

STATE ANXIETY, MINDFULNESS AND HEART RATE VARIABILITY DYNAMICS IN HEALTHY ADULTS

Dissertation submitted by

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Under the Guidance of

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TO

**SWAMI VIVEKANANDA YOGA ANUSANDHANA SAMSTHANA
(S-VYASA)**

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

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DECLARATION

I, hereby declare that this study was conducted by me at Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA), Bengaluru, under the guidance of Dr. Raghavendra Bhat, Assistant Professor, S-VYASA University Bengaluru.

I also declare that the subject matter of my dissertation entitled “State Anxiety, Mindfulness and Heart Rate Variability Dynamics in Healthy Adults” has not previously formed the basis of the award of any degree, diploma, or similar titles.

Date: 17/12/2016

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Date: **17/12/2016**

Place: Bengaluru

Jintu Kurian

CERTIFICATE

This is to certify that Ms.Jintu Kurian is submitting this literature review “**Concept of Mindfulness**” and Experimental Research on “**State Anxiety, Mindfulness and Heart Rate Variability Dynamics in Healthy Adults**”, towards the partial fulfillment of the requirement for the Master of Science in Yoga By Swami Vivekananda Yoga Anusandhana Samsthana (SVYASA) and this is a record of work carried out by him in this Institute.

Place: Bangalore

Dr. Raghavendra Bhat

Date: 17/12/2016

Guide

**STANDARD INTERNATIONAL TRANSLITERATION CODE USED TO
TRANSLITERATE SANSKRIT WORDS**

a	=	अ	ña	=	ळ	pa	=	प
ā	=	आ	ca	=	च	pha	=	फ
i	=	इ	cha	=	छ	ba	=	ब
ī	=	ई	ja	=	ज	bha	=	भ
u	=	उ	jha	=	झ	ma	=	म
ū	=	ऊ	ñ	=	ञ	ya	=	य
e	=	ए	ṭa	=	ट	ra	=	र
ai	=	ऐ	ṭha	=	ठ	la	=	ल
o	=	ओ	ḍa	=	ड	va	=	व
au	=	औ	ḍha	=	ढ	sa	=	स
m	=	अं	ṇa	=	ण	śa	=	श
ḥ	=	अः	ta	=	त	ṣa	=	ष
ka	=	क	tha	=	थ	ha	=	ह
kha	=	ख	da	=	द	kṣa	=	क्ष
ga	=	ग	dha	=	घ	tra	=	त्र
gha	=	गं	na	=	न	jña	=	ज्ञ

ABSTRACT

State anxiety, mindfulness and heart rate variability dynamics in healthy adults

Background

India is currently facing disorders in lifestyle, and resulting physical, mental, and social disharmony such anxiety, stress, worries, lack of awareness, variations in the heart rate. The epidemiological studies shows a hike from communicable diseases to non-communicable diseases indicating that the adults are more prone for anxiety related, mindfulness related and heart rate related issues.

Introduction

Mindfulness has been conceptualized as the process of bringing attention and awareness to objects within the experience of the present moment with a non-judgmental and non-evaluative acceptance and openness. State anxiety (SA) can be conceptualized as “a state in which an individual is unable to instigate a clear pattern of behavior to remove or alter the event/object/interpretation that is threatening an existing goal. Heart rate variability (HRV) refers to beat to beat alterations in the heart rate and is associated with cardiac autonomic regulation.

Correlational study design was used. Eighty three subjects were assessed using state anxiety and mindfulness questionnaire and heart rate variability measurement. There was no intervention, since our objective was to understand correlation between mindfulness, state anxiety and heart rate variability.

Result: SMAAS, STAI and HRV were assessed to understand the correlation between these three variables. Results showed significant high negative correlation between SMAAS and STAI. STAI and LF of HRV is positively correlated whereas SMAAS and LF is negatively correlated. There was a significant moderate negative correlation between STAI and HF, whereas SMAAS is positively correlated with HF. And also, there was a significant moderate positive correlation between STAI and LF/HF ratio and negative correlation between SMAAS and LF/HF ratio.

Conclusion: There was a significant moderate negative correlation between STAI and, whereas SMAAS is positively correlated with HF. And also, there was a significant moderate positive correlation between STAI and LF/HF ratio and negative correlation between SMAAS and LF/HF ratio.

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1.0 INTRODUCTION

MINDFULNESS

Mindfulness is defined as the awareness emerging through paying attention on the present moment, or on the purpose, being nonjudgmental to the opening up of moment to moment experiences. Mindfulness is being widely applied in clinical psychology. It is gaining popularity worldwide as being found effective in dealing with clinical interventions. Mindfulness based stress reduction is a 8 week intervention session to be practiced daily.(Kang & Whittingham, 2010)

The understanding of mindfulness has got its origin from Buddhist traditions. Studies show that mindfulness is been found to be effective for both clinical and non-clinical problems. The common disorders like pain, depression, anxiety and even major problems like cancer has been found to have got relief as a part of mindfulness practice. .(Kang & Whittingham, 2010)

Mindfulness was introduced by John Kabat Zinn as a therapeutic practice and was practiced as MBSR in three therapeutic ways: mindfulness-based cognitive therapy (MBCT), Acceptance and commitment therapy (ACT), and dialectical behavioral therapy (DBT). Formal mindfulness being practiced in sitting position is done in MBSR and MBCT. In ACT and DBT behavioral strategies are used along with formal mindfulness practice. ACT is used only in clinical psychology.(Kang & Whittingham, 2010)

Mindfulness can build a focused awareness practices through an improved left-brain concentration skills. It can also build more holistic skills. Mindfulness meditation has been proven to have beneficial effects on brain and body. Mindfulness is all about experiencing the present moment at the best you can at any given time. (Susan Kaiser, 2010) Mindfulness is an attribute of consciousness, which is been believed since long to promote our well-being (PsycINFO Database Record (c) 2016).

Mindfulness takes us through that ride of the integration of both the left and the right side of the brain. It also develops kindness and compassion for our self, for others and also for the world around us. Traditional way of mindfulness teaches about involving inner experience, outer experience and both together, (“Mindfulness for Children,” 2010).

Mindfulness has many important benefits. It enhances one’s life and ability to deal with tough experiences and certain conditions such as stress, anxiety, and depression. It also improves self-understanding. (Deborah Bowden2011)Mindfulness acts as a protection against emotional exhaustion at home and at work .(Daniel J. Siegel ,et al, 2010).

Vipassana is a kind of mindfulness meditation which is found to have its drastic impact on heart rate variability (HRV), which is a Psycho physiological marker of both the mental and physical health (Heathers JA, et al)Mindfulness practice is more cognitive, aiming for a present-centered awareness which is non elaborative and nonjudgmental. Its central component involves self-regulation of attention to control concentration. It also focuses on stress reduction and positive state elevation.(Deborah Bowden , 2011).

Mindfulness-based stress reduction (MBSR) is a systematic training in meditation that enable people to self-regulate their reactions to stress and the negative emotions. (Brown & Ryan, 2003). Studies suggest that MBSR may be effective in reducing stress, anxiety, and distress (Carmody & Baer, 2008; Roth & Robbins, 2004).

Mindfulness is an attribute of consciousness long believed to uplift the awareness in daily living activities. Research based studies on mindfulness provides a theoretical test to know the role of mindfulness in psychological well-being. Correlational, quasi-experimental, and laboratory studies show that the MAAS measures a unique quality of consciousness which is in turn related to the well-being constructs, which differentiates mindfulness practitioners from others, and that is associated with enhanced self-awareness. (Brown, Kirk Warren; Ryan, Richard M. 2003)

Finally, a clinical intervention study with cancer patients demonstrates that increases in mindfulness over time relate to declines in mood disturbance and stress. (PsycINFO Database Record (c) 2016). Researches projected out theoretical and empirical examination of the impact of mindfulness in mental well-being.

MAAS measures the self-awareness, unique quality of consciousness that is related to a variety of well-being constructs, that differentiates mindfulness practitioners from others.

State mindfulness is an important state that predicts the self-regulated behavior and positive emotional states of individuals. A clinical intervention study with cancer patients

demonstrated an increase in mindfulness over time in relation to reduction in stress and mood disturbances. (Brown, K. W., & Ryan, R. M. 2003)

STATE ANXIETY

Anxiety can be defined as an emotional disorder with uncomfortable emotional states in which one may perceive danger, feels powerless, and experiences tension in preparing for an expected danger. (Nemati, A. 2013)

Today's ever-changing, technologically advanced, and competitive environment is found to cause lot of stress and anxiety in human. Excessive and frequent anxiety can impair normal living functioning. Spiel Berger defines anxiety as the subjective feeling of tension, apprehension, nervousness, and worry, associated with an arousal of the autonomic nervous system. (Spielberger, C. D.2010).

The central characteristic of anxiety is worry. Anxiety has a negative effect on aspects such as, social, personal, and academic performance. Psychologists categorize anxiety into state, trait, and situation specific anxiety. Trait anxiety is chronic and pervasive across situations and is not triggered by specific events. (Huberty, T. J. 2009)

Anxiety is a negative emotional response to threatening circumstances. State anxiety (SA) can be conceptualized as “a state in which an individual is unable to instigate a clear pattern of response or behavior towards an object or an event that threatens the goal”. The neural organization of anxiety spans multiple levels of the brain, from somatic integration of the limbic system, which is a complex mechanism, to the elementary adaptive function of the brainstem. Anxiety is associated with elevated high blood pressure, increased respiratory rate, heart rate. Autonomic nervous system (ANS) is a key system that involved in the generation of this physiological arousal. The ANS responds both to central stimuli and to activation of reflex sensory inputs (Dimitriy, 2016)

State anxiety can be conceptualized as a response to a particular anxiety provoking stimulus. (Young, D. J. 1994). State anxiety is the anxiety being felt at the present moment of time. It occurs as a response to a definite situation. Situation-specific anxiety has been used to emphasize the multifaceted and persistent nature of some anxieties. (Young, D. J. 1994). It is usually aroused at specific situations, such as public speaking, class Tests etc. (Spiel Berger and Sarason, 1989)

A situation-specific trait refers to the anxiety states and worry conditions are that experienced during an examination. (Hobfoll, S. E. 1989). Test anxiety, then, is a debilitating experience of anxiety during the preparation for a test or during the test itself. As mentioned by Jing (2007), research on test anxiety has identified three models that explain the origin of test anxiety. (Nemati, A. 2013). In the first model called learning-deficit model, the problem lies not in taking the test, but in preparing for the test. This model identifies the students with high test anxiety, who tend to have or use inadequate learning or study skills, while preparing for their examination. (Nemati, A. 2013). The second model is the interference model. This model focus that, during the test students with test anxiety focus on task-irrelevant stimuli, which negatively affect the performance. (Pugh, C. M., Obadina, E. T., & Aidoo, K. A, 2009). This interference can be classified into two: physical distraction, and inappropriate cognition. The examples for physical distraction and inappropriate cognition are Sweaty palms and muscle tension, and stating “I am stupid, I won’t pass” or “others are finishing before me”. The third model of test anxiety includes people who think they have prepared adequately well for a test, but in reality they have not. These people question their abilities after the test, which creates anxiety during the following test. Whatever is the cause for test anxiety, it affects the learning. (Fortney, J. C., Harman, J. S., Xu, S., & Dong, F. 2009).

State Anxiety disorders are a major worldwide health problem that affect a large number of individuals every year. (Fortney, J. C., Harman, J. S., Xu, S., & Dong, F. 2009). Stress and anxiety are the most contributing factors for many chronic diseases. In turn it results in disharmony of even quality of life, worsen the disease and treatment. Anxiety is a state of Disturbed thought process that usually results from stress. (Amber W. Li, 2012)

HEART RATE VARIABILITY

Heart rate variability (HRV) shows the function of the heart and influences of autonomic and other physiological systems on HRV. The measurement of HRV is recorded using ambulatory electrocardiograph (ECG). ECG is a useful method used for both scientific and clinical investigation purposes. (J Zntern Med, 1995)

Heart rate variability is measured by linear and non-linear methods, and various other methods. HRV analysis in clinical cardiology is its measurement in post infarction patients, in whom abnormal HRV indicates an increased chances for cardiac problems. (H. V. HUIKURI, 1995)

Physiological basis of heart rate variability

The power of high frequency (HF) oscillations are related to respiration. It provides information about the phasic efferent vagal input to the heart. The High frequency Oscillations of heart rate is modulated mainly by the central nervous system and pulmonary afferent stimuli. Baroreceptors, sensory mechanoreceptors, and chemoreceptors are located throughout the large vessels. The peripheral vasculature and the ventricles of the heart, modulate the Low Frequency and Very Low Frequency oscillations of heart rate. (H. V. HUIKURI, 1995)

Pathological states of heart show abnormalities in the different components of HRV. That may not be directly commented as increased or decreased efferent activity in specific limbs of the autonomic nervous system. The reductions in the autonomic modulation of heart rate and the different components of HRV may be more complex in pathological conditions which is not yet completely understood. (H. V. HUIKURI, 1995)

Heart rate variability has been mostly seen to be studied on post infarction and myocardial infarction cases. In the very early post infarction phase, HRV is found as reduced both in the inferior and in the anterior myocardial infarction (H. V. HUIKURI, 1995)

Yoga is a holistic way of life leading to a state of complete physical, social, mental, and spiritual well-being and harmony with nature. Yoga is a subject of research for the past few decades on its therapeutic benefits and the influence of yoga on certain modern epidemic diseases like anxiety, mental stress, obesity, Diabetes, hypertension, and many other diseases. Individual studies are found to have shown drastic effect of yoga in these conditions, specially anxiety and stress. (Taneja DK, 2013)

WHY THIS STUDY

There are various studies on mindfulness, state anxiety, and heart rate variability in healthy as well as various diseased conditions but there is a lack of studies on evaluating and comparing the co-relation between mindfulness, state anxiety and heart rate variability in healthy volunteers who are new to yoga field.

2.0 ANCIENT LITERATURE REVIEW

CONCEPT OF MINDFULNESS IN TRADITIONAL TEXTS

That is mind has five modifications; direct sense perception, wrong knowledge, mere verbal idea, deep sleep with or without dreams and memory; the store house of all the past experiences at unconscious, subconscious and super conscious states. Thoughts are conceived as waves in the ocean of pure consciousness. As waves come up and diffuse, in mind waves of thoughts come up and diffuse, these waves could be violent or calm(Stayananda sarawati.,2008)

According to Bhagavat Gita

चञ्चलं हि मनः कृष्ण प्रमाथि बलवद्दमम् ।

तस्याहं निग्रहं मन्ये वायोरिव सुदुष्करम् ॥ भ-गी-६-३४ ॥

cañcalaṁ hi manaḥ kṛṣṇa pramāthi balavhṛdham ।

tasyāhaṁ nigrahaṁ manye vāyoriva suduṣkaram ॥ bha-gī-6-34 ॥

For the mind is restless, turbulent, obstinate and very strong, O Kṛṣṇa, and to subdue it is, it seems to me, more difficult than controlling the wind.

ज्यायतो विषयान्पुंसः सङ्गस्तेषुपजायते ।

सङ्गात्सञ्जायते कामः कामात्क्रोधोऽभिजायते ॥ भ।गी-२-६२ ॥

क्रोधाद्भवति सम्मोहः सम्मोहात्स्मृतिविभ्रमः ।

स्मृतिभ्रंशाद् बुद्धिनासो बुद्धिनाशात्प्रणश्यति ॥ भ।गी- २।६३ ॥

jyādhato viṣayānpumsaḥ saṅgasteṣupajāyate।

saṅgātsaññājate kāmahaḥ kāmātkrodho'bhijāyate।। bha।gī-2-62।।

krodhādbhavati sammohaḥ sammohātsmṛtivibhramaḥ।

smṛtibhramśād buddhināso buddhināśātpraṇaśyati।। bha।gī- 2।63।।

When a man thinks of the objects of desire, attachment for them arises; from attachment is born; from desire anger arises. it explains that those who have strong sense of identity with their mind-body complex and sense of doership, they keep thinking about sense object again and again. Slowly because of this repeated thought pattern they develop longing or inclination for those sense object. One can get the nine obstacles in his life journey. These are: illness, the lack of strength and will power, doubt, lack of attention, laziness, under control of sensory organs, illusion, frustration, and instability of mind.

क्रोधाद्भवति सम्मोहः सम्मोहात्स्मृतिविभ्रमः ।

स्मृतिभ्रंशात् बुद्धिनाशो बुद्धिनाशात्प्रणश्यति ॥भ-गी-२-६३ ॥

krodhādbhavati sammohaḥ sammohātsmṛtivibhramaḥ।

smṛtibhramśāta buddhināśo buddhināśātpraṇaśyati।। bha-gī-2-63।।.

From anger comes delusion; from delusion loss memory; from loss of memory the destruction of discrimination; from the destruction of discrimination he perishes.

प्रजहाति यदा कामान्सर्वान्पार्थ मनोगताम् ।

आत्मन्योवात्मना तुष्टः स्थितप्रज्ञस्तदोच्यते ॥भ-गि-५५ ॥

prajahāti yadā kāmānsarvānpārtha manogatām|

ātmanyovātmanā sthitaprajñastadocyate||bha-gi-55||

When aman completely casts off, o Arjuna, all the desires of the mind and is satisfied in the Self by the self, then is he said to be one of steady wisdom.

यततो ह्यपि कौन्तेय पुरुषस्य विपश्चितः ।

इन्द्रियाणि प्रमाथीनि हरन्ति प्रसभं मनः ॥२-६० ॥

yatato hyapi kaunteya puruṣasya vipaścitaḥ|

idriyāṇi pramāthīni haranti prasabham manaḥ||2-60||

The senses are so strong and impetuous, O arjuna, that they forcibly carry away the mind even of a man of discrimination who is endeavoring to control them. There are many learned sages, philosophers and transcendentalists who who try to conquer the senses , but in spite of their endeavors, even the greatest of them sometimes fall victim to material sense enjoyment due to the agitated mind. Even visvāmitra, a great sage and perfect yogi, was misled by menakā into sex enjoyment.

इन्द्रियाणि मनो बुद्धिर् अस्याधिष्ठानम् उच्यते ।

एतैर् विमोहयत्य् एष ज्ञानम् आवृत्यद् देहिनम् ॥३-४० ॥

indriyāṇi mano buddhir asyādhiṣṭhānam ucyate|

etair vimohayaty eṣa jñānam āvrtyad dehinam||3-40||

The senses, the mind and intelligence are the sitting place of the lust. Which veils the real knowledge of the living entity and bewilders him. Mind is the center of all the activities of the senses, and as a result, the mind is the reservoir of all the ideas of sense, gratification and a results, the mind and the senses become the repository of the lust. Next, the intelligence department, the capital of such lustful propensities.

इन्द्रियाणां हि चरताम् यन्मनोऽनुविधीयते ।

तदस्य हरति प्रज्ञाम् वायुर्नावमिवाम्भसिज्ज ॥२-६७ ॥

indriyāṇāṃ hi caratām yanmano'nuvidhīyate|

tadasya harati prajñām vāyurnāvamivāmbhasiñña||2-67||

For the mind, which follows in the wake of the wandering senses, carries away his discrimination as the wind carries a boat on the waters.

असंशयं महाबाहो मनो दुर्निग्रहं चलम् ।

अभ्यासेन तु कौन्तेय वेराग्येण च गृह्यते ॥६-३५ ॥

asamśayaṃ mahābāho mano durnigrahaṃ calam|

abhyāseṇa tu kaunteya veirāgyeṇa ca gṛhyate||6-35||

Undoubtedly, O mighty-armed, the mind is difficult to control and is restless;but, by practice, O Son of Kunti, and by dispassion it is restrained.

यं हि न व्यथयन्त्येते पुरुषं पुरुषर्षभ ।

समदुःखसुखं धीरं सोऽमृतत्वाय कल्पते ॥१५ ॥

yam hi na vyathayantye te puruṣam puruṣarṣabha |

samaduḥkhasukham dhīraṁ so'mṛtatvāya kalpate ||15||

O best among men(arjuna), the person who is not disturbed by happiness and distress and steady and issteady in both is certainly eligible for the liberation.

न बुद्धिभेदं जनयेदज्ञानां कर्मसङ्गिनाम् ।

जोषयेत्सर्वकर्माणि विद्वान्युक्तः समाचरन् ॥२६ ॥

na buddhibhedam janayedajñānāṁ karmasaṅginām |

joṣayetsarvakarmāṇi vidvānyuktaḥ samācaran ||26||

Let not the wise disrupt the minds of the ignorant who attached to fruitive action. They should not be encouraged to refrain from work, but to engage in work in the spirit of devotion.

उद्धरेदात्मनात्मानाऽऽत्मानं नात्मानमवदयेत् ।

अत्मैव ह्यात्मनो बन्धुरात्मैव रिपुरात्मनः ॥५ ॥भ ।गी ।६ ॥

uddharedātmanātmānā"tmānaṁ nātmānamavādayet |

atmaiva hyātmano bandhurātmaiva ripurātmanaḥ ||5||bha|gī|6||

A man must elevate himself by his own mind, not degrade himself. The mind is the friend of conditioned soul, and his enemy as well. The purpose of the yoga system is to control the mind and to draw it away from attachment to sense objects. In material existence one is subjected to the influence of the mind and the senses. The more one is attracted by sense objects, the more one becomes entangled in material existence. The best way to disentangle oneself is to always engage the mind in Krishna consciousness.

प्राणापानौ समौ कृत्वा नासाभ्यन्तरचारिणौ ॥२७॥

यतेन्द्रियमनोबुद्धिर्मुनिर्मोक्षपरायणः ।

विगतेच्छाबयक्रोधो यः सदा मुक्त एव सः ॥२८॥भ।गी।-५॥

sparśānkr̥tvā bahirbāhyāṁścakṣuścaivāntare bhruvoḥ|

prāṇāpānau samau kr̥tvā nāsābhyntaracāriṇau||27||

yatendriyamanobuddhirmunirmokṣaparāyaṇaḥ|

vigtecchābayakrodho yaḥ sadā mukta eva saḥ ||28||bha|gī|-5||

Shutting out all external sense objects, keeping the eyes and vision concentrated between the two eyebrows, suspending the inward and outward breaths within the nostrils-thus controlling the mind, senses and intelligence, the transcendentalist becomes free from desires, fear and anger. One who is always in this state is certainly liberated.

योगिनो यतचित्तस्य युञ्जतो योगमात्मनः ॥२९॥भ।गी।६॥

yathā dīpo nivāstho neṅgate sopamā smṛtā|

yogino yatacittasya yuñjato yogamātmanah||19||bha|gī|6||

As a lamp placed in a windless spot does not flicker—to such is compared the Yogi of controlled mind, practising Yoga in the Self (or absorbed in the Yoga of the Self).

According to Patanjili yoga sutra

योगश्चित्तवृत्तिनिरोधः ॥ प-यो-सु-१-२ ॥

yogascitavṛttinirodhaḥ|| pa-yo-su-1-2||.

Yoga is the restriction of transformations of mind. We get information from the external world through our sensory organs and we perform actions through our organ of action . In between these two , we have an internal mechanism known as antahkarana ,which is referred to as consciousness or citta . the antahkarana has four facets . they are mind (manas) , buddhi (intellect) , ahankara (ego) , and chitta (consciousness).The mind is referred to as a monkey. There will be a constant activity going on in the mind. The only time the mind rests is during sleep. When the mind is not working, the person will experience extreme happiness. Essentially, man wants to be happy all the time. However, he can not afford to sleep all the time. Through yoga he learn how to rest the mind when he is awake.

प्रमाण विपर्यय विकल्प निद्रा स्मृतयः । प-यो-सु-१-६ ॥

pramāṇa viparyaya vikalpa nidrā smṛtayaḥ| pa-yo-su-1-6||

The mind has five modifications; direct sense perception, wrong knowledge, mere verbal idea, deep sleep with or without dreams and memory; the store house of all the past experiences at unconscious, subconscious and super conscious states. Thoughts are conceived as waves in the

ocean of pure consciousness. As waves come up and diffuse, in mind waves of thoughts come up and diffuse, these waves could be violent or calm..

तत्प्रतिषोधाथर्मैकतत्त्वाभ्यासः ॥प-यो-१-३२ ॥

tatpratiṣoḍhātharmekatattvābhyāsaḥ||pa-yo-1-32||

To prevent or deal with these modifications of the mind and their consequences, the recommendation is to make the mind one-pointed, training it how to focus on a single principle or object.

अभ्यासवैराग्याभ्यां तन्निरोधः ॥प-यो-१-१२ ॥

abhyāsavairāgyābhyāṁ tannirodhaḥ|pa-yo-1-12||

One-pointedness is to be achieved through practice, and non-attachment:- The two principle of abhyāsa practice, and vairāgya non-attachment; make the foundation for Yoga meditation. Sleep is the vritti of absence of mental contents for its support.

स्मृतिपरिशुद्धौ स्वरूपशून्योवार्थमात्रनिर्भासा निर्वितर्का ॥प-यो-सु- २-४३ ॥

smṛtipariśuddhau svarupaśunyovārthamātranirbhāsā nirvitarkā| pa-yo-su- 2-43||

After the clarification of memory, when the mind is as if devoid of self awareness and the true knowledge of the object is alone shining within, that is *Nirvitarka*.

तत्र शद्वार्थज्ञान्विकल्पैः संकीर्णा सवितर्का ॥प-यो-सु-१-४२ ॥

tatra śadbārthajñānvikalpaiḥ saṅkīrṇā savitarkā|pa-yo-su-1-42||

In that state (of samadhi) on account of alternating consciousness between word, true knowledge and sense perception, the mixed state of mind is known as Savitarka Samapatti.

दुःखदौर्मनस्याङ्गमेजयत्वश्वसप्रस्वासा विक्लेषहभुवः ॥३१ ॥

duḥkhadaurmanasyāṅgamejayatvaśvasaprasvāsā vikṣepahabhuvah||31||

The obstacles are recognised in four consequentially. They are 1) mental or physical pain, 2) sadness or dejection, 3) restlessness, shakiness, or anxiety, and 4) irregularities in the exhalation and inhalation of breath.

मैत्रीकरुणामुदितोपेक्षाणां सुखदुःख पुण्यापुण्यविषयणांभावनातश्चित्तप्रसादनम् ॥प-यो-सू-१-३३ ॥

maitrīkaruṇāmuditopekṣāṅāṁ sukhaduḥkha

puṇyāpuṇyaviṣayaṅāmbhāvanātaścittaprasādanam|pa-yo-sū-1-33||

To calm the mind one should develop cultivating attitudes of friendliness, compassion, gladness and interference respectively towards happiness, misery and vice. A yogi should be compassionate with those who are going through hard times in life . these qualities will help to prevent transformations of mind . In relationships, the mind becomes purified by cultivating feelings of friendliness towards those who are happy, compassion for those who are suffering, goodwill towards those who are virtuous, and indifference or neutrality towards those we perceive as wicked or evil.

विशोका वा ज्योतिष्मति ॥ प-यो-सू-१-३६ ॥

viśokā vā jyotiṣmati|| pa-yo-sū-1-36||

An agitated mind can be calmed by bright light which is devoid of unhappiness. The only light we can think of as bright and free from sorrow is atman inside us . Upanisads say that Atman

is situated in our heart centre . by concentrating on the mind in this space ,a person becomes free from sorrow.

वीतरागविषयं वाचित्तम् ॥प-यो-सू-१-३७ ॥

vītarāgaviṣayaṁ vācittam |pa-yo-sū-1-37||

One can calm the mind by fixing the mind those people who are free from desire . the whole idea of yogi is to calm the mind and to make it free from its transformations . focussing our mind on people who we respect and believe , may help us in concentrating the mind .

स्वप्ननिद्राज्ञानालम्बन वा ॥प-यो-सू-१-३८ ॥

svapnanidrājñānāmbana vā|pa-yo-sū-1-38||

One can also calm the mind by thinking about the experience of dreams and sleep. Every day atman goes through different stages . during wakeful state ,we keep in contact with the external world and during dream state we experience several events. Some of them may scare us and some may give us inner peace . Suppose , if we see pleasant things like moon light or someone worshipping our favourite diety , those events can be used to meditate and calm the mind .

यथाभिमतध्यानाद्धा ॥ प-यो-सू-१-३९ ॥

yathābhimatadhyānāddhā|| pa-yo-sū-1-39||

Dhyana and dharana helps us calm our mind . or by meditating on anything else we desire , we can prevent transformation of mind . sage Patanjali says about many ways to take control of the mind and calm it down . he says that people can adopt many ways which they like or which are more acceptable for them to meditate . in Gita , Bhagavan teaches Arjuna several ways of yoga and even encourages him to fight for the war . A yogi can adopt any method which he likes to keep his mind not getting distracted.

विषयवती वा प्रवृत्तिरुत्पन्ना मनसः स्थितिनिवन्धिनी ॥ प-यो-सू-१-३५ ॥

viṣayavatī vā pravṛttirutpannā manasaḥ sthitinivandhinī ॥ pa-yo-sū-1-35॥

Concentrate on the activity of the special senses to calm the mind. Sage Patanjali continues to suggest few other methods to calm the mind to enter deeper layers of consciousness. And go into the state of samadhi. Our sensory organs are ears, skin, eyes, tongue and nose. They get information such as sound, touch, sight, taste & smell. If a yogi concentrate his mind on any of the sensory organ mentioned above & may experience the specialities of these organs.

ता एव सवीजः समाधिः ॥ प-यो-सू-१-४६ ॥

tā eva savījaḥ samādhiḥ ॥ pa-yo-sū-1-46॥

There is always an object either in gross or subtle form in sabeeja samadhi to meditate upon. opposite of sabeeja samadhi is nirbeeja samadhi. The object chosen for meditation is BEEJA, means seed. In nirbeja samadhi the purusha (atman) is taken for meditation.

निर्विचारवैशारद्येऽध्यात्मप्रसादः ॥ प-यो-सू-१-४७ ॥

nirvicāravaiśāradye' dhyātmapasādaḥ ॥ pa-yo-sū-1-47॥

Nirvichara samadhi is a state where the yogi will experience utmost purity of mind. When samadhi gets deeper, the rajas & tamas gunas will be destroyed totally. He will be very pure with a calm mind & will be ready to understand the prakruti & purusha. Kathopanishad says (6

to7) that, when a person's mind is calm he is said to be in paramagati (understands the real nature of the universe)state.

ऋतुम्भरा तत्र प्रज्ञ ॥ प-यो-सू-१-४८ ॥

ṛtumbharā tatra prajñā ॥ pa-yo-sū-1-48 ॥

When a person's mind is pure with no any transformations his consciousness called ritambhara. Rtam means truth. When truth is born by individual then it becomes truth bearing. The yogi will then find happiness in himself and in this state the he is found to be free from viparyaya and vikalpa.

तज्जः संस्कारोऽन्यसंस्कारप्रतिबन्धी ॥प-यो-सू-१-५० ॥

tajjaḥ saṁskāro'nyasaṁskārapratibandhī ॥pa-yo-sū-1-50 ॥

The feeling produced by sabeeja samadhi will come in the way of other feelings .The mind requires an object to concentrate on,this object wil prevent other objects of feelings from taking possessions of the mind. The yogi will not getting any new feelings. Then he is said to be free from future births.

तस्यापि निरोधे सर्वनिरोधान्निर्बीजः समाधिः ॥प-यो-सू-१-५१ ॥

tasyāpi nirodhe sarvanirodhānirbījaḥ samādhiḥ | pa-yo-sū-1-51 ||

When a yogi has achieved the last stage of sabeeja Samadhi and attained the Alinga state, he can transcend the realm of prakriti. And thus he can obtain the state of self-realization by going into nirbeeja Samadhi. Nirbhijja Samadhi will appear when all the transformation of the mind is suppressed. In order to go deep into the subtler forms of objects a yogi has to concentrate on the objects chosen for meditation. This is the way to understand prakriti. For reaching the state of self-realization yogi has to come out of prakriti.

We have to follow a good and disciplined life by a constant practice of meditation for achieving a state of self-realization. This enable us to clean the mind and reform it out of all the disturbances and thus to attain control over the mind.

According to Vedanta Sara

मनो नाम सङ्कल्पविकल्पात्मिकान्तःकरणवृत्तिः ॥ वेदान्तसारः - ६६ ॥

Mano nāma saṅkalpavikalpātmikāntaḥkaraṇavṛttiḥ || Vedā sār- 66 ||

Sankalpa and Vikalpa these two terms can explained either in relation to thought or action when a person cannot determine whether a particular object is this or that or when he cannot determine whether he will perform a particular action or not, then the aspect of internal organ called Manas is said to function.

According to Mandukyopanishad

दिव्यो ह्यमूर्तः पुरुषः स बाह्याभ्यन्तरो ह्यजः ।

अप्राणो ह्यमनाः शुभ्रो ह्यक्षरात् परतः परः ॥ मुण्डकोपनिषत् - २.१.२ ॥

Divyo hyamūrtaḥ puruṣaḥ sa bāhyābhyantaro hyajaḥ ।

Aprāṇo hyamanāḥ śubhro hyakṣarāt parataḥ paraḥ ॥ Muṇḍakopaniṣat - 2.1.2॥

Self-resplendent, formless, unoriginated and pure, that all-pervading Being is both within and without. Anterior both to life and mind, He transcends even the unmanifested causal state of the universe.

तपसा चीयते ब्रह्म ततोऽन्नमभिजायते ।

अन्नात् प्राणो मनः सत्यं लोकाः कर्मसु चामृतम् ॥ मुण्डकोपनिषत् - १.१.८ ॥

Tapasā cīyate brahma tato'nnamabhijāyate ।

Annāt prāṇo manaḥ satyaṁ lokāḥ karmasu cāmṛtam ॥ Muṇḍakopaniṣat- 1.1.8॥

Through purposeful intensity, reality becomes constructed ‘[as a seeming universe made up of seeming things]. ‘From that food is born. ‘From food, living energy, ‘mind, truth; ‘worlds, and in actions the deathless. ‘That which knows in all experience, ‘and which knows all that is known, ‘whose intensity consists of knowledge; ‘from that is born all this [apparent] existence: name, form and food....

जागरितस्थानो बहिष्प्रज्ञः सप्ताङ्ग एकोनविंशतिमुखः स्थूलभुग्वैश्वानरः प्रथमः पादः ॥ माण्डूक्योपनिषत् - ३ ॥

Jāgaritasthāno bahiṣprajñāḥ saptāṅga ekonaviṁśatimukhaḥ sthūlabhugvaiśvānaraḥ
prathamāḥ pādaḥ ॥ Māṇḍūkyopaniṣat - 3 ॥

First is Waking / Gross: The first aspect of Atman is the Self in the Waking state, Vaishvanara. In this first state, consciousness is turned outward to the external world. Through its seven instruments and nineteen channels it experiences the gross objects of the phenomenal world.

स्वप्नस्थानोऽन्तः प्रज्ञाः सप्ताङ्ग एकोनविंशतिमुखः

प्रविविक्तभुक्तैजसो द्वितीयः पादः ॥ माण्डूक्योपनिषत् - ४ ॥

Svapnasthāno'ntaḥ prajñāḥ saptāṅga ekonaviṁśatimukhaḥ
Praviviktabhuktaijaso dvitīyaḥ pādaḥ ॥ Māṇḍūkyopaniṣat - 4 ॥

Second is Dreaming / Subtle: The second aspect of Atman is the Self in the Dreaming state, Taijasa. In this second state, consciousness is turned towards the inner world. It also operates through seven instruments and nineteen channels, which engage the subtle objects of the mental realm.

According Viveka chudamani :

अन्तः करणमेतेषु चक्षुरादिषु वर्ष्मणि ।

अहमित्यभिमानेन तिष्ठत्याभासतेजसा ॥ विवेकचूडामणिः - १०३ ॥

Antaḥkaraṇameteṣu cakṣurādiṣu varṣmaṇi ।

Ahamityabhimānena tiṣṭhatyābhāsatejasā || Vivekacūḍāmaṇiḥ - 103||

The inner organ (mind) has its seat in the organs such as the eye etc., aswell as in the body, identifying itself with them and endued with a reflection ofthe Atman.

अहङ्कारः स विज्ञेयः कर्ता भोक्ताभिमान्ययम् ।

सत्त्वादिगुणयोगेन चावस्थात्रयमश्नुते ॥ विवेकचूडामणिः - १०४ ॥

Ahaṅkāraḥ sa vijñeyaḥ kartā bhoktābhimānyayam ।

Sattvādiguṇayogena cāvasthātrayamaśnute|| Vivekacūḍāmaṇiḥ - 104||

Know that it is Egoism which, identifying itself with the "body, becomes the doer or enjoyer and in conjunction with the Gtmas such as the Sattva, assumes the three different states.

According Chandogyopanishad :

अन्नमशितं त्रेधा विधीयते तस्य यः स्थविष्ठो

धातुस्तत्पुरीषं भवति यो मध्यमस्तन्मा ॥ छान्दोग्योपनिषत् - ६.५.१ ॥

Annamaśitaṁ tredhā vidhīyate tasya yaḥ sthaviṣṭho

Dhātustatpurīṣaṁ bhavati yo madhyamastanmā||Chāndogyopaniṣat - 6.5.1||

Food (the Earth) that is eaten gets divided into three parts. The grossest portion becomes fecal matter. The middle portion becomes flesh, and the subtlest portion becomes the mind.

अन्नमयं हि सौम्य मनः आपोमयः प्राणस्तेजोमयी वागिति

भूय एव मा भगवान्विज्ञापयत्विति तथा सोम्येति होवाच ॥ छान्दोग्योपनिषत् - ६.५.४ ॥

Annamayaṁ hi saumya manaḥ āpomayaḥ prāṇastejomayī vāgiti

Bhūya eva mā bhagavānvijñāpayatviti tathā somyeti hovāca

॥Chāndogyopaniṣat - 6.5.4॥

“Thus, the mind is what we eat, Prana is made up of water, and speech is fire”. Svetaketu doesn't understand and asks his teacher to explain again. He agrees.

According Aitharopaniṣad :

यदेतद्धृदयं मनश्चैतत् । संज्ञानमाज्ञानं विज्ञानं प्रज्ञानं मेधा

दृष्टिर्धृतिमतिर्मनीषा जूतिः स्मृतिः संकल्पः क्रतुरसुः कामो

वश इति । सर्वाण्येवैतानि प्रज्ञानस्य नामधेयानि भवन्ति ॥ ऐतरेयोपनिषत् - ३.२ ॥

Yadetaddhṛdayaṁ manaścaitat | sañjñānamājñānaṁ vijñānaṁ prajñānaṁ medhā

drṣṭirdhṛtimatirmanīṣā jūtiḥ smṛtiḥ saṅkalpaḥ kraturasuḥ kāmo

vaśa iti | sarvāṅyevaitāni prajñānasya nāmadheyāni bhavanti

॥ Aitareyopaniṣat - 3.2 ॥

It is this heart (intellect) and this mind that were stated earlier. It is sentience, rulership, secular knowledge, presence of mind, retentiveness, sense-perception, fortitude, thinking, genius,

mental suffering, memory, ascertainment resolution, life-activities, hankering, passion and such others. All these verily are the names of Consciousness.

Concept of Mindfulness in Buddhist traditional texts

Introduction to Buddhism

The religious, philosophical, and mind-training tradition that we know as Buddhism began in Northern India 2,500 years ago with the teachings of a man by the name of Siddhartha Gautama. Gautama came to be known as “the Buddha”, meaning “the awakened one”. The Buddha was believed to have achieved final liberation from suffering, or enlightenment, and his teachings outline a path for others to follow to also achieve this liberation. Mindfulness is a key aspect of this path. Buddhism as it exists today forms three major schools: Theravada, Mahayana, and Vajrayana. The Theravada school dominates in Thailand, Sri Lanka, Cambodia, and Burma, whereas the Mahayana school dominates in China, Japan, Mongolia, Nepal and Tibet. The Mahayana school includes distinctive forms of Buddhism such as Chan/Zen Buddhism, Pure Land Buddhism, and Tibetan Buddhism. The Vajrayana “school” is not, strictly speaking, a separate school but a specialized subclass of Mahayana Buddhism. Tibetan Buddhism is a prominent example of Vajrayana Buddhism within the Mahayana fold. Vajrayana Buddhism is also found in China and Japan, known respectively by their native names of Zhenyan and Shingon. All three schools of Buddhism can be said to contain authentic Teachings of the historical Buddha, although there are debates as to whether Theravada, chronologically the earliest tradition, is deemed “closer” to the original teachings of the Buddha.

Mindfulness in Buddhisam

Mindfulness (Pail: sati; Sanskrit: smrti; Tibetan: dranpa), as a concept and practice, occupies a significant place in the overall schema of Buddhist meditative training. It is also defined in a variety of ways across the Buddhist schools and throughout Buddhist history. This section seeks to articulate the multiple understandings of mindfulness within Buddhism by drawing on all three major traditions of Buddhism in existence in the contemporary world—Theravada, Mahayana, and Vajrayana. Wallace (2006, 2007); Wallace and Hodel (2008) argues strongly for a contextually embedded understanding of Buddhist meditation, and this approach will be followed here. Mindfulness in the Buddhist context includes the following: simple bare awareness of moment to moment experience; “gatekeeping” awareness; remembering and sustaining attention on a familiar object; a process of systematically recollecting a sequence of ideas; conjoined with introspective vigilance that monitors the stability and clarity of awareness; wisely directed attention that probes into the source of experiential content; and non-dual co-emergent awareness at the subtlest level of consciousness, free from all conceptual constructs and frames.

3. LITERATURE REVIEW

Mindfulness acts as a protection against emotional exhaustion at home and at work. Anxiety, stress, Depression, tiredness and irritability all used to get stabilized with regular meditation. Also, working memory and creativity gets improved, reaction time becomes faster, and mental and physical stamina also gets improved. In fact, those who practice mindfulness regularly are found happier and more contented, and are less likely to suffer from psychological distress (Daniel J. Siegel ,et al,2010)

Sl. No	Author year	Title	Samples and Design	Result and Conclusion
1.	Behav Res Ther. 2013 ,Jul;5	Mindfulness and heart rate variability in individuals with high and low generalized anxiety symptoms	Pre post deign N=43	Mindfulness enhance parasympathetic influences on the heart rate.
2.	Ross W. May, Mandy Bamber, Gregory S. Seibert, 2015	Understanding the physiology of mindfulness: aortic hemodynamics and heart rate variability	N=135 Between group study	mindfulness demonstrated a strong negative relationship with myocardial oxygen consumption and left ventricular work but not heart rate or blood pressure
3.	Jonathan R. Krygiera, 2013	Mindfulness meditation, well-being, and heart rate variability: A preliminary investigation into the impact of intensive Vipassana meditation	(n = 21) and Controls (n = 39) Between group design	mindfulness meditation decreases cardiac vagal tone
4.	Shirley Telles,	Blood Pressure and Heart Rate Variability during	N=26	There was a decrease in systolic BP and

	2014	Yoga-Based Alternate Nostril Breathing Practice and Breath Awareness	Repeated measures ANOVA	respiration rate; while RMSSD and NN50 increased.
5.	Bruce H. Friedman, 1998	Autonomic balance revisited: Panic anxiety and heart rate variability	N=46 Within group design	Reduced HRV in panic anxiety, in contrast with portrayals of excess autonomic lability in anxiety
6.	Leah Lagos, 2013	Heart Rate Variability Biofeedback as a Strategy for Dealing with Competitive Anxiety	N= 38 Between group design	HRV bio feed back training may help the athlete cope with the stress of competition and/or improve neuromuscular function.
7.	Dimitriy A, 2016	State Anxiety and Nonlinear Dynamics of Heart Rate Variability in Students	N=74 Simple pre post	The results showed a positive correlation between SA scores and $\alpha 1$. No association was found between changes in SA scores and $\alpha 2$
8.	Peter R, et al ,2015	Heart rate variability and autonomic control of heart in athletes	N=32 Within group design	The result indicates that parasympathetic activity is substantially greater in yoga practitioners
9.	Daniel J. Siegel ,2010	Role of Mindfulness as a protection against emotional exhaustion at home and at work.	N= 68 Within group design	Those who practice mindfulness regularly are found happier and more

				contented, and are less likely to suffer from psychological distress
10.	Langer, Ellen J, 1989	Double-edge concept of mindfulness / mindlessness on healthy adults	N=46 Between group design	Mindfulness improve health, productivity, overcoming addictions, avoiding burnout, and increasing our control over self.
11.	Gould LF, 2014	School based mindfulness and yoga programme on performance improvement by students and teaching and interaction skill of teachers.	N=87 N=24 Between group design	The potential on improving the skills and performance consistently of students and teachers was understood
12.	Barkan, 2015	A study on MBSR on Big Five dimensions of personality .	N=72 Between group design	The result showed that participants with higher levels of agreeableness and openness were liking to use the MBSR intervention techniques.
13.	Deborah Bowden, 2010	A randomized trial to compare the effects of Brain Wave Vibration (BWV) training, with meditative exercise practice, with Iyengar yoga and Mindfulness	N=56 Pre post study	Participants showed an improvement in sleep, memory, and health status improvement.
14.	Chu IH, 2015	A randomized controlled, to compare the work outcomes in adults.	N=68 ANOVA	Participants showed an improvement in their mood.

4.0 AIM AND OBJECTIVES

4.1 Aim of the Study

The aim of this study was to understand the relationship between the mindfulness, state anxiety and heart rate variability in healthy volunteers.

4.2 Objectives of the Study

- To find out the correlation between state mindfulness (using state mindful attention awareness scale) and heart rate variability.
- To find out the correlation between state anxiety and heart rate variability.
- To find the correlation between state anxiety and mindfulness.

4.3 Rationale of the Study

Research studies have shown that, heart rate variability will vary with mental states. Trait anxiety is known to reduce heart rate variability and vagal tone which is important risk factor and predictor of cardiovascular morbidity and mortality. The association between mindfulness, state anxiety and heart variability not studied. Hence, in the present study, we have assessed correlation between mindfulness, state anxiety and heart rate variability in healthy adults.

4.4 Hypothesis

There may be a significant correlation between mindfulness, state anxiety and heart rate variability.

4.5 Null hypothesis

There may not be any significant correlation between mindfulness, state anxiety and heart rate variability

4.6 Ethical consideration

The Institutional Review Board (IRB) Approval: The study was approved by the IRB of SVYASA University.

Signed informed consent was obtained from the subjects before the study.

4.7 Definition of Key Terms

Mindfulness

Mindfulness has been conceptualized as the process of bringing attention and awareness to objects within the experience of the present moment with a nonjudgmental and non-evaluative acceptance and openness.

State anxiety

Anxiety is a negative emotional response to threatening circumstances. State anxiety (SA) can be conceptualized as “a state in which an individual is unable to instigate a clear pattern of behavior to remove or alter the event/object/interpretation that is threatening an existing goal”

Heart rate variability:

Heart rate variability (HRV) refers to beat to beat alterations in the heart rate and is associated with cardiac autonomic regulation.

5.0 METHODS

5.1 Participants

Announcement about the study was placed on the University notice boards. We studied eighty-three (37 male and 46 female) healthy volunteers with their ages ranging from 28 to 50 years (mean age \pm SD; 33.42 \pm 5.63 years). They were all naïve yoga students at Swami Vivekananda Yoga Anusandhana Samsthana (S-VYASA), Bengaluru. Participants who can read and understand English were included for the study. Participants with any kind of illness and who were on medication were excluded from the study. Participants with age above fifty years were excluded because HRV is known to vary with age. The study protocol was explained to all subjects and signed consent was obtained.

The required sample size was calculated using G power, fixing Alpha at 0.05, Effect Size at 0.45, Power at 0.84 and two tail direction. The z test gave an outcome of 54 sample size as require for the present study and here, eighty three samples were taken.

5.2 Design

We used correlational study design. Eighty-three subjects we assessed using state anxiety and mindfulness questionnaire and heart rate variability measurement.

5.3 Assessments

State Mindful Attention Awareness scale (SMAAS)

The SMAAS is a valid tool for measuring state mindfulness. The scale is designed to assess the short-term or current expression of a core characteristic of mindfulness. This is a receptive state

of mind and sensitive awareness of observing the present moment. The SMAAS 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"). SMAAS has shown excellent psychometric properties (Cronbach's alpha = .92)

State Anxiety Inventory (STAI-SF)

The state trait anxiety inventory-short form (STAI-SF) consists of two questionnaires of 20 items each. The first questionnaire measures state anxiety (how one feels at the moment); the second, trait anxiety (how one generally feels). A standardized, short-form of STAI has been used for this study. STAI-SF consists of six items assessing the extent to which patients feel "calm," "tense," "upset," "relaxed," "content," and "worried" on a 4-point scale ranging from "not at all" to "very much." Items consist of equal numbers of anxiety-present and anxiety-absent. Three items are scored in reverse order to avoid a response bias. The items were summed to produce a total score in which higher scores are related to greater anxiety. The six items STAI-SF demonstrated good reliability coefficient ($r > .82$).

Heart Rate Variability (HRV)

The ECG was recorded using 16 channel human physiology system (Power Lab 16/35, AD Instruments, Australia) with a standard bipolar limb lead I configuration. The ECG was digitized using a 16-bit analog-to-digital converter at a sampling rate of 1 KHz and was analyzed off-line to obtain the HRV spectrum. Frequency domain analysis of HRV data were carried out.

5.4 Intervention

There was no intervention, since our objective was to understand correlation between mindfulness, state anxiety and heart rate variability.

5.5 Data extraction

State mindful attention awareness scale (SMAAS)

Reverse score all items then average all 5 values. (0=6, 1=5, 2=4, 3=3, 4=2, 5=1,6=0) High score indicates higher state mindfulness.

State anxiety Inventory (STAI SF)

State anxiety Inventory (Short form) calculated using scoring key given in manual. In this question number 1, 4, 5 is reversing score (1=4, 2=3, 3=2, 4=1). Further total score was obtained by adding up the entire question.

Heart rate variability

The following data were extracted from the 16 channel human physiology system. Frequency domain and time domain analysis of HRV data were carried out. The analysis was done using the software Lab Chart 8 (AD instruments, Australia). The energy in the HRV series in the following specific frequency bands were studied viz., very low frequency (LF) (0.0– 0.04 Hz), LF (0.04–0.15 Hz) and high- frequency (HF) band (0.15–0.5 Hz). According to guidelines, LF and HF band values were expressed as normalized units.

5.6 Data analysis

Data were entered and tabulated in excel. It was analyzed using the statistical analysis software R (version 3.2). Data were tested for normality using Kolmogorov Smirnov test. Person's correlation was used to understand relationship between above mentioned variables.

6.0 RESULTS

Summary table 1: Showing mean and standard deviation of variables

Variables	SMAAS	STAI	LF	HF	LF/HF ratio
Scores	3.78 ± 1.26	12.81 ± 3.61	56.98 ± 20.02	42.78 ± 19.93	2.45 ± 3.09

Person's correlation was used to understand the relationship between SMAAS, state anxiety and components of heart rate variability. There was a significant high negative correlation between SMAAS and STAI ($r = -.942, P < 0.001$). STAI and LF of HRV is positively correlated ($r = .252, P < 0.05$) whereas SMAAS and LF is negatively correlated ($r = -.259, P < 0.05$).

There was a significant moderate negative correlation between STAI and HF ($r = -.255, P < 0.05$), whereas SMAAS is positively correlated with HF ($r = -.264, P < 0.05$). And also, there was a significant moderate positive correlation between STAI and LF/HF ratio ($r = .304, P < 0.05$) and negative correlation between SMAAS and LF/HF ratio ($r = -.313, P < 0.05$).

Summary table 2: Showing correlation between SMAAS, STAI and HRV

		Correlations				
		STAI	SMAAS	Lfnu	Hfnu	Lfhfratio
STAI	Pearson Correlation	1	-.942**	.252*	-.255*	.304**
	Sig. (2-tailed)		.000	.022	.020	.005
	N	83	83	83	83	83
SMAAS	Pearson Correlation	-.942**	1	-.259*	.264*	-.313**
	Sig. (2-tailed)	.000		.018	.016	.004
	N	83	83	83	83	83
Lfnu	Pearson Correlation	.252*	-.259*	1	-.998**	.771**
	Sig. (2-tailed)	.022	.018		.000	.000
	N	83	83	83	83	83
Hfnu	Pearson Correlation	-.255*	.264*	-.998**	1	-.773**
	Sig. (2-tailed)	.020	.016	.000		.000
	N	83	83	83	83	83
Lfhfratio	Pearson Correlation	.304**	-.313**	.771**	-.773**	1
	Sig. (2-tailed)	.005	.004	.000	.000	
	N	83	83	83	83	83

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

7.0 DISCUSSIONS

In the present study eighty-three healthy volunteers were studied. SMAAS, STAI and HRV were assessed to understand the correlation between these three variables. Results showed a significant high negative correlation between SMAAS and STAI. STAI and LF of HRV is positively correlated whereas SMAAS and LF is negatively correlated. There was a significant moderate negative correlation between STAI and HF, whereas SMAAS is positively correlated with HF. And also, there was a significant moderate positive correlation between STAI and LF/HF ratio and negative correlation between SMAAS and LF/HF ratio.

Frequency domain analysis of heart rate variability reflects autonomic modulation. HF is associated with parasympathetic activity whereas LF is related to both sympathetic and parasympathetic nervous system activity (Shaffer, McCraty, & Zerr, 2014).

Mindfulness is associated with several indicators of emotional regulation. Earlier studies have shown negative correlation between mindfulness and trait anxiety (Mankus, Aldao, Kerns, Mayville, & Mennin, 2013) and negative correlation between state anxiety and nonlinear components of HRV (Dimitriev, Saperova, & Dimitriev, 2016). The findings of our study are in line with earlier studies. High mindfulness would enhance parasympathetic activity. Regular practice of meditation would increase mindfulness and heart rate variability and would reduce state anxiety.

8.0 APPRAISAL

8.1 Summary and Conclusion

Results showed significant high negative correlation between SMAAS and STAI. STAI and LF of HRV is positively correlated whereas SMAAS and LF is negatively correlated. There was a significant moderate negative correlation between STAI and HF, whereas SMAAS is positively correlated with HF. And also, there was a significant moderate positive correlation between STAI and LF/HF ratio and negative correlation between SMAAS and LF/HF ratio.

8.2 Implication of the study

It is well understood that HRV is indicator of cardiac health and autonomic activity. Current study has shown positive correlation between mindfulness and HF component of HRV (which is associated with vagal tone).

8.3 Strength of the study

We studied mindfulness, state anxiety and heart rate variability in eighty-three healthy volunteers. Subject's co-operation during the study was excellent.

8.4 Limitations of the study

Time domain and nonlinear analysis of HRV was not done in the present study. We included both male and female participants for the study. Gender might be a confounding factor.

8.5 Suggestions for the future

In future, it will be interesting to study correlation between SMAAS, STAI and HRV in naïve and experienced yoga practitioners and also participants with high and low stress. Time domain and non-linear components of HRV also should be studied to understand more information.

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APPENDICES

APPENDIX 1: PARTICIPANT'S INFORMED CONSENT

Informed consent to.....

Swami Vivekananda Yoga Research Foundation

#19, EkanathBhavan, K.G. Nagar, Bangalore -560019

You are being invited to participate in a research study.

This form is designed to provide you with information about this study.

The Principle investigator or representative will describe this study to you and answer any of questions.

If you have any questions or complaints about the informed consent process or the research study, please contact the Institutional Ethical Committee.

1. Name of the subject:

2. Title of Research study: Immediate effect of BST and Mind Sound Resonance Technique on state anxiety and psychomotor performance in healthy volunteers: a self-controlled comparative study

3. a. Principal investigator: jintu kurian [(M.Sc in yoga therapy)]

Under the guidance of Dr. Raghavendra Bhatt

b. Sponsor of the study: SVYASA, Bangalore

4. **The purpose of the study:** The aim of the present study was to find the correlation between mindfulness, state anxiety and heart rate variability in healthy volunteers

5. **Procedures for this research:**

Procedure for measurement: The measurements are intended to assess the state anxiety level, attention level and the heart rate variability of the participants.

6. **Potential Health risks or Discomforts:** There are no risks of the study and healthy volunteers were chosen.

7. **Potential Health benefits to you or to others** this research study: The details which are given in this study is intended to improve the attention and mindfulness and reduce the state anxiety and thus to maintain the heart rate variability. So you are likely to have huge benefited directly by participating in this study.

8. **Potential financial risks:**none.

9. **Potential financial benefits to you or others:**none.

10. **Compensation for research related injury:** In the unlikely event of yoursustaining a physical or psychological injury arising out of this study, primary carewill be provided at Swami Vivekananda Yoga Research Foundation without charge.However, hospital expenses will be covered under an appropriate group insurancescheme available with any general insurance company.

11. **Conflict of interest:** Participation in this study is purely voluntary. Howeverbefore giving your consent please see that no conflict of interest arises. Your name and personal information will be kept strictly confidential.

12. **Alternatives to participating** in this research study since participation in thisstudy is entirely voluntary and if you choose to participate, you are free to withdraw your consent and

discontinue participation in this research study at any time by giving it in writing without this decision affecting your medical care and health insurance provided to you during the study. If you have any question regarding your rights as a subject, you may phone the Institutional Ethics Committee office at (080) 7826033.

13. **Withdrawal from this research study** if you wish to stop your participation from this research study for any reason, you should contact Jintu kurian at Jintukurian@gmail.com You may also contact the Institutional Ethics Committee (IEC) office at (080) 7826033.

14. **Confidentiality:** The Swami Vivekananda Yoga Research Foundation will protect the confidentiality of your records to the extent provided by Law. You may understand that the study sponsor and the Institutional Ethics Committee have the right to review your records.

15. **Assent procedures:** Not applicable

16. **Signatures:** ----- Subject's name:

The Principal investigator or representative has explained the nature and purpose of the above described procedure and the benefits and risks that are involved in this research protocol. -----

----- Signature of Principal investigator

Date:

You have been informed of the above-described procedure with its possible benefits and risks and you have received a copy of this description. You have given permission for your participation in this study. -----

----- Signature of the Subject

Date:

If you are not the subject, please print your name -----and indicate
one of the following: ----- The Subject's parent ----- Other, please
explain -----

The subject's guardian ----- A proxy -----

Signature of witness Date

SPIELBERGERS STATE TRAIT ANXIETY INVENTORY (STAI)

STAI FORM X-1

Date:

Age:

Name:

Gender:

Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then fill the appropriate number in the box to the right of the statement to indicate how you feel at this moment. There is no right or wrong answers. Do not

spend too much time on any one statement but give the Answer which seems to describe your present feelings best.

Choose the answers from the choice given below:

1 = Not at all	2 = Some what	3 = Moderately So	4 = Very much so
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Sl No	Particular	1	2	3	4
1	I feel calm				
2	I am tense				
3	I feel upset				
4	I am relaxed				
5	I feel content				
6	I am worried				

MINDFULNESS QUESTIONNAIRE

The MAAS is a 15-item scale designed to assess a core characteristic of dispositional mindfulness, namely, open or receptive awareness of and attention to what is taking place in the present. The scale shows strong psychometric properties and has been validated with college, community, and cancer patient samples. Correlational, quasi-experimental, and laboratory studies have shown that the MAAS taps a unique quality of consciousness that is related to, and

predictive of, a variety of self-regulation and well-being constructs. The measure takes 10 minutes or less to complete.

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what really reflects your experience rather than what you think your experience should be. Please treat each item separately from every other item.

Sl. No.	Particulars	Not at all 1 2	Somewhat 3 4	Very much 5 6
1	I find it difficult to stay focused on what's happening in the present.			
2	I was doing something without paying attention			
3	I rush through activities without being really attentive to them.			
4	I find myself preoccupied with the future or the past.			
5	I find myself doing things without paying attention.			

Scoring information:

To score the scale, simply compute a mean of the 15 items. Higher scores reflect higher levels of dispositional mindfulness.

Sl No	Name	Age	Gender	SA	MF	MeanRR	HR	SINN	RMSD	NN50	Lpower	Hpower	T.Power	Lfau	Hfau	Lbf ratio
01	abhishhek	29	M	14	3.4	760.2	79.38	55.4	34	63	1615	461	2807	77.7	22.2	3.503
02	aditya	30	M	13	3.8	771.1	78.14	55.7	36.3	61	1226	497	2532	70.9	28.7	2.467
03	Ambre Nil	29	M	16	3	999.8	60.39	81.3	69.8	117	2435	1921	7217	55.9	44.1	1.267
04	Ameya	28	F	12	4	692.3	87.15	51.5	27	37	2119	271	3018	88.6	11.3	7.812
05	amol A De	34	M	10	4.4	859	70.04	45.1	33.3	33.3	861	558	2504	60.7	39.3	1.543
06	anitha san	38	F	10	4.6	742.7	81.06	43.2	30.8	47	495	378	1072	56.7	43.3	1.31
07	Anuj	30	M	11	4.4	721.3	83.45	41.5	23.5	12	503	223	1181	69.2	30.7	2.253
08	Anuradha	36	F	16	2.4	681.6	88.99	53.5	37.9	80	1059	428	4497	71.2	28.8	2.472
09	anuradha	35	F	12	3.8	808.3	74.56	53.5	48.1	123	1001	1257	3444	44.3	55.6	0.796
10	appu	28	M	11	4.2	878.6	68.67	65	58.4	158	757	2276	3760	25	75	0.333
11	B.Ravinde	38	M	9	5.2	818.4	73.38	23.7	17	1	65	205	468	23.9	76.1	0.315
12	B.Devi sre	35	F	8	5.4	911	66.11	54.5	54.5	132	707	989	2018	41.7	58.3	0.715
13	bhuvanasi	40	F	20	1.4	798.4	76.26	95.3	68	182	2709	2328	6072	53.8	46.2	1.163
14	bindujs	40	F	13	3.8	694.6	86.49	24.8	12.9	0	141	33	569	80.7	18.8	4.302
15	binduM	41	F	9	4.6	868.1	69.35	50.9	59.5	179	1016	937	2829	51.4	47.4	1.084
16	Budhi Bai	31	M	11	4	829.1	72.72	65.6	64.9	72	572	394	1417	59.2	40.8	1.45
17	chanakya	29	M	15	2.8	723.6	83.7	70.5	43.6	54	2105	1119	4293	65.3	34.7	1.881
18	chandrika	34	F	13	3.8	769.9	78.13	37.4	27.7	29	271	237	958	53.4	46.6	1.145
19	daneswar	34	M	17	2.6	709.8	84.77	38.3	22.5	9	576	84	1227	87.2	12.7	6.889
20	Darshan	35	M	14	3.2	838	72.17	77	68	69	2518	312	3321	84.7	12.6	6.965
21	deewakar	28	M	10	4.2	805.5	74.71	43.9	35.7	58	527	260	1271	66.3	32.7	2.03
22	devendra	30	M	10	4	850.3	70.68	34.2	21.9	8	139	166	841	45.6	54.3	0.84
23	dhushyan	34	M	8	5.4	907.7	66.33	61	69.5	46	2163	1777	4574	54.9	45.1	1.217
24	Gangotri p	29	F	6	5.8	629.2	95.58	30.5	17.3	5	197	140	706	58.4	41.5	1.406
25	gopinigan	30	F	17	2.8	720.5	83.97	67.2	33.3	59	3336	486	4271	87.3	12.7	6.869
26	helen mary	28	F	9	5.2	879	68.47	53.7	45	102	912	845	2182	51.9	48.1	1.076
27	hemal ash	31	M	20	1.4	667.7	90.9	75.3	64.5	79	2156	3262	8160	39.7	60.1	0.661
28	Heo jayon	30	F	12	3.6	707.7	85.17	48.1	28.6	31	655	393	1884	62.5	37.4	1.669
29	janardhan	50	M	9	5.2	1004.3	59.96	46.5	45.1	3	106	118	764	47.3	52.6	0.899
30	Jaya Paree	30	F	17	2.6	695.8	86.87	60.9	46.3	133	660	1296	3096	33.7	66.2	0.509
31	julia caroli	35	F	20	1.2	965.5	62.84	100.2	59.2	122	9262	498	10237	94.9	5.1	18.595
32	kashmeera	37	F	12	3.6	955	63.16	70.1	78.7	290	915	2470	3917	27	72.9	0.37
33	Kasturi B.	30	F	9	5.2	921.8	73.22	43.7	31.5	39	427	170	1681	71.2	28.4	2.511
34	latika rath	34	F	11	4.6	812.1	74.24	56.2	33.3	54	762	544	2009	58.4	41.6	1.403
35	lovely	29	F	12	3.8	678.7	88.87	52.2	32.9	55	876	978	2512	47.2	52.8	0.895
36	madhu kus	31	M	11	4	857.7	70.17	48.2	34.1	209	717	646	2239	52.6	47.4	1.99
37	namata ad	28	F	15	3.4	795.2	75.98	67.5	57.5	136	1038	1947	4124	34.8	65.2	0.533
38	Mani meg	29	F	13	3.2	704.6	85.89	65.7	65	254	421	2360	3963	15.1	84.7	0.178
39	manjunath	34	M	8	5.2	735.1	85.83	37.1	19.2	4	332	278	1551	54.4	45.5	1.195
40	Manuvech	36	M	9	5.4	838	71.77	39.6	24.6	19	507	269	1544	65.3	34.7	1.881
41	meghana	29	F	18	1.8	752.9	80.51	74.4	55.6	147	1780	2055	4809	46.3	53.5	0.866
42	Nakul sing	31	M	14	3.2	979.6	61.47	59.5	53.4	100	426	662	1820	29.1	60.9	0.643
43	naveeta si	33	F	10	5.2	693.1	86.86	40.3	26	15	455	558	1196	44.9	55.1	0.815
44	Nithya	35	F	11	4.8	769.4	78.22	43.5	24.7	20	732	280	1679	72.3	27.6	2.616
45	Nivedita	30	F	16	2.4	761	79.62	78	68.3	178	1039	1483	4548	41.1	58.6	0.701
46	padmanav	30	M	14	2.8	896.9	67.31	65.3	57.7	70	856	811	2606	51.3	48.6	1.055
47	prajakta	29	F	15	1.4	956.2	63.06	68.3	53.6	128	1391	173	3242	64.3	35.7	1.8
48	prajwal	29	M	21	2.8	730.6	82.36	39.6	21.3	3	321	278	1031	53.6	46.3	1.157
49	Priyanka	31	F	18	1.4	824.2	73.23	63.4	53.5	158	1146	1410	3378	45.7	54.3	0.841
50	puma sha	47	M	10	4.8	963	62.54	32.9	52.3	127	711	1335	3717	34.7	65.2	0.532
51	pumima st	37	F	11	4.8	838.5	71.91	60.1	42.2	84	1409	533	3537	72.5	27.4	2.644
52	rajashree	54	F	11	3.8	826.6	72.78	42.6	19.4	3	1110	130	2064	89.5	10.5	8.508
53	Rajat Chau	32	M	17	2.2	998.4	60.41	70.7	62.2	85	2318	1313	4131	63.8	36.2	1.765
54	Rajesh	33	M	14	4	730.1	82.7	57.4	41.7	102	1004	216	1802	81.9	17.6	4.647
55	rangappa	55	M	6	5.8	812.6	73.93	28.5	12.4	0	95	46	418	67.6	32.4	2.09
56	Rasika	28	F	12	4.2	750.1	80.23	41.4	39.3	6	1044	521	1830	66.7	33.3	2.002
57	renupriya	29	F	18	2.2	699	86.9	77.4	53.2	152	3340	2150	5940	60.8	39.2	1.554
58	S.Kavita	30	F	19	1.8	631.2	95.52	51.1	55.7	9	510	262	1270	66	33.9	1.948
59	shambhuli	31	M	15	3.2	774.2	77.79	48.2	40.5	31	361	998	1833	26.5	73.4	0.361