < 0.001$) and VSC scores (Spearman's rho = –0.456; $p < 0.001$). There was a strong positive correlation found between VSC and VFS scores (Spearman's rho = 0.830; $p < 0.001$). The correlation statistics are depicted in Table 3.

3.4. Adverse effects

Participants were encouraged to report any adverse effects to the investigators throughout the study. Other than two participants in the experimental group, who reported mild headache following the practice of trataka on the first day, no adverse events were reported.

4. Discussion

In the current study, the effect of the two-week practice of trataka was found to reduce self-reported mind wandering & Symptoms of Visual Strain along with enhanced state mindfulness. Further, we also noted a positive correlation between mind-wandering with symptoms of visual strain, and both were negatively correlated with state mindfulness. These findings indicate that the practice of trataka can be used to reduce visual strain and its consequences on psychological well-being. This is the first study assessing the effects of trataka on visual strain, mind-wandering, and mindfulness to the best of our knowledge.

Several benefits of the digital revolution are known. During the current COVID-19 pandemic, work and learning made us realize the umpteen possibili- ties associated with the digital revolution. However, excess use of digital displays has led to several physical and psychological implications, including increased visual strain and mind-wandering. A few studies have explored the possibility of the use of yoga techniques for managing such situations. A combination of yoga practices for sixty days reduced visual discomfort among computer professionals [22]. The six weeks of yoga-based eye exercise reduced optometry student's eye fatigue symptoms [24]. Another study indicated a reduction in visual fatigue among twenty nursing students following yoga practices [23]. The results of the current study concur with these earlier studies on yoga-based techniques for managing visual strain.

The reduction in mind-wandering and increased state mindfulness is similar to earlier studies on yoga practices such as yogic breathing [27] and meditation techniques [26]. A systematic review mentioned that yoga and meditation intervention nurture mindfulness and may be feasible and effective for building resilience in childhood and adolescence [37]. A randomized controlled trial showed meditation practice could increase mindfulness and reduced mind-wandering [38]. However, the effect of trataka on these domains was not explored before our study. Earlier studies on trataka have shown an improvement in cognitive performance and reduced anxiety [39, 40]. Such enhanced cognitive functions could be due to improved mindfulness and reduced mind wandering. The observations from our study indicate the beneficial role of trataka in such psychological domains.

The possible mechanism of action for reducing visual strain could be giving deep rest to the extraocular muscles through trataka. Traditional texts of Yoga describe the practice of trataka to induce such relaxation to the eyes [29]. Also, gazing at one point could reduce mind-wandering and increased mindfulness. Earlier studies indicate that the practice of trataka may lead to a meditative state of mind [41]. Besides, reduction in visual strain may have contributed to better mindfulness and reduced mind-wandering. Since mind-wandering and mindfulness are related to the emotional state of the individual [27, 42], the practice of trataka may have led to emotional regulation. Such positive emotional regulation is also associated with other yoga techniques [43, 44].

Working/studying from home has become the new normal. There are several ergonomic implications of working from home, such as musculoskeletal pain,

discomfort, as well as fatigue [1, 2]. Yoga practices could be helpful in such conditions [45]. The current study focused on the implication of prolonged digital display usage, and checking the effects of trataka on other physical discomforts was beyond the scope of the study. Other limitations of the study include using only self-rated questionnaires to assess visual strain, mindfulness, and mind-wandering and short follow-up duration. Future studies may explore the attention-related tasks as well as the neurological correlates of changes associated with trataka. The application of yoga practices for influencing ophthalmological disorders is in a nascent stage. Further studies on trataka with visual strain may use clinical assessment tools such as tear break-up time, corneal fluorescein staining, tear osmolarity, ocular scattering index, and an objective tool like the tear film thickness.

5. Conclusions

The practice of trataka was found to reduce the visual strain and mind-wandering while improving the state mindfulness. The practice can be implemented to mitigate visual strain and associated psychological implications due to prolonged exposure to digital displays, which has increased during the COVID-19 pandemic.

Conflict of interest

None to report.

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frontiers in Psychology

ORIGINAL RESEARCH
published: 17 December 2021
doi: 10.3389/fpsyg.2021.773049

Effect of *Trataka* (Yogic Visual Concentration) on the Performance in the Corsi-Block Tapping Task: A Repeated Measures Study

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Background and Objective: Attention and memory are essential aspects of cognitive health. Yogasanas, pranayama, and meditation have shown to improve cognitive functions. There has been no assessment of *Trataka* (yogic visual concentration) on working or on spatial memory. The present study was planned to assess the immediate effects of *Trataka* and of eye exercise sessions on the Corsi-block tapping task (CBTT).

Methods: A total of 41 healthy volunteers of both genders with age 23.21 ± 2.81 years were recruited. All participants underwent baseline assessment, followed by 2 weeks of training in Trataka (including eye exercise). Each training session lasted for 20 min/day for 6 days a week. After completion of the training period, a 1-week washout period was given. Each participant then was assessed in two sessions in *Trataka* and in eye exercise on two separate days, maintaining the same time of the day. Repeated measure analysis of variance with Holm's adjustment was performed to check the difference between the sessions.

Results: Significant within-subjects effects were observed for forward Corsi span andforward total score ($p < 0.001$), and also for backward Corsi span ($p < 0.05$) and backward total score ($p < 0.05$). *Post hoc* analyses revealed *Trataka* session to be better than eye exercises and baseline. The eye exercise session did not show any significant changes in the CBTT.

Conclusion: The result suggests that *Trataka* session improves working memory, spatial memory, and spatial attention.

Keywords: *Trataka*, yoga, shatkriya, kriya, Corsi-block tapping task, eye exercise, cognition, spatial memory

OPEN ACCESS

Edited by:
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Reviewed by:
Karin Matko, Technische Universität Chemnitz, Germany
Srikanth N. Jois, World Pranic Healing Foundation India, India

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Specialty section:
This article was submitted to Cognition, a section of the journal Frontiers in Psychology

Received: 09 September 2021
Accepted: 22 November 2021
Published: 17 December 2021

Citation:
Swathi PS, Bhat R and Saoji AA (2021) Effect of Trataka (Yogic Visual Concentration) on the Performance in the Corsi-Block Tapping Task: A Repeated Measures Study. Front. Psychol. 12:773049. doi:10.3389/fpsyg.2021.773049

INTRODUCTION

Yoga, an ancient Indian tradition, is aimed at all-round personality development (Taimni,2010). The practices in the discipline of yoga include yama and niyama (moral and ethical conduct), asana (physical postures), pranayama (regulated breathing), dharana, dhyana (meditation), and shuddhikriya (cleansing practices). Scientific research in recent times has explored the positive impact of yoga practices on various domains of physiology and psychology in healthy and therapeutic settings (Field,2016). One major area of interest in yoga research has been the effects of yoga practices on cognition and performance. Yoga practices appear to prevent neurodegeneration and enhance neuroplasticity by influencing specific brain areas involved with domains of cognition

such as hippocampus, amygdala, prefrontal cortex, insula, and default mode network (Marciniak et al.,2014;Gothe et al., 2019). A meta-analysis, which included fifteen RCTs and eight acute exposure studies, indicated the beneficial effect of yoga on cognition, attention, processing speed, and memory (Gothe and McAuley,2015).

Various aspects of cognition, such as spatial and visual memory scores (Joshi and Telles,2008;Garg et al.,2016;Gupta et al.,2019), verbal memory (Naveen et al.,1997), executive functions, attention, and concentration (Chattha et al.,2008), working memory (Subramanya and Telles,2009), response inhibition (Rajesh et al.,2014), visual attention (Jarraya et al., 2019), and task-switching (Anusuya et al.,2021), were found to be positively influenced through yoga practices such as yogasanas, pranayama, and meditation techniques. Yoga practice was found to be better than physical exercises in improving cognitive functions in school children (Vhavle et al.,2019).

The classical texts of *Hathayoga* described the profound impact of the six cleansing techniques on various aspects of one's personality, which are also validated through empirical studies (Muktibodhananda,1999;Swathi et al.,2020). *Trataka* (Yogic Visual concentration) is one of the cleansing techniques considered to enhance vision and positively influence cognitive processes. Since the process of *Trataka* involves focused attention on a candle flame, the practice leads to the mind becoming one-pointed and arouses inner vision (Muktibodhananda,1999). Earlier studies on *Trataka* and cognition have demonstrated enhanced performance in Stroop Task (Raghavendra and Singh, 2016;Sherlee and David,2020), Six Letter Cancelation, Trail Making tasks (Talwadkar et al.,2014), and Critical Flicker Fusion (Mallick and Kulkarni,2010). Considering the earlier studies on *Trataka* and cognition, we hypothesize that *Trataka* may positively influence the domains of cognition, such as spatial and working memory. Corsi-block tapping task (CBTT) is a neuropsychological test that measures visuospatial short-term and working memory. The task can be performed using a computer to collect the data with precision (Kessels et al., 2000;Siddi et al.,2020). Considering the wide use and ease of administration of CBTT, the current study was designed to evaluate the effect of *Trataka* on the performance in the CBTT.

MATERIALS AND METHODS

Participants

A total of 90 volunteers from a University in South India were briefed about the study protocol. Out of which, 60 consented to participate in the study. The inclusion criteria were normal vision (6/6) on Snellen's chart and regular physical and psychological health as assessed by a physician who, otherwise, had no role in the study. We included participants with prior experience of yoga practices other than *Trataka*. We excluded volunteers who had any known eye disorders, including refractive errors, color blindness, glaucoma, cataract, any ophthalmological surgeries, or presence of cognitive or neurological disorders, respiratory or cardiac, and sensory abnormalities. We also excluded participants who had a history of smoking or alcoholism. Finally, 41 subjects (8 male and 33 female) with their mean ($\pm$ SD) age 23.21 $\pm$ 2.81 years were recruited to the study. Out of the 41 subjects, 31 were pursuing their undergraduate education, 4 were graduates, and 6 had completed postgraduation. Their experience in yoga ranged between 1 and 7 years (mean $\pm$ SD = 3.98 $\pm$ 1.44).

Sample Size Calculation

The sample size was calculated using G*power where alpha was 0.05 and power was 0.8. The effect size was found to be 0.50 (Gupta et al.,2019). The recommended sample size resulted in being 33 participants for each session. Considering dropouts to be at about 25% during the training, we decided to have 41 participants for each session.

Ethical Consideration and Trial Registration

The Institutional Ethics committee approved the study of the university (Ref. No: RES/IEC-SVYASA/182-C/2021). Written informed consent was obtained from individual participants before their recruitment to the study. The study was registered with the Clinical Trial Registry of India (CTRI/2021/03/031872).

Trial Design

We executed a within-subject repeated measures design. All participants underwent baseline assessment, followed by 2 weeks of training in *Trataka* (including eye exercise). Each training session lasted for 20 min/day for 6 days a week. This orientation was administered to avoid individual variations in the practice. After completion of the training period, a 1-week washout period was given. Each participant then was assessed in two sessions in *Trataka* and in eye exercise on two separate days, maintaining the same time of the day (between 4 pm and 6 pm). The order of allotment of *Trataka* and eye exercise sessions was block randomized using a web-based random number generator[1]. Half the participants practiced *Trataka* on day 1, eye exercise on day 2 and vice versa. The CBTT was recorded following both the trial conditions (*Trataka* and eye exercise).

Intervention

Baseline

The participants were asked to give their baseline assessment without any intervention. On the day of baseline assessment, the participants were seated comfortably in a cross-legged position for 5 min prior to the commencement of the CBTT performance.

Trataka Session

Each *Trataka* session consisted of 20 min practice. Throughout the practice, the participants were seated comfortably on the floor in a cross-legged position. The practice consists of 2 distinct stages. Each *Trataka* session involved a preparatory stage of eye exercises for 10 min. These were performed with eyes open in a well-lit, soundproofed recording room in the laboratory. During this stage, the participants were asked to move the eyeballs in horizontal, vertical, diagonal, and circular directions. The second

[1] www.randomizer.org

stage is the practice of gazing at the candle flame in a dark room, where the candle was placed at the participant's eye level at a distance of 2 m. The participants were asked to fix their gaze on the candle flame for about 2 to 3 min without blinking their eyes. Then they were asked to visualize the candle flame between the eyebrows with closed eyes. This process was repeated for three rounds. Later, subjects were asked to defocus, and practice concluded in silence with a prayer. This stage lasted for a total duration of 10 min. A pre-recorded audio was used to maintain uniformity of the practice among participants.

Eye Exercise Session

The eye exercise session included eyeball movements in the horizontal, vertical, diagonal, and circular directions for 10 min followed by 10 min of quiet sitting with closed eyes. The eyes open part was performed in well-lit room, while the eyes closed part was performed by switching off the lights to maintain similarity of interventions.

Assessments

Corsi-Block Tapping Task

Corsi-block tapping task is a popular neuro-psychological task used to assess working and spatial memory. Nine blue squares appear on the screen. For each trial, the squares "light up" as yellow one by one in a varying sequence. After the presentation, the participants had to click each of the boxes in a similar order in which they have to "lit up" the first part of the task, i.e., forward tapping. In the second part of the task, they maintained the reverse order, i.e., backward tapping (Kessels et al.,2008). The task begins with a two-box sequence to a maximum of nine. The test gets terminated when the participant cannot remember the sequence for two consecutive trials at any one level. Hence, the test assesses the following four variables: (i) forward Corsi span, (ii) forward total score, (iii) backward Corsi span, and (iv) the backward total score. **Figure 1** illustrates the forward and backward CBTT.

Presentation of Corsi-Block Tapping Task

We assessed the participants at baseline, following *Trataka* and eye exercise sessions. The participants were asked to avoid caffeine consumption on all the assessment days as it may alter their cognitive abilities. The CBTT (Kessels et al.,2000, 2008) was presented using the INQUISIT software package 4.0 (Millisecond Software, LLC, Seattle, WA, United States) on a Dell desktop computer with a 21.5 color monitor. Uniform configuration was maintained for the computers on which the CBTT was presented to maintain the uniform processing speed. All participants received a practice session prior to the actual assessment session to familiarize themselves with the CBTT. The experiment was conducted individually in a room under standard fluorescent lighting in the research laboratory.

Data Analysis

The data were tabulated and data analyses were performed using JASP statistical package version 0.14.1[2]. The data were tested for normality and repeated measures (RM) ANOVA for within-subjects effects. *Post hoc* corrections were done using Holm's method for checking the differences between sessions.

[2] https://jasp-stats.org

RESULTS

All 41 participants (eight male) completed all three sessions. RM ANOVA demonstrated significant within-subjects effect in Forward Corsi Span $F(2,80) = 8.757$, $p < 0.001$; Forward total scores $F(2,80) = 11.377$, $p < 0.001$; Backward Corsi Span $F(2,80) = 3.629$, $p = 0.031$; Backward total scores $F(2,80) = 3.950$, $p = 0.023$. The within-subjects effects obtained through RM ANOVA are presented in **Table 1**.

Pairwise comparisons between the sessions performed through RM ANOVA with Holm's corrections demonstrated significantly higher scores following *Trataka* sessions when compared with baseline for Forward Corsi Span, $t = 4.11$, $p < 0.001$; Forward Total Score, $t = 4.76$, $p < 0.001$; and Backward Total Score, $t = 2.74$, $p < 0.05$. Scores following the *Trataka* session were significantly higher than following Eye exercises for Forward Corsi Span, $t = 2.74$, $p < 0.05$; Forward Total Score, $t = 2.65$, $p < 0.05$. The scores increased from baseline, following Eye exercise only for Forward Total Scores, $t = 2.10$, $p < 0.05$. The effect sizes and *t*-values for between sessions using RM ANOVA with Holm's correction along with the group mean and SD are reported in **Table 2**.

DISCUSSION

The current study was designed to elicit if the practice of *Trataka* affects the working and the spatial memory through the performances in the CBTT. All the four measures, viz., forward and backward Corsi spans, and total scores, demonstrated significance within the subject's effect. The Corsi span and total scores were higher following *Trataka* while comparing with baseline and Eye exercises. Scores following eye exercises and baseline sessions were insignificant except in Forward total score. The forward span and total score of CBTT measure material-specific slave systems. The backward test measures primarily tax central executive resources (Monaco et al.,2013). Thus, improvements in both forward and backward span and total scores indicated a positive effect of *Trataka* on working, spatial memory, and executive functions while comparing with baseline and eye exercises.

Earlier studies on *Trataka* and cognition have shown improvements in the domains of selective attention, cognitive flexibility, and response inhibition through the Stroop task (Raghavendra and Singh,2016;Sherlee and David,2020). Another study shown improvement in the performance of critical flicker fusion after the immediate practice of *Trataka* in 35 volunteers (Mallick and Kulkarni,2010). After the practice of *Trataka* for 26 days, the performances of the digit span test, the six-letter cancelation test, and the trail making test significantly improved in thirty elderly subjects compared to the waitlist control group (Talwadkar et al.,2014). Thus, improvements

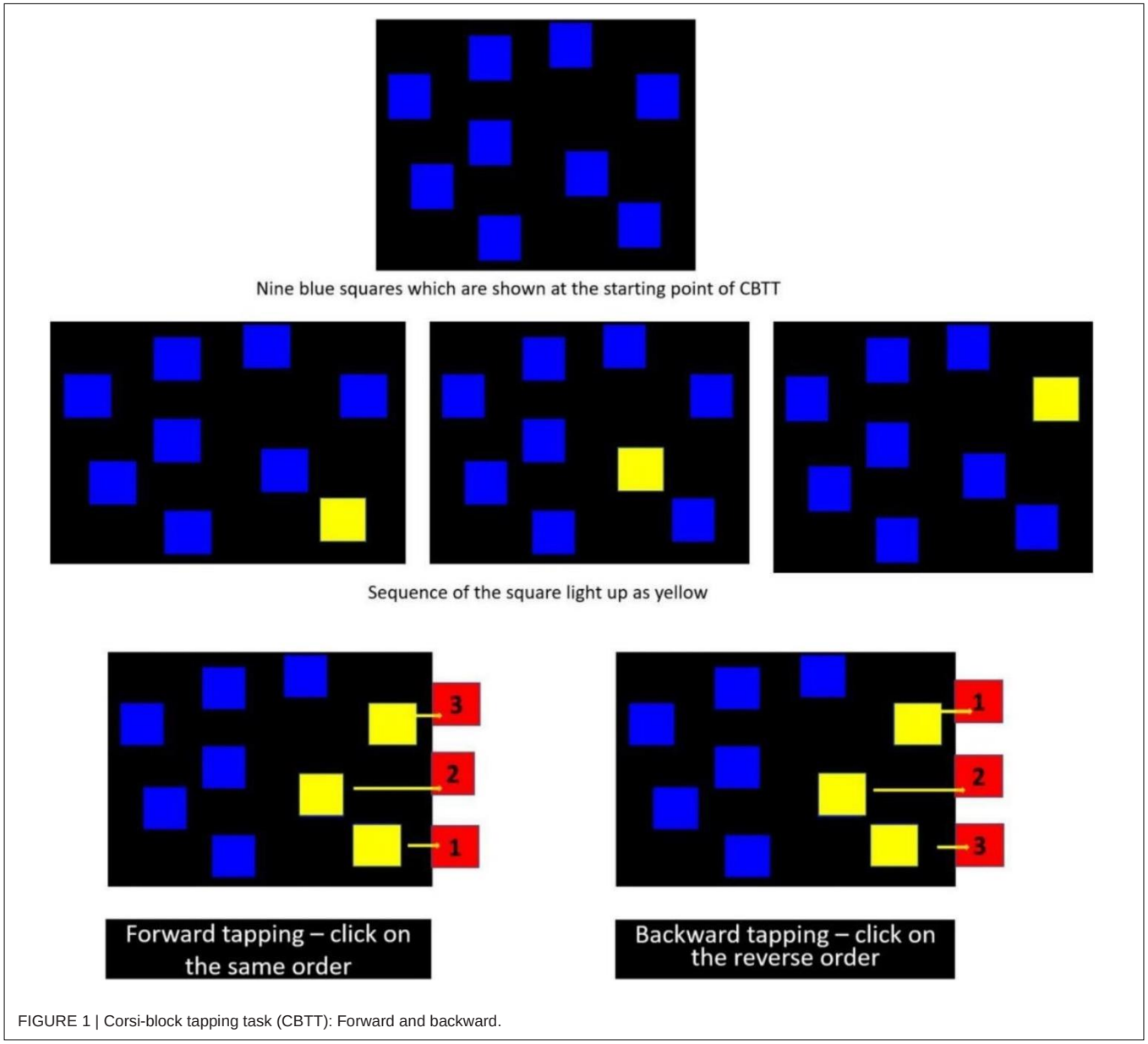

FIGURE 1 | Corsi-block tapping task (CBTT): Forward and backward.

TABLE 1 | Results of repeated measures analysis of variance for within-subjects effects.

Variable	*F*	df	*P*	Partial η^2
Forward Corsi span	8.757	2, 80	<0.001	0.180
Forward total score	11.377	2, 80	<0.001	0.221
Backward Corsi span	3.629	2, 80	=0.031	0.083
Backward total score	3.950	2, 80	=0.023	0.090

noted in our study in the cognitive abilities following *Trataka* are similar to the earlier studies.

Trataka practice is indicated to positively influence cognition from both classical texts of yoga (Muktibodhananda,1999) and empirical studies (Swathi et al.,2020). Although classified as a cleansing procedure, the practice of *Trataka* is similar to focused meditation techniques. Earlier studies on meditation for a total duration of 8 weeks shown decreased negative mood and enhanced attention, working memory, and decreased state anxiety on the trier social stress test (TSST) in population naive to meditation practice (Basso et al.,2019). Another focused attention meditation showed significant improvement in working memory in the reading span test and in activation of bilateral dorsolateral prefrontal cortex (DLPFC) during the intervention in the experimental group (Yamaya et al.,2021). Similarly, other Yoga interventions showed improved cognitive communicative abilities (Namratha et al.,2017).

The improvement in the performance of CBTT may have been mediated through relaxation, attained through the

TABLE 2 | Pairwise comparisons between sessions for the performance in Corsi-block tapping task (CBTT) using repeated measures ANOVA with Holm's

Variables	Baseline	*Trataka*	Eye exercise	Baseline vs. *Trataka*			Baseline vs. Eye exercise			*Trataka* vs. Eye exercise		
				t value	*p* value	Cohen's	*t* value	*p* value	Cohen's	*t* value	*p* value	Cohen's
Forward Corsi span	5.5 ± 0.8	6.1 ± 0.9	5.7 ± 1.0	−4.11	<0.001	0.642	−1.37	=0.17	0.214	2.74	<0.05	0.428
Forward total score	44.26±15.59	56.95 ± 17.77	49.87 ± 18.60	−4.76	<0.001	0.743	−2.10	<0.05	0.329	2.65	<0.05	0.415
Backward Corsi span	5.9 ± 0.4	6.1 ± 0.4	5.8 ± 0.7	−2.22	=0.06	0.348	−0.20	=0.84	0.032	2.43	=0.052	0.379
Backward total score	51.41 ± 10.67	56.68 ± 10.91	52.97 ± 11.67	−2.74	<0.05	0.427	−0.81	=0.42	0.127	1.92	=0.115	0.301

practice of *Trataka* (Raghavendra and Ramamurthy,2014). The possible mechanisms for improving working and spatial memory following the *Trataka* session could be the process of *Trataka* itself, involving focused attention. This focused attention is also elaborated in the *Yoga Sutras* (aphorisms) of *Patanjali* (Taimni,2010). A recent study has also demonstrated enhanced mindfulness, attention, and reduced mind-wandering with the practice of *Trataka* (Swathi et al.,2021). Thus, improved working memory found in our study could be due to a reduction in mind-wandering and enhanced focusing. The prefrontal cortex is associated with memory, attention, executive functions, and various other complex cognitive functions (Miller,2000). Thus, the results following the *Trataka* session could be due to activation of the prefrontal cortex. However, further studies with neuroimaging techniques may be required to confirm this mechanism of action.

Another possible mechanism could be a surge in melatonin release due to practice in the dim light. It is known that bright light tunes the suprachiasmatic nucleus (SCN) that regulates the circadian rhythm. Exposure to bright light impedes the melatonin synthesis, whereas the dim light initiates the surge in melatonin release (Zisapel,2018). Melatonin has been found to positively influence learning and memory (Zakaria et al.,2016). Thus, further studies on *Trataka* may assess the serum melatonin levels as one of the variables.

Our study indicated a beneficial role of *Trataka* in enhancing the CBTT performance in healthy volunteers. CBTT performance is commonly altered in neurodegenerative disorders such as early-stage Parkinson's (Stoffers et al.,2003) and Alzheimer's disease (Guariglia,2007). Thus, future studies may be planned in a clinical population, where the CBTT performance is compromised.

Using a repeated measures design for immediate effect is one of the strengths of the study. We also used a computer-based program to execute CBTT, which enabled robust results (Brunetti et al.,2014). The limitation of the study includes not incorporating a neuro-imaging technique, which has limited our ability to predict the exact mechanism of action. Thus, future studies on *Trataka* and cognitive performance should include neuroimaging techniques. Another major limitation of the study is control condition which had eye exercise for 10 min followed by 10 min of quiet sitting in which they were told not to meditate. However, we are not sure if during quiet sitting, if they focused on breathing or let their mind wandered freely. We could not get an equal number of male and female participants and were also unable to study the impact of long-term practice of *tataka*. Lastly, the effect of *Trataka* in a population with mild cognitive decline could be studied in future.

CONCLUSION

The results of this study indicated a positive impact of the *Trataka* session on the CBTT, indicating enhanced working memory, spatial memory, and spatial attention among the subjects compared to the baseline and eye exercise sessions.

Thus, *Trataka* could be used to improve memory and attention in young adults.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Swami Vivekananda Yoga Anusandhana Samsthana. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

PS was involved in conceptualization, execution, data collection, and writing and editing of the manuscript. RB was involved in conceptualization, data analysis and interpretation, and writing and editing of the manuscript. AS was involved in conceptualization, data collection, analysis and interpretation, and writing and editing of the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

The authors gratefully acknowledge Swami Vivekananda Yoga Anusandhana Samsthana (Deemed to be University), Bengaluru, for the funding.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.