

## **Part – I**

# **CONCEPT OF CAKRĀS AND CORRESPONDING QUALITIES &**

## **Part – II**

# **EFFECT OF TIBETAN BUDDHIST MINDFULNESS MEDITATION (*VIPASSANA*) ON HEART RATE VARIABILITY (HRV) SPECTRUM**

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF  
THE REQUIREMENT FOR THE MASTER'S DEGREE IN (M.S.c) in

*YOGIC SCIENCES*

BY

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TO

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(Deemed University, Recognized by U.G.C, Govt. of India through HRD)**

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This page is very important as this is the only opportunity which I have got sincerely to thank and express my attitude towards those who have helped me in completing this project

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I thank all those who have helped me in this work in some way or other.

R. S. K. Mohapatra

**CERTIFICATE**

This is to certify that Dr R. S. K. Mohapatra is submitting this dissertation containing two parts: Part-I; Literature Research on Concept Of Cakrās And Corresponding Qualities and Part-II; Experimental Research on Effect Of Tibetan Buddhist Mindfulness Meditation (*Vipassana*) On Heart Rate Variability (HRV) Spectrum, in partial fulfillment of the requirements for the Master's degree in Yogic Sciences. He registered for the course on September 11, 2002 in Vivekananda Yoga Mahavidyapeetham of Swami Vivekananda Yoga Anusandhana Samsthana under the division of Yoga & life sciences and this dissertation is a record of the work carried out by him in this institute.

12 January 2004  
Prashanti Kutiram

Guide

Co guide

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Registrar  
VYOMA of s VYASA

## DECLARATION

I hereby declare that the work presented in this dissertation is done by me under the guidance of Dr Shirley Telles & Dr H R Nagendra. I also declare that this work entitled  
Part-I

Concept Of Cakrās And Corresponding Qualities.

Part- II

Effect of Tibetan Buddhist Mindfulness Meditation (*Vipassana*) On Heart Rate Variability (HRV) Spectrum.

Has not previously formed the basis of any degree, diploma, membership or similar titles.

Place: Prashanti Kutiram

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Date: January 10, 2004

## ABSTRACT

### Part-I

Cakrās are centers of śakti in prāṇamayā kośa that receive and send information and prana śakti, connecting nerves, hormones and emotions. The subject of cakrās as such is very vast. So this report tries to give a brief summary of various aspects of cakrās especially from yogic āsanās point of view.

The report commences with the history of the Cakra system. It is followed by the understanding of these energy centers in relation to body and mind. The concepts of kuṇḍalini, Granthi and Nadis as enumerated by our ancient rishis and munis have also been looked into.

Each Cakra then has been described with emphasis on the mental and physical issues. Yogic āsanās especially helpful in alleviating the conditions have also been discussed. A sincere attempt has been made to cover the research work done by modern scientists on cakrās.

Thus the report attempts on the whole to provide a bird's eye view of a vast subject.

### Part-II

The present study was aimed to determine the effect of Tibetan Buddhist Mindfulness meditation (*Vipassana*) on the heart rate variability (HRV), a specific indicator of autonomic nervous system (ANS) function. The practice requires considerable awareness with expansive relaxation. 14 males of age range 22 to 41 years (mean  $29.0 \pm 5.19$ ) having completed 10 days basic training on *Vipassana*, participated in this study. The heart rate variability of all the subjects was assessed in two test sessions, which included a period of meditation and control (random) thinking. There was no significant reduction in heart rate during meditation session compared to the base line. During non-meditation random thinking the heart rate decreased in second, third but maximally in the fifth (4.3beats/min) compared to the baseline (paired T-Test). There was no change in the low frequency to high frequency ratio of the heart rate variability spectrum. The heart rate change in non-meditation suggests that the decrease in heart

rate which occurred during the random thinking sessions appears to have been prevented by the practice of Tibetan Buddhist Mindfulness (*Vipassana*) meditation.

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**PART-1:  
Literary Research**

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**Title: CONCEPT OF *Cakrās* AND CORRESPONDING QUALITIES**

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s are children of the cosmos. All our organs correspond to energies fluctuating in the cosmos. According to ancient teachings subtle worlds of the cosmos create our individual bodies. Like the universe our energy system consists of seven worlds, and has seven primary bodies (or auric layers) that interact with each other. These bodies consist of the energies and the corresponding universal world accordingly, deal with them, and receive the energy information from them (8).

Besides the physical bodies, our individual energy systems consist of ether, astral, mental, karmic, intuitive, nirvana, and absolute subtle energy bodies. Subtle because it is difficult to perceive them with our senses. Nevertheless, we can perceive them when specially trained and use bioenergy methods.

All subtle bodies in a human energy system communicate with each other, and with the physical body, through the energy “transformers” – cakrās. cakrās transform cosmic universal life support energies into human energy systems. In Sanskrit, the Cakra is a wheel of life. Indian tradition considers invisible cakrās as centers of consciousness.

All humans have cakrās whether we are aware of them or not. cakrās are in fact, centers of different levels of consciousness, ranging from almost bodily to highly spiritual. Healthy cakrās spin all the time bringing energy to the physical body and all its energy layers. Thus cakrās play a very important role in well being and health of human beings.

## **CHAPTER – 2**

### **HISTORY OF THE CAKRA SYSTEM**

Now that the cakrās have become New Age parlance, there are many interpretations of their meaning and function being bandied about. While this popularity is making the cakrās a household word, it is also spreading a lot of confusing, conflicting, and often erroneous information. It is important to realize the cakrās come from an ancient tradition, which many New Age teachers have barely explored. Here is a brief summary of the development of the cakrās historically.

The Vedas, which are the oldest written tradition in India, (2,000 - 600 B.C.) were written largely by the Indo-European invaders of India, known as the Aryans. The Aryans were said to have entered India on chariots, and the original meaning of the word cakrās as "wheel" refers to the chariot wheels of the invading Aryans. (The correct spelling is cakrās though pronounced with a ch as in church.) The word was also a metaphor for the sun, which "traverses the world like the triumphant chariot of a cakravartin." (Ruler) and denotes the eternal cycle of time called the *kalacakrū*, or wheel of time. In this way, it represents celestial order and balance.

It is said the cakravartins were preceded by a glowing golden disk of light, much like the halo of Christ, only this spinning disk was seen in front of them (perhaps their powerful third cakrās?). The birth of a cakravartin was said to herald a new age. It is also said that the god Vishnu descended to Earth, having in his four arms a cakra a lotus flower, a club, and a conch shell. (This may have referred to a *Cakra* as a discus-like weapon.). There is some mention of the cakrās as psychic centers of consciousness in the *Yoga Upanishads* (circa 600A.D.) and later in the *Yoga Sutras of Patanjali* (circa 200 B.C.). pātanjali's tradition was largely dualistic, however, stating that nature and spirit were separate, and that the goal of yoga was to rise above nature.

The cakrās and Kundalini came to be an integral part of yoga philosophy in the non-dual Tantric tradition, which arose in the 7th century, in reaction to the dualist philosophy which preceded it. This tradition advised being in the world rather than separate from it. Tantra is commonly thought of in the West as primarily a sexual tradition, as Tantrism does put sexuality in a sacred context. Yet this is actually only a small part of a broad philosophy which includes many practices of yoga, worship of deities, especially the Hindu goddesses, and integration of the many polaric forces in the universe.

The main text about cakrās that has come to us from the West is a translation by an Englishman, Arthur Avalon, in his book, *The Serpent Power* published in 1919. Other texts such as: the, *ṣaṭcakra nirupaṇa* written by an Indian pundit in 1577, and the *pādaka pañcaka*,

written in the 10th century, contains descriptions of the centers and related practices. There is also another 10th century text, called the *gorakṣaśatakam*, which gives instructions for meditating on the *cakrās*. These texts form the basis of our understanding of *Cakra* theory and Kundalini yoga today.

In these traditions, there are seven basic *cakrās*, and they all exist within the subtle body, overlaying the physical body. Through modern physiology we can see that these seven *cakrās* correspond exactly to the seven main nerve ganglia which emanate from the spinal column. There are two minor *cakrās* mentioned in the ancient texts, the *soma Cakra*, located just above the third eye, and the *ānanda kāṇḍa lotus*, which contains the Celestial Wishing Tree (Kalpataru) of the Heart *Cakra*.

## CHAPTER – 3

### CAKRA PERCEPTION

The *cakrās* have subtle aspects on all levels of vibration. This is extremely complicated and most of the realization of these levels must be very personal. Anyone who possesses a slight degree of clairvoyance may easily see them in etheric double, where they show themselves as saucer like depressions or vortices in its surface. When quite undeveloped they appear as small circles about two inch in diameter, glowing dully in the ordinary man ; but when awakened and vivified they are seen as blazing, coruscating whirlpools, much increased in size, and resembling miniature suns.

So different people see occult aspects from different point of view. Some concentrate on their more subtle mystical aspects, some on their energy and pranic manifestations, some on their functional reality, some on their psychological effects, and still others on their physical concomitants. However these discrepancies are largely semantic due to differing cultural, educational and personal understandings. This is a common problem amongst men when communicating regarding the experiences of cakrās comes to question. So it is better to understand cakrās by one's own personal experience rather than trying to understand the cakrās through the written or verbal descriptions of others.

### 3.1 CAKRA SYMBOLOGY:

There are different colours and symbols of the cakrās. They are all beautiful and form an intrinsic part of the awakening of the individual cakrās. Each *Cakra* has a particular color, mantra, situation, and range of experiences associated with it.

Whereas the various esoteric cults and spiritual systems use different symbols to represent cakrās, in Yoga the cakrās are symbolized by Lotus flower. As a matter of fact the symbol of Lotus is very important. It represents the three stages: i.e. Ignorance, Aspiration, and Endeavor to reach the ultimate stage of illumination. The Lotus thus symbolizes mans growth from the lowest states of awareness to the higher states of consciousness.

The culmination of the growth o the Lotus is a beautiful flower. In the same way, the culmination of man's spiritual quest is the awakening and blossoming of human potential. Thus principal cakrās are visualized as lotus flower. The commentary on Yogini Hridaya describes 32 cakrās .However in different Indian Yoga Granthas there are different mentions of the actual number of the cakrās.

However, there are seven main *cakrās* –

- a) Mulādhāra - 4 petalled deep red Lotus.
- b) Svādhiṣṭhāna - 6 petalled vermilion Lotus.

- c) Maṇipūra - 10 petalled bright Yellow Lotus.
- d) Anāhata - 12 petalled Blue Lotus.
- e) Viśuddha - 16 petalled Violet Lotus.
- f) Ājnā - 2 petalled Silver Grey Lotus.
- g) Sahasrāra - 1000 petalled multicolored or Red Lotus.

But the exposition and perception of a Cakra is different for different people because it is primarily a subjective experience. However one thing is definite, as one moves up through the cakrās, the frequencies of the colours become more subtle and more powerful.

### **3.2. CAKRA KṢETRAM: (PLACE OF ENERGY)**

The kṣetram can be regarded as reflections of the original Cakra, trigger points and when we concentrate on them it create a sensation which passes through the nerves to the Cakra itself and then travels up to the brain.

Mulādhāra does not have a kṣetram, but Svādhiṣṭhāna, Maṇipūra, kṣetram, Viśuddha and Ājnā have physical counterparts directly in front of them on the same horizontal plane. Svādhiṣṭhāna kṣetram is at the level of the pubic bone in front of the body just above the genital organ. Maṇipūra kṣetram is at the navel, Anāhata kṣetram is at the heart and Viśuddha kṣetram is located on the front surface of the throat pit in the vicinity of the thyroid gland. Ājnā kṣetram is bhrumadhya, the mid eyebrow centre.

## CHAPTER – 4

### UNDERSTANDING KUṆḌALINI, GRANTHIS AND NADI

The word kuṅḍalini actually comes from the word Kunda, meaning ‘A deeper place, pit or cavity’. In relation to human body it refers to concave cavity in which the brain, resembling a coiled and sleeping serpent, nestles. Kuṅḍalini is the creative energy; it is the energy of the self expression. However, most commonly Kuṅḍalini is illustrated as a sleeping serpent three and half times coiled. The three coils represents the three matras of OM, which relates to the past, present and future; to the three gunas; tamas, rajas and sattva; to the three states of consciousness; waking, sleeping and dreaming; to the three types of experience; subjective experience, sensual experience and absence of experience. The half coil represents the state of transcendence, where there is neither waking, sleeping nor dreaming. So the three and half coils signify the total experience and the experience of transcendence (1).

The awakening of kuṅḍalini is the prime function of human incarnation and when the kuṅḍalini is awakened man is no longer a gross physical body operating with a lower mind and low voltage prana. Instead every cell is charged with the high voltage prana of kuṅḍalini. And when total awakening occurs, man becomes a junior god, an embodiment of divinity. However in the psychophysiology of Yoga, three knots (Granthis) are encountered in the awakening of the kuṅḍalini and the ascent to higher consciousness. These are three locations i.e. Brahma, Vishnu & Rudra where consciousness and energy are tightly knotted or intertwined, and must be unraveled if reality of higher consciousness is to be experienced (1).

The nadis on the other hand are not nerves but rather channels for the flow of consciousness. Within the net work of 72 lakh nadis (ref-10), there are ten main channels, and of

this ten, three are most important for they control the flow of prana and consciousness within all the other nadis of the body. Out of this three iḍā nadi controls all the mental processes while piṅglā nadi controls all the vital processes and susumnā nadi is the nadi for spiritual energy.

## CHAPTER – 5

### KNOWING - CAKRĀS

#### EVOLUTION: -

The human organism, its functioning, and the condition of its subtle bodies depends on the cakrās, work or spinning. When the cakrās are spinning effectively, they bring balanced functioning of the organism, a free flow of energies, and harmony between consciousness and sub-consciousness and between inner and outer worlds as well.

Cakrās at the physical level work through cords, which are nothing but lines of energy, resembling a string that enter the *Cakra* and connects one person with another.

A brief description of cakrās according to various available texts is given under;

#### 5.1 MULĀDHĀRA (ROOT) CAKRA:-



In ṣaṭcakra nirupaṇa it is said in 5<sup>th</sup> verse -

अथाऽऽधारपद्मं सुषुम् णास्यलग् नं ध्वजाधो गुदोर्ध्वं चतुःशोणपत्रम् ।

अधोवक्तमुधत्सुवर्णाभवर्णैर्वकारादिसान्त्तर्युतं वेदवर्णैः ॥५॥

*Athādhārapadmaṁ suṣum ṇāsya lag nam dhvajādho gudordhvaṁ  
catuḥśoṇapatram*

*adhovaktamudhat suvarṇābhavarṇaiḥ vakārādisāntairyutam veda varṇaiḥ* ॥५॥

*Now we come to the adhara lotus ( Muladhara). It is attached to the mouth of susumna, and it is placed below the genitals and above the anus. It has four petals of crimson hue. Its head (mouth) hangs downwards. On its petals are the four letters from Va to Sa, of the shining colour of gold.*

**Location** – Base of the spine in men and between the ovaries in women

### **Color**

Primary– Red

Secondary – Black

**Function** - It is some times called the “survival” *Cakra*.

- Concerned with those mechanisms which keep the physical body alive; money, food & Shelter.
- Family scars, social and familial information that form a persons idea of reality :
  - includes immediate and extended family, race, social status, educational level, family legacy and family expectations as handed down through generations;
  - “Tribal mind” concerned with loyalty.

**Bija Sound:** Lang.

**Animals:** Elephant, ox, bull.

**Deities:** brahmā, ḍākini, gaṇeśa Kubera, umā , lakṣmī, Prisni, Gaia, Persephone, Erda, Ereshkigal, Anat, Ceridwen, Geb, Hades, Pwyll, Dumuzi, Tammuz, Atlas.

**Body Parts** – The hips, legs, rectum, kidneys, bones, colon and lower back.

**Mental, Emotional issues** – Inability to keep a job or permanent living Situation; lack of commitment; operating out of fear; need for safety/ security in the world; not able to stand up for self or to provide for life necessities; unfinished business with partners, abuse or neglect in childhood; limiting psychological programming.

**Health issues** – Sciatica; varicose veins; chronic low back pain; rectal tumour or cancer.

**Yoga therapy:-**

**Backache** - back stretching, bow, cobra, cow face, spinal twist.

**Sciatica** – big toe.

**Cancer** – sun salutation.

**Recommended specific yoga posture:-** Star posture (5)

Sit comfortably, erect with legs extended in front of you, and breath regularly

1. Bend your right knee towards your chest, and place the sole of your foot opposite your left knee. Maintain this distance throughout the practice.
2. Bend your left knee and bring the soles of your feet together, allowing your knees to fall gently towards the floor.

3. Clasp your hand around your feet without shifting the position.
4. Exhale, slowly bending forward. Lower your face towards your feet until you reach a point of mild tension. Hold in that position and breathe in to the stretch.
5. Hold the position for as long as you comfortably can. Breathe regularly.
6. Slowly resume your starting position, breathe gently into each movement.
7. Rest.

## **Mulādhāra Meditation**

In the mulādhāra meditation, feel the energy flowing through the first chakra. Then get in touch with that center of consciousness which is your earth-like nature and become that consciousness to the exclusion of everything else.

To begin the mulādhāra meditation, it is first necessary to get in touch with the energy of the mulādhāra center and increase it. By increasing the level of energy, it will be easier to experience the energy in the Cakra, and then the consciousness which is a manifestation of the sub-field created by the Cakra. To start, find a comfortable position, preferably with your back straight, close your eyes and begin to breathe deeply through your nose without separation between inhalation and exhalation, and feel yourself relaxing. Take your time and let yourself become conscious of your body. This is easiest to do if you pay attention to your breathing for about five minutes, allowing it to get deeper and more rhythmic with each breath. After about five minutes, bring your attention to your first Cakra at the base of your spine. It's all right if you don't know exactly where it is. Bring your attention to where you think it is. Then begin breathing in and out from your first Cakra.

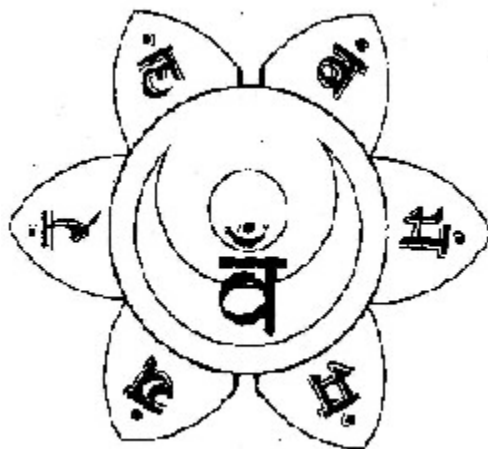
Feel that on every inhalation the breath does not stop at the bottom of your lungs but continues flowing down all the way to the base of your spine. Without separation between inhalation and exhalation, breathe out naturally through your nose. On each exhalation feel as if the energy at the base of your spine is growing stronger. You will feel the energy as a heat and intensity which will become more powerful on each exhalation. As it grows stronger, visualize the energy there as a ball of fiery, red energy. Continue both experiencing and visualizing the

energy growing brighter for two or three minutes. Let your consciousness, which for most people is centered somewhere around the shoulders and neck, move downward until it reaches the base of your spine and becomes centered in the ball of energy. Become the ball of energy and feel yourself being drawn downward into the Earth.

As this happens, pay attention to how you feel physically, emotionally and mentally. For some of you there will be profound changes on each level. Some of you will experience imagery associated with the Earth, imagery associated with the cycles of life, death and rebirth. Some students report experiencing feelings of continuity and rapport with other life forms or feelings of security, partnership and belonging associated with Nature and Mother Earth.

By doing this exercise repeatedly, you will learn about different aspects of your earth-like nature and your connection and interdependent relationship with the Earth. I would suggest that you take at least 10 minutes for this part of the meditation. After 10 minutes or when you are satisfied, take a deep breath through your nose, and as you exhale mentally repeat, "Every time I come to this level of consciousness I learn to use more of my mind more creatively." Next let your breathing return to normal, release the ball of energy at the base of your spine and the imagery associated with the first chakra. Then mentally return to the room and relax. After a few moments, begin to count mentally from one to five and open your eyes. One will feel wide awake, perfectly relaxed and better than one did before

## 5.2 SVĀDHIṢṬĀNA ( SPLEEN )CAKRA :-



In ṣaṭcakra nirupaṇa verse 15<sup>th</sup> it is said-

सिन्दूरपूरुचिरारुणपद्ममन्यत् सौषुम्णमध्यघटितं ध्वजमूलदेशे ।

अङ्गच्छदैः परिवृतं तडिदाभवर्णैर्वाद्यैः सविन्दुलसितैश्चपुरन्दरान्तैः ॥१५ ॥

*Sindūrapūrucirāruṇapadmamanyat sauṣumṇmadhyaghaṭitam dhvajamūladeśe |  
acchadaih parivoratantaḍidābhavarṇaivārdyaih sabindu lasitaiśca  
puraṁdarāntaiḥ ||15||*

*There is another lotus (svādhistana) inside the susumnā at the root of the genitals, of a beautiful vermilion colour. On its six petals are the letters from Ba to Puramdara, with the Bindu superposed, of the shining colour of lightning.*

**Location:** Lower abdomen to navel area.

**Colour** : Orange

**Function:** Energy centre through which we perceive other peoples emotions (Clairsentience);

- Concerned with to day to day physical aspects of living; also with people to whom we relate and with the quality of our relationships.
- Concerned with sexual energy and is the point from which we send and receive sexual feelings.
- Also concerned with creativity.

**Bija Sound:** Van.

**Animals:** Makara, fish, sea creatures

**Deities:** Indra, varuṇa , viṣṇu , rākini, Diana, Jemaya, Tiamat, Mari, Conventina, Poseidon, Lir, Ganymede, Dionysius, Pan

**body parts:** Ovaries, vagina, genitals, lumber spine, kidneys, bladder and large intestine.

**Mental, Emotional issues** - Problems with money, sex and control issues with other people; blame and guilt; power or control in the physical world; emotional aspects; fear of abandonment; sexual, emotional abuse/ incest.

**Health Issues** : Sexual dysfunction; reproductive disorders; fibroid tumors; allergies; skin disorders; Hemorrhoids; prostate and bladder problems; pelvic/lower back pain; over indulgence in food or sex.

**yoga therapy:-**

**Reproductive Organ:** Back Stretching, cobra, plough, the butterfly

**Prostate:** spinal twist, the butterfly, shoulder stand.

**Addiction:** Sun salutations, balance posture, pose of tranquility.

**Recommended specific yoga posture:** The Camel (5).

1. Come into a Kneeling position with legs together, toes pointing backward.
2. Bring your hand to your waist, supporting your lower back, and very carefully tilt your head backward.
3. Slowly and with careful awareness, place your right hand on your left heel- Hips should be kept elevated.
4. Breathe regularly and hold this position for as long as comfortable.
5. Release by slowly and carefully resuming the starting position.
6. Rest.

**Svādhiṣṭhāna Meditation**

To begin the svādhiṣṭāna meditation, find a comfortable position with your back straight. Close your eyes and begin breathing deeply through your nose without separation between inhalation and exhalation and feel yourself relaxing. Take your time and become conscious of your body by following your breath for about five minutes. After about five minutes, bring your attention to your second Cakra, right above your sexual organs. Then bring your breath to your second Cakra. On each inhalation, feel the energy centered in your sexual organs increasing. You will feel it as a heat and intensity which will grow stronger on each inhalation. As it grows stronger, visualize the energy there as a ball of orange energy. Experience and visualize it growing stronger and brighter for about two or three minutes.

Next, feel your consciousness moving downward until it reaches a point just above your sexual organs and feel your consciousness centered in that ball of energy. Become the ball of energy and feel yourself beginning to radiate outward from that center through out your body and then into the outer environment. Feel the magic and the sense of wonder which is a manifestation of the energy which radiates from the second Cakra. Pay attention to how you feel physically, emotionally and mentally. Some of you may feel spontaneous bursts of energy running up and down your spine or through your body. These are called **Kriyā** in Sanskrit. They are normal; enjoy them. You might feel them as a warm current of energy, or vibrations flowing through your body. These sensations are associated with an increased energy flow. Pay attention to the changes you experience, but don't try to influence them. After a short time you will begin to experience imagery associated with the second Cakra. Some of it might be sexual at first but if you don't identify with it or get attached to it, the sexual imagery will pass and it will be replaced with pictures associated with the creative process.

Take at least 10 minutes for this part of the meditation. After about 10 minutes or when you are satisfied, take a deep breath through your nose and as you exhale mentally repeat, "Every time I come to this level of consciousness I learn to use more of my mind in more creative ways." Then let your breathing return to normal, release the ball of energy by your second Cakra and the imagery associated with it and mentally return to the room and relax. After a few moments, begin to count mentally from one to five and when you reach the number five, open your eyes. You will feel wide awake, perfectly relaxed and better than you did before.



**Location:** Above the navel, below the chest.

**Colour:** Yellow.

**Functions:** It is the bodies' distribution point for psychic energies – psychic energy pumps;

- Power/ control centre. Will, personal power, authority, self control and self esteem.

**Bija Sound:** Rang.

**Animal:** Ram.

**Deities:** Agni, Surya, Rudra, Likini, Ra, Apollo, Helios, Athene, Brigit, Amaterasu, Belenos, Apis.

**Body Parts:** Stomach, bladder, pancreas, small intestine, liver and gall bladder.

**Mental, emotional issues:** fear, intimidation, lack of self confidence, self respect, or self control; inability to trust others; fear of assuming responsibility or making decisions for self; over emphasis on power/recognition; authority issues.

**Health Issues :** Digestive problems; indigestion; gastric or duodenal ulcers; anorexia nervosa; bulimia; arthritis; liver dysfunction; weight collected around the middle of the body.

**Yoga therapy :-**

**Stomach:** - mountain posture, pose of tranquility, the tree.

**Indigestion** – Cobra, spinal twist, pose of tranquility.

**Anorexia** - Pose of tranquility, back stretching, cobra, and spinal twist

**Recommended specific yoga posture; Spinal twist ( 5 )**

1. Sit up nice and tall, spine comfortably erect. With legs extended in front. Breathe regularly
2. Bend right leg at the knee and place right foot to the outer side of the left knee. Keep breathing.
3. On exhalation, slowly and smoothly turn your upper body to the right, placing both hands on the floor at your right side. Turn your head and look over your right shoulder.
4. Continue breathing regularly and hold this position for as long as comfortable.

**Mañipūra Meditation**

In this meditation you will get in touch with that transcendental self who allows you to participate and empathize with other people, and to connect deeply with them. By experiencing the radiations of the third Cakra consciously, you will transcend "me" concerns and experience the selflessness which permits you to connect with other people and to feel the deep contentment associated with that connection. To begin the mañipūra meditation, find a comfortable position with your back straight, close your eyes and begin breathing deeply through your nose without separation between inhalation and exhalation. As you breathe deeply, feel yourself relaxing. Become conscious of your body by paying attention to your breath for about five minutes. After about five minutes, bring your mental attention to your third chakra located just below the breastbone and begin breathing in and out from it. On each inhalation you will feel the energy in the solar plexus growing stronger. You will feel it as growing in heat and intensity. As the energy grows stronger, visualize it as a ball of golden yellow energy. Visualize and experience it growing brighter for two or three minutes. Next, feel your consciousness moving downward until it becomes centered in the ball of energy. Become the ball of energy and feel yourself radiating

outward from it, first through out your body and then into the outer environment. As you radiate, you will feel yourself beginning to melt. You will feel yourself becoming watery and fluid. As your consciousness radiates from that center, you will feel a profound empathy. This empathy, which is the product of trust and contentment, will permit you to feel compassion for the pain and suffering of others as well as for yourself. Surrender to these feelings and let them flow through you.

Take about 10 minutes for this part of the meditation. After about 10 minutes or when you feel satisfied, take a deep breath through your nose and as you exhale mentally repeat, "Every time I come to this level of consciousness I learn to use more of my mind in more creative ways." Then let your breathing return to normal, release the ball of energy from your third Cakra and the imagery associated with it, and mentally return to the room and relax. After a few moments, count mentally from one to five and when you reach the number five, open your eyes. You will feel wide awake, perfectly relaxed and better than you did before.

#### 5.4 ANĀHATA (HEART ) CAKRA :



In ṣaṭcakra nirupaṇa 23<sup>rd</sup> it is told -

तस्योर्ध्वे हृदि पङ्कजं सुललितं बन्धूककान्त्युज्ज्वलं

काद्यैर्द्वादशवर्णकैरुपकृतं सिन्दूररागाञ्चितैः ।

नाम्नाऽनाहत जिवितं सुरतरुं वाञ्छतिरिक्तप्रदं

वायोर्मण्डलमत्र धूमसदृशं षट्कोणशोभान्वितमं ॥२३॥

*tasyordhdve hrđi pankajam sulalitam bandhūkakāntyujjvalam*

*kādyairdvādaśavarṇakairupakritam sindūrarāgāścitaiḥ|*

*nāmnānāhata jivitam suratarum vāchātiriktapradam*

*vāyormaṇḍalamatra dhūmasadrśam satkoṇaśobhānvitam||23||*

*Above maṇipūra Cakra in the heart, is the charming lotus, of the shining colour of the Bandhuka flower, with the twelve letters beginning with Ka, of the colour of vermilion, placed therein. It is known by its name of anāhata, and is like the celestial wishing-tree, bestowing even more than (the supplicant's) desire. The region of Vayu, beautiful and with six corners, which is like unto the smoke in colour, is here.*

**Location:** Heart, centre of the chest

**Colour:** Primary – Green

Secondary – Pink

**Functions:** The *Cakra* of love affinity, compassion and nurturance;

- “Oneness” with life : Devine/ unconditional love, forgiveness and openness’;
- Sense of identity;
- Connects the lower three physical/ emotional centers to the three higher mental/ spiritual centers;
- Sometimes referred to as “high heart” *Cakra* in women – the “low heart” *Cakra* being the second *Cakra*

**Bija Sound:** Yang.

**Animals:** antelope, birds, dove.

**Deities:** viṣṇu , kraṣṇa, lakṣmī , kāma, ísvara, vāyu , Aditi, urvaśi , Eros, Freyja, Maat, Aphrodite, Isis, Aeolus, Shu, Asclepius, Pan, Dian Cecht.

**Body parts:** Heart circulatory system, lungs, shoulder and upper back.

**Mental, Emotional Issues :** Grief, issues with forgiveness, demanding judge- mentality, unresolved anger, hostility and criticism; self centeredness; resentment, fear, bitterness; decrease in love of life; inability to give love to self or others; inability to receive love. If the low “heart” in a woman has been closed through rape, incest, or abuse, a woman cannot truly open her “high heart” until the wound has been acknowledged and the healing process has started.

**Health Issues:** heart problems (congestive heart failure, myocardial infarction); Emotional instability; problems with breathing; asthma, allergy; lung cancer; breast cancer, middle of the back pain.

**Yoga therapy:**

**Asthma:** - mountain posture, pose of tranquility, lotus, bow.

**Bronchitis:** - Cobra, mountain posture, fish, shoulder stand

**Heart Disease:** - Pose of Tranquility, mountain pose, cleansing breath.

**Blood Pressure:** - Pose of Tranquility, cleansing breath.

### **Recommended specific yoga posture: The cobra ( 5 )**

- 1 Lie on the stomach, head turned to the side. Relax your arms and hands by your side. Breathe regularly.
- 2 Turn your head to the front, resting your forehead on the floor. Place your hands on the floor directly beneath your shoulders. Keep your arms close to your side.
- 3 Inhale, lift your upper body slowly and carefully, bending backward in one smooth movement. Breathe regularly and continue arching the rest of the spine, keeping the hips against the floor.
- 4 When the back is arched as far as comfortable stop. Breathing should be smooth and continuous.
- 5 When one is ready to release to position it should be very slowly and with controlled movement, lowering the back to the floor, starting with the abdomen, chest, chin, nose and forehead. Breathing should be continuous and synchronized with movement.
- 6 Relax, turning the head to the side and the arms beside the body.

### **Anāhata meditation**

Find a comfortable position with your back straight. Close your eyes and breathe deeply through your nose without separation between inhalation and exhalation, and relax. Become conscious of your body by following your breath for a few minutes. Bring your attention to your fourth Chakra at the center of breastbone. Then bring your breath to your fourth chakra. On each inhalation feel the energy centered in your heart Chakra grows stronger. As it grows stronger, visualize the energy there as a ball of emerald green light. Feel your consciousness move downward until it

reaches a point at the center of your chest and feel your consciousness centered in the ball of energy. Then become the ball of energy and feel yourself radiate outward from that center through your body and then into the outer environment.

Feel the love which radiates through the heart Cakra and pay attention to how you feel physically, emotionally and mentally. You will experience warmth that pulsates rhythmically from your heart and fills your whole body. After about ten minutes, take a deep breath through your nose then let your breath return to normal, release the ball of energy by your fifth chakra and any imagery associated with it and mentally return to the room and relax.

### 5.5 VIŚUDDHA ( THROAT ) CAKRA :



In ṣaṭcakra nirupaṇa verse 29<sup>th</sup> it is said -

विशुद्धाख्यं कण्ठे सरसिजममलं धूमधूमावभासं

स्वरैः सर्वैः शोणैर्दलपरिलसितैर्दिपितं दिप्तबुद्धेः

समास्ते पूर्णेन्दुप्रथिततमनभोमण्डलं वृत्तरूपं

हिमच्छायानागोपरि लसिततनोः शुक्लवर्णाम्बरस्य ॥२९॥

*viśuddhākhyam kaṇṭhe sarasijamamalam dhūmadhūmrāvabhāsam*

*svaraiḥ sarvaiḥ śoṇairdalaparilasitairdipitam diptabuddheḥ*

*samāste pūrṇenduprathitatamanabhomaṇḍalam vattarūpaṁ*

*himacchāyānāgopari lasitatanoh śuklavarnāambarasya||29||*

*In the throat is the Lotus called viśuddha, which is pure and of a smoky purple hue. All the (sixteen) shining vowels on its (sixteen) petals, of a crimson hue, are distinctly visible to him whose mind (Buddhi) is illumined. In the pericarp of this lotus there is the Ethereal Region, circular in shape, and which like the full Moon. On an elephant which as snow is seated the Bija of Ambara, who is white of colour.*

**Location:** Throat area, at the base of larynx.

**Colour:** Light Blue

**Functions:** cakrās of communication, inspiration, personal expression, and following ones dreams;

- Centre through which one receives “inner voice” – clairaudience (Clear Hearing).
- Ability to receive nourishment-talking responsibility for ones personal needs;
- Power of the spoken word – speaking your “truth” – higher knowledge.

**Bija sound:** Hang.

**Animals:** elephant, bull, lion.

**Deities:** sarasvati, gaṅgā, the Muses, Nabu, Brigit, Apollo, Hermes, Seshat.

**Body Parts:** Throat, neck, jaw, teeth and the thyroid gland.

**Mental, emotional issues:** issues with personal expression: inability to express one’s true feelings, thoughts, and beliefs; inability to speak up for oneself; issues regarding following one’s dreams and using one’s power to create in the physical world.

**Health Issues** : communication and / or speech problems; stuttering; thyroid problems; swollen glands; TMJ ( Tempero Mandibular Joint problems ); gum difficulties; throat and mouth ulcers; scoliosis; laryngitis; chronic sore throat; raspy throat; depression; shyness.

**Yoga therapy:**

1 **Thyroid** – pose of tranquility, child pose, spinal twist, sun salutation.

2 **Depression** – sun salutation, pose of tranquility, the cobra, spinal twist.

3. **Throat** – Lion.

4. **TMJ** – pose of Tranquility, cleansing breath.

**Recommended yoga posture: The Lion (5)**

Position yourself in any comfortable position –

- 1 Inhale and draw in a slow deep breath.
- 2 Exhale as you open your eyes and mouth as wide as possible.
- 3 Slowly, stick out your tongue as far as it will go without straining.
- 4 Hold the position as long as exhalation lasts, then slowly relax your tongue and facial muscles.

5 Continue breathing and visualizing all tension draining away from the face and throat.

### **Viśuddha Meditation**

In the viśuddha meditation, you will get in touch with the joy that is a manifestation of the transforming quality of the fifth Cakra. To begin the viśuddha meditation, find a comfortable position with your back straight. Close your eyes and begin breathing deeply through your nose without separation between inhalation and exhalation, and feel yourself relaxing. Take your time and become conscious of your body by following your breath for about five minutes. After about five minutes, bring your attention to it. Then bring your breath to your fifth Cakra. On each inhalation feel the energy centered in your throat Cakra growing stronger.

You will feel it as a heat and intensity. Visualize the energy there as a ball of blue light. Experience and visualize it growing stronger and brighter for about two or three minutes.

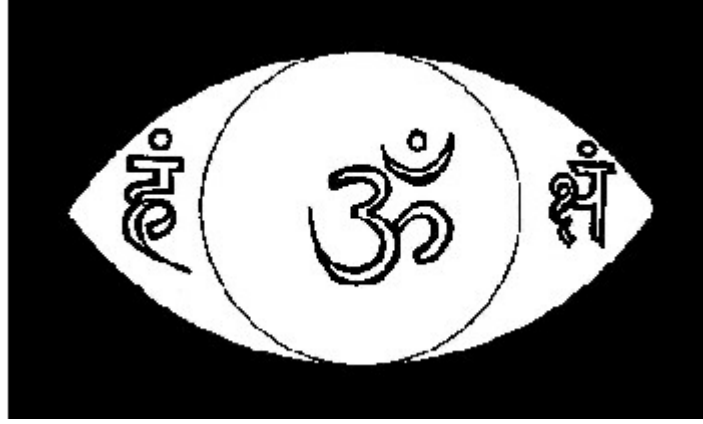
Feel your consciousness move downward until it is centered in the ball of energy. Then become the ball of energy and feel yourself radiating outward from that center through your body and into the outer environment. Feel yourself in your fearless character . . . noble and full of courage; experiencing the integrity of choosing yourself at every moment. Feel an inner affirmation coming through you--an affirmation which says "yes" to life at every moment. The more you are centered in your throat, the more triumphant you will feel. Without diminishing anyone else, your life will be victorious at every moment.

If you wish, you can mentally repeat the affirmation, "At last I am free" over and over to yourself. As you experience your victory on all levels of causation simultaneously, you will feel streams of energy shooting up your spine. As they pass your throat chakra, they will become currents of unconditional joy. Accept your victory. By doing so, you will be fulfilling your Dharma by being yourself completely at every moment.

Take at least ten minutes for this part of the meditation. After about ten minutes or when you are satisfied, take a deep breath through your nose and as you exhale mentally repeat "Every time I come to this level of consciousness, I learn to use more of my mind in more creative ways."

Then let your breath return to normal, release the ball of energy by your fifth Cakra and any imagery associated with it and relax. After a few moments, count mentally from one to five and when you reach the number five, open your eyes. You will feel wide awake, perfectly relaxed and better than you did before.

### 5.6 Ājnā (THIRD EYE) CAKRA:



In ṣaṭcakra nirupaṇa verse 33<sup>rd</sup> it is told -

आज्ञा ख्यानाम्बुजं तद्धिमकरसदृशं ध्यानधामप्रकशं

हक्षाभ्यां वै कलाभ्यां प्रविलसितवपुर्नेत्रपत्रं सुशुभ्रम् ।

तन्मध्ये हाकिनि सा शशिसमधवला वक्तषट्कं दधाना

विद्यां मुद्रां कपालडमरुजपवर्तिं विभ्रती शुभ्रचित्ता ॥३३॥

*ājnā khyānāmbujaṃ taddhimakarasadrśaṃ dhyānadhāmaprakaśaṃ*

*hakṣābhyāṃ vai kalābhyāṃ pravilasitavapurnetrapatraṃ suśubhram |*

*tanmadhye hākini sā śāśisamadhavalā vaktasaṭkaṃ dadhānā*

*vidyāṃ mudrāṃ kapālaṃ ḍamarujapavartī vibhratī śubhracittā ||33||*

The lotus named ājnā is like the moon, (beautifully white). On its two petals are the letters Ha and Ksa, which are also white and enhance its beauty. It shines with the glory of dhyāna. Inside it is the śakti Hakini, whose six faces are like so many moons. She has six arms, in one of which she holds a book, two others are lifted up in the gestures of dispelling fear and granting boons and with the rest. She holds a skull, a small drum, and a rosary. Her mind is pure (śuddha-Citta).

**Location**-center of the forehead, between the eyebrows.

**Color** - Indigo.

**Function** – clairvoyant (clear seeing) center, intuition, wisdom, personal Vision;

- Is the Cakra of visualization, imagination and insight;
- Another function is to let you know when other people are thinking of you, which is a form of “mental telepathy”.

**Bija Sound:** Aum.

**Animal:** Owl.

**Deities:** śakti Hakini, kraṣṇa , paramśiva , Isis, Themis, Apollo, Iris, Morpheus, Tara, Hecate, Belenos.

**Body parts-** eyes, face and brain.

**Mental and Emotional issues-**fear of self evaluation; intuitive skills and knowledge; misuse of intellectual skills; fear of being open to the ideas of others; paranoia and anxiety; refusal to learn from life experiences.

**Health issues** – eye problems; headache; brain tumors; blood clots; neurological disorders; blindness; deafness ; spinal difficulties ; scissors; learning disabilities ; tension; lack of concentration ; sinus problems; mental confusion ; lack of spiritual understanding or vision.

**Yoga therapy:-**

**Tension** - back stretching, pose of tranquility, mountain pose, and shoulder stand.

**Eye strain** - pose of tranquility, child pose.

**Headache** – lion, pose of tranquility.

**Sinusitis** - mountain pose, pose of tranquility, sun salutation.

**Recommended specific yoga posture: Palming (5)**

1. Sit up tall, spine comfortably erect, at a table or desk where you can also rest your elbows.
2. Rub palms of your hands together, briskly, warming them and charging them with natural electricity.
3. Gently place your palms (fingers together to block the light) over your closed eyes. Rest your fingers slightly on your forehead. Relax your eyelids, avoiding placing any pressure on the eyeballs. Breathe regularly.
4. Stay in this position for one to two minutes.
5. Separate your fingers and open your eyes to let your eyes adjust to the light. Relax your arms and hands. Blink your eyes for few times to help get you back into your body.
6. Repeat, if you would like. This exercise helps relieve eye strain.

**Ājnā Meditation**

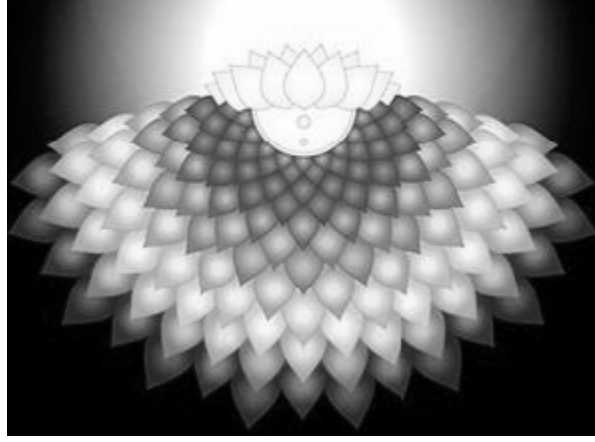
In the ājnā meditation, you will get in touch with the quality which harmonizes everything within you. To begin the ājnā meditation, find a comfortable position with your back straight. Close your eyes and begin breathing deeply through your nose without separation between inhalation and exhalation, and feel yourself relaxing. Take your time and become conscious of your body by following your breath for about five minutes. After five minutes, bring your attention to your sixth Cakra, between your eyebrows. Then bring your breath to your sixth Cakra. On each inhalation feel the energy centered in your third eye grows stronger. You will feel it as a heat and intensity which will grow stronger on each inhalation.

As it grows more powerful, visualize the energy there as a ball of indigo light. Experience and visualize it growing stronger and brighter for about two or three minutes. Then feel your consciousness move upward until it reaches a point between your eyebrows and feel your consciousness centered in the ball of energy. Then become the ball of energy and feel yourself radiating from that center through your body and into the outer environment.

Feel yourself as the union of selves. Feel your mind radiate in all directions simultaneously and feel yourself fill the room with your consciousness. Pay attention to how you feel physically, emotionally and mentally. The more you are centered in the third eye, the more complete will be the union between consciousness and unconsciousness. In this condition you will feel what seems like an electrical current running through your physical body, and your entire head will begin to glow with the center of this fire being the third eye.

Take at least ten minutes for this part of the meditation. After ten minutes, or when you are satisfied, take a deep breath through your nose and as you exhale mentally repeat, “Every time I come to this level of consciousness, I learn to use more of my mind in more creative ways.” Then let your breathing return to normal, release the ball of energy by your sixth cakra and the imagery associated with it and mentally return to the room and relax. After a few moments begin to count mentally from one to five and when you reach the number five, open your eyes. You will feel wide awake, perfectly relaxed and better than you did before.

## **5.7 SAHASRĀRA (CROWN)CAKRA**



In ṣaṭcakra nirupaṇa verse 41<sup>st</sup> it is said-

तदूर्ध्वेशङ्खिन्या निवसति शिखरे शुन्यदेशे प्रकाशं

विसर्गाधः पद्मं दशशतं दलं पूर्णपूर्णेन्दुशुभ्रम् ।

अधोवक्तं कान्तं तरुणरविकलाकान्तं किञ्जल्कपुञ्जं

ललाटाद्यैवर्णैः परिलसितवपुःकेवलानन्दरुपम् ॥४१॥

*tadūrdhve śankhinyā nivasati śikhare śunyadeśe prakāśam  
visargādhah padmaṁ daśaśata dalaṁ pūrṇapūrṇenduśubhram  
adhovaktaṁ kāntaṁ taruṇaravikalākānta kinjalkapunjam  
lalāṭādyaivarṇaiḥ parilasitava puḥkevalānandarupam||41||*

*Above all these, in the vacant space wherein Sankhini Nadi is, and below viśargais the lotus of thousand petals. This Lotus, lustrous and whiter than the full Moon, has its head turned downward. It charms. Its clustered filaments are tinged with the colour of the young Sun. Its body is luminous with the letters beginning with A, and it is the absolute bliss.*

**Location** - top of the head.

**Color** -violet.

**Function** - Cakra of “knowingness” or pure intuition, seeing the larger purpose in our lives;

- Free will / ownership of body;
- Attitudes, faith, values, ethics, courage and humanitarianism.

**Bija Sound:** none.

**Animals:** none associated.

**Deities:** Shiva, varuṇa, āma- kāl, Zeus, Odin, Nut, Enki, Inanna, Mimir, Ennoia.

**Body parts** – spine and nervous system.

**Mental, emotional issues-** inability to trust life; issues with selflessness; inability to see the larger patterns in life; absence of faith; lack of inspiration; issues with humanitarianism; inability to make decisions; confusion.

**Health issues** – loss of freewill; paralysis; bone cancer; skeletal problems; muscular system and nervous system diseases; genetic disorders; fatal illness; brain problems; pineal gland disorders.

**Yoga therapy :-**

**Immune system** - pose of tranquility, spinal twist, sun salutation, the tree.

All forms of yoga leads to opening of the charkas, to the wakening of the higher consciousness.

**Recommended specific yoga posture: pose of tranquility (5)**

1. Lie full on your back, legs extended, with your feet a comfortable distance apart, and each foot falling limply outward.

2. Relax your arms by your sides, a comfortable distance from your body. Release any tension from your hands.
3. Focus on your breathing, taking nice deep breathes from the abdomen. Inhale, breathing in positive, cleansing energy, and exhale, releasing any tension or toxins.
4. When you are breathing has settled in to a smooth, light, rhythmic action, start to focus your full attention on individual body parts, so that tension in each area just drains away, leaving the body totally relaxed. One way of doing this is by first tensing (contracting the muscles in) each body part, holding the tension, and then releasing it (called the contraction and relaxation method of stretching).

One sequence of relaxation is as follows; start with your feet and work your way up through the body to the head; feet, calves, front of thighs, pelvis, abdomen, lower back, chest, upper back, fingers, hands, forearms, upper arms-back and front, shoulders, throat, neck, jaw, lips, tongue, eyes, brow and scalp.

1, Continue focusing on your breathing, quieting the mind. Scan your body once more for tension, breathing into areas that may still be holding tension.

2. Hold this position as long as comfortable.

### **Sahasrāra Meditation**

When it comes to the crown Cakra, no meditation is possible because a person doesn't exist as a separate being any longer but instead at every moment he is in union with the All and the All at every moment is meditating through him.

Sitting quietly, doing nothing .Spring comes, and the grass grows by itself

## CHAPTER – 6

### METHODS OF OPENING CAKRĀS

cakrās can be awakened by various methods which can be practiced individually or in combination. However the first method can not be practiced, because it is awakening by birth.

1. Awakening by birth - If the parents are highly evolved then the child born to them will have charkas which have already opened. If a child comes with partial awakening, he is called a saint, and if he comes with full illumination, he is known as incarnation, or son of god. Although it is difficult to convince but through yoga one can transform the quality of genes and may be then more and more children with open cakrās can be produced.

2. Tapaṣyā – It is a psychological or psycho-emotional process through which the aspirant tries to set in motion a process of metabolism that will eradicate the habits that creates weakness and obstructs the opening of cakrās.. The strength of will which is the result of tapaṣyā leads to the opening.

3. Rāja yoga- This process is the total merging of individual consciousness with superconsciousness. It occurs by a sequential process of concentration, meditation and communion; experience of union with the absolute or supreme. However rāja yoga method of opening charkas is very difficult for most people as it requires time, patience, discipline and perseverance.

4. Kriyā Yoga- It is the most simple and practical way for modern man as it does not require confrontation with the mind. It is best for tumultuous, noisy, *rājasika* mind. It does not create a explosive opening but can bring visions and other mild and controllable experiences.

5. Śakti pāta - This method of opening is performed by the guru. The opening is instant, but it is only a glimpse, not a permanent event.

## CHAPTER – 7

### EXPERIENCE OF OPENING CAKRĀS

The adventure of opening the cakrās is a journey through the border region between the known and the unknown. There is a profound alteration in consciousness after this process.

The preliminary opening of charkas is followed by the experience of light in bhrumadhya, the eyebrow center. Usually the other signs and symptoms of opening charkas are decrease in appetite for food and sleep, quietness of mind and the most important is the breathing pattern in the nostrils which changes normally every fourth day, according to the cycles of the moon. When the actual opening occurs there is an explosion in the realm of experience and there are symptoms like release of energy, like an electric shock from the bottom of the spinal chord as if it were connected to an electric power point. At times there is a feeling of lightness and one may visualize the spinal chord as a florescent light. There is detachment from normal emotions of life and everybody seems as dry as a desert. But at the same time the mind become very dynamic and appears to be formless.

How ever these are few symptoms and all of them pass quickly and then one comes back to normal life. Externally one is same but after this the inner awareness is far greater and vaster.

In ṣaṭcakra nirupaṇa verse 46<sup>th</sup> it is said -

इह स्थानज्ञात्वं नियतनिजचित्तो नरवरो

न भुयात् संसारे पुनरपि न बद्धस्त्रिभुवने ।

समग्रा शक्तिः स्यान्नियत मनसस्तस्यध कृतिनः

सदा कर्तुं हर्तुं खगतिरपि वाणी सुविमला ॥४६॥

*iha sthānaṁ jñātva niyatanijacitto naravaro*

*na bhuyāt saṁsāre punarapi na baddhastribhuvane ।*

*samagrā śaktiḥ syānniyata manasastasya krtinaḥ*

*sadā karttuṃ harttuṃ khagatirapi vāṇī suvimalā||46||*

*that most excellent of men who has controlled his mind and known this place is never again born in the Wandering, as there is nothing in the three worlds which binds him. His mind being controlled and his aim achieved, he possessed complete power to do all which he wishes, and to prevent that which is contrary to his will. He ever moves towards the Brahman. His speech, whether in prose or verse, is ever pure and sweet.*

## CHAPTER - 8

### SCIENTIFIC RESEARCH AND CAKRĀS

One man who has helped to pioneer scientific research into yoga and cakrās is Dr. Hiroshi Motoyama. In search for the existence of cakrās, Motoyama has developed his own machinery.

One of these is the ‘*Cakra* instrument’ which is designed to detect the electromagnetic field of the body and any changes which take place in it due to *Cakra* stimulation and activation. Looking like a telephone booth and enclosed in a light-proof, lead-shielded room, the machine was designed to detect energy generated in the body and then emitted from it in terms of various physical variables such as electrical, magnetic and optional energy changes. Copper electrodes are positioned at the top and bottom of the cage and a sliding, square panel with electrodes on all four sides is free to traverse up and down the frame structure so as to be positioned at any part of the subject’s body. An electromagnetic field is set up between the electrodes and any vital energy ejected from the body affects this sensitive field. A copper electrode and a photo-electric cell are positioned 12 and 20 centimeters in front of the subject, level with the classical position for a given *cakra*. The location is monitored for changes as the individual concentrates his mental energy at the *Cakra* point, and measurements are made for 3 to 5 minutes before, during and after concentration on the *Cakra*. Because of its powerful pre amplifier (impedance near infinity), even the most subtle energy ejection can be picked up and recorded. Information recorded is sent to various amplifiers, computerized analyzers and oscilloscopes and is recorded on a highly sensitive chart recorder. He measured *Cakra* activity in normal subjects and recorded readings in numerous subjects practicing yoga versus untrained, control subjects and found that in and untrained subject concentrating on *ajñā Cakra* there was no change recorded by the electrodes of his instrument. This he compared with another subject who has been practicing yoga for five years and marked that there was a rise in electrical activity from *ajñā Cakra* thus show in that he had developed control over *ajñā Cakra* by practicing yoga.

Objective evidence for the existence of the cakras also appears to have been founded by kinesiologist Valerie Hunt and her associates at UCLA in America, assisted by Rosalyn Bryere, a psychic “aura reader”. Hunt used a number of measurements in order to study the body’s field emission when it being stimulated by deep muscle massage (Rolfing). The study concluded that there had been direct correspondence in every instance throughout all recording between the distinctive wave form and the psychic description of color emanating from the cakrās. The relationship between the emotional state and the color was also accurate. However in early Rolfing sessions the cakras appeared to be uneven, small, and low in frequency and amplitude. The primary colors were also indiscriminate. As the technique continued the cakras became large, even in size, and of lighter color while the wave forms were at higher amplitude and frequency.

The work of Motoyama and Hunt points to the fact that the *Cakra* locations have both a physical component and a psychic component. This scientific description fits the definition of the cakrās as vortices of energy, the interacting points of the most powerful psyche and physical forces which control our total human existence.

## **CHAPTER - 8**

### **SUMMARY AND CONCLUSIONS**

cakrās have a subtle aspect of existence. They cannot be understood by simple book reading. Rather than trying to understand charkas through the words written or said one should and must experience through personal experience.

At present we are going through a change over phase where science has come out through its water tight compartments and has started looking to the knowledge of energy propounded by our ancient rishis with renewed interest. It is this new found interest that is opening up new horizons as far as cakrās are concerned. cakrās and kuṇḍalini are now reinvestigated for their power to heal and open up channels of unbound, infinite source of śakti within our physical frame of existence. New research in this field has certainly established the existence and power of cakrās. However there is still a wide scope for research. Science has for the time being certainly placed itself in a position where the mystery of divine, infinite śakti can be understood.

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**PART-2**  
**Experimental Research**

**Title:** EFFECT OF TIBETAN BUDDHIST MINDFULNESS  
MEDITATION (*VIPASSANA*) ON HEART RATE VARIABILITY  
(HRV) SPECTRUM

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**UNCTION**

Recent scientific studies have begun to reveal some glimpses into the regional mechanisms of brain that become active in different types of thoughts ( Ganong-1985).There has been attempts

to understand the brain maps during mind modifying techniques such as meditation and relaxation responses (Lele, 1991).

Meditation is a complex mental process involving changes in cognition, sensory perception, affect, hormones and autonomic activity (Newberg & Iverson, 2003). Meditation offers a fascinating window into human consciousness; psychology and experience; the relationship between mental states and body physiology; emotional and cognitive processing; and the biological correlates of religious experience.

Early scientific research on meditation such as Zen and other were basically carried out with the interest and expectation of discovering new possibilities and potentialities of these practices influencing the physical and mental health, for promotive and therapeutic benefits (Kasamatsu & Hirai, 1966; Sugi & Akutsu, 1968).

The subsequent researches have contributed additional novel information on EEG, Psychophysiological changes and autonomic functions in practitioners of Transcendental meditation (Wallace, 1970; Wallace et al., 1971; Orme –Johnson, 1975; Banquet, 1973; Travis & Wallace, 1999; Travis, 2001) and other meditations (Elson et al., 1977; Corby et al., 1978; Telles & Desiraju, 1993; Telles et al., 1995). A more detailed review of the scientific literature on meditation is given in the next section of this dissertation.

Since then there has been a growing interest to discover the nature of changes that could occur due to practice of different types of meditation. Out of numerous meditation procedures, some have become particularly popular because of easy to practice methodology for the busy world. Transcendental Meditation, Brahmakumaris Raja Yoga, Zen and ‘OM’ meditations are such examples. Tibetan Buddhist Mindfulness (*vipassana*) meditation is another well know standardized meditation technique.

However Tibetan Buddhist classification of mind, its divisions and the systems of meditation practices aimed at achieving ideal states of being are a complex presentation of psychological, behavioral and spiritual concepts and processes that demand thorough understanding before assessing their values and outcomes (Rapgay et al., 2000). '*vipassana*' is the technique of meditation that encompasses the above features. Studies on '*vipassana*' have suggested an enduring increase in sensitivity and pre attentive processes involved in visual detection (Brown et al., 1984).

Since there has been no report on the autonomic and respiratory variables of '*vipassana*' meditation, it was decided to study the heart rate variability, a specific indicator of autonomic nervous system during the practice of (*vipassana*) meditation and its comparison with random thinking.

## **CHAPTER – 2**

### **AIMS AND SCOPE**

1. To understand the influence of Tibetan Buddhist Mindfulness (*vipassana*) meditation on autonomic nervous system, using a specific indicator, 'HRV' spectrum.
2. To understand the changes in nervous system based on type of meditation, exp- Dharana, Dhyana aspect of *vipassana* meditation.



## CHAPTER – 3

### REVIEW OF LITERATURE

#### 3.1 GENERAL

“Yoga is a timeless, pragmatic science which has evolved over thousands of years. It deals with the physical, mental, moral and spiritual wellbeing of man as a whole” (Iyengar, 1966).

The earliest systematic description of this practice was the classic treatise the: “Yoga Sutras” of Patanjali, dating back to 200 B.C. Patanjali enumerates the eight (*asta*) limbs or stages (*anga*) of yoga. They are: universal moral commandments (*yama*); Self purification by discipline (*Niyama*); posture (*Asana*); voluntary regulation of the breath (*Pranayama*); withdrawal and emancipation of the mind from external objects (*Pratyahara*); concentration (*Dharana*); meditation (*Dhyana*) and a state of super consciousness in which the aspirant becomes one with the Paramatma or Universal spirit (*Samadhi*).

Of these eight steps, *Asanas*, *Pranayamas* and *Dhyana* (meditation) techniques are exhaustively discussed and used than the others. Scientific studies on yoga deal mainly with these three practices.

#### 3.2 EARLIER SCIENTIFIC STUDIES ON MEDITATIONS

The earliest scientific study on yogic practice was done by Swamy Kuvalyananda in the early 1920, in which he reported sub-atmosphere pressure in the various internal cavities during *Uddiyana- bandha* and its extensions of *navli*.

In the following studies on meditation, the results are mainly based on single session studies, which cannot be considered adequate on account of the changes in the physiological variables from day to day in a single individual.

Meditation is a highly subjective process not easy to define or describe, Sage Patanjali referred to *dhyana* (meditation) in verse 3.2 as an uninterrupted flow of the mind towards the object chosen for meditation.

Different techniques of the meditation employ different strategies, but fundamentally they all aim at heightening awareness and bringing mental processes under greater control. Some techniques involve concentration and the meditator is taught to fix the attention on an object. The object of meditation may be internal or external. As concentration increases, distractions reduce and these longer periods of continued awareness are called meditation. In mindfulness the meditator learns to view one's own thoughts and perceptions dispassionately, without reacting to them.

Studies on meditation can be broadly grouped according to the techniques employed, viz. Transcendental Meditation, Brahmakumaris Raja Yoga Meditation, Zen meditation, Tantric Yoga meditation and 'OM' meditation.

### 3.3 TANTRIC YOGA MEDITATION

For this technique the meditator has to repeat a sacred mantram given by the guru, along with intense concentration. This is the type of meditation practiced by the Ananda Marga organization, Pondicherry, India.

Elson et al., (1977) studied both amateurs and experienced practitioners (average experience was 1.8 years) of Ananda Marga meditation and found that there was an increase in

alpha and theta activity during meditation. There was a decrease in skin conductance and rate of respiration.

In another study, Corby et al., (1978) investigated 2 groups of meditators. The average experience was 2.1 – 4.4 years. All subjects were very committed and practiced for a minimum of 3 hours per day. There was also a control group. Meditators showed a statistically significant increase in alpha and theta activity compared to the control group. This study also reported changes in autonomic parameters. Heart rate and respiratory rate changes were not significant within the group. During meditation there was a trend for the heart rate to decrease relative to the control group. One of the subjects had a near *Samadhi* (enlightenment) experience, and they recorded an increase in heart rate, respiratory rate and a marked decrease in skin resistance.

### 3.4 RAJA YOGA MEDITATION

This technique involves the eight stages given by sage Patanjali in the Yoga Sutras. The meditator concentrates on an image, as already described; as already described. This may be either internal or external. The ultimate stage is called *Samadhi* (enlightenment).

Bagchi and Wenger (1957) studied 14 subjects during Raja Yoga Meditation and during a control period, during which the subject rested. They did not show changes in electroencephalogram (EEG) patterns, heart rate or blood pressure. However, there was an increase in skin resistance and a decrease in respiratory rate. In a later report (1961), Wenger and Bagchi measured various physiological changes occurring during Raja Yoga meditation in 4 yoga students (2 to 7 years experience) and 4 subjects with longer experience. In both the more and less experienced subjects, heart rate increased by 1 or 2 beats per minute during meditation. This was more marked in the latter. Studies of finger pulse volume, showed slightly higher values after meditation.

In the seniors, the mid meditation pulse volume and on the whole the basal levels were higher and changes were more pronounced, when compared to the yoga students. In both group groups the systolic and diastolic blood pressure readings were slightly more than in the pre-meditation period. All average blood pressure readings were greater for the older yogis than for the yoga students in meditation. With regards to the respiratory system response, the yoga students showed a dip in breath rate from about 14 to 6 or 7 breaths per minute, which remained approximately constant during the remainder of the meditative period. The authors also reported that palmar conductance has decreased in both groups during meditation. In the yoga students the decrease in palmar conductance was more than that seen during a period of relaxation. The authors postulated that in those individuals who had many years of experience, their ambient breath rate was lower than those whose practice, was of shorter duration and hence, the change in their breath rates would be less marked than that of the yoga students.

Gharote (1971) measured the changes in the metabolic rate during Raja Yoga Meditation in a single subject. The average metabolic rate recorded over 3 days prior to meditation was 37.1 calories per square meter per hour, only 1 calorie higher than the subject's basal metabolic rate. The mean metabolic rate during meditation (29.67) was less than the pre-meditation value though this was not statistically significant. The metabolic rate tested soon after meditation (40.03) showed a statistically significant increase compared to the mean during meditation ( $p < 0.01$ ). This subject was known to go into a profound meditative state in which there was non-responsiveness to external stimuli and a diminution of EEG and EKG voltages.

Telles et al., (1993) studied 18 males in the age range of 20 to 52 years (mean  $34.1 \pm 8.1$ ), with 5-25 years experience in meditation (mean 10.1). Each subject was assessed in three test sessions which included a period of meditation and also in three control (non meditation)

sessions, which included a period of random thinking. Group analysis showed that the heart rate during the meditation period was increased compared to the preceding baseline period as well as compared to the value during the non-meditation period of control sessions. In contrast to the change in the heart rate there was no significant change during meditation for the group as a whole in palmar GSR. Finger plethysmogram amplitude and respiration rate. On an individual basis changes which met the following criteria were noted: (1) changes which were greater during meditation (compared to its preceding baseline) than changes during post meditation or non-meditation periods (also compared to their preceding baseline), (2) Changes which occurred consistently during the three repeat sessions of a subject and (3) changes which exceeded arbitrarily-chosen cut off points. This individual level analysis revealed that changes in autonomic variables suggestive of both activation and relaxation occurred simultaneously in different subdivisions of the autonomic nervous system in a subject. Apart from this there were differences in patterns of change among the subjects who practiced the same meditation. Hence, a single model of sympathetic activation or overall relaxation may be inadequate to describe the physiological effects of a meditation technique.

### 3.5 ZEN MEDITATION

Zazen- Zen meditation is a fundamental part of both the soto and Rinzai sects of Zen Buddhism. In this form, the ultimate state of enlightenment or satori is aimed at. This technique involves concentration. The practitioners are very committed and lead austere and disciplined lives. Hirai (1960), found changes in the breathing during Zen meditation. The breath rate decreased to 4-5 breaths per minute. The amplitude of both abdominal and thoracic breathing increased during

meditation. However, the amplitude of abdominal breathing was greater than that of thoracic. The same study reported an acceleration of the pulse rate during meditation to between 80 and 100 beats/minute.

In a study on experienced Zazen mediators, Akishige (1968) reported a decrease in spontaneous skin conductance responses during Zazen. The same study also showed that there was a decrease in oxygen consumption and rate of respiration, associated with Zen meditation.

Goyeche and others (1972) compared Zen meditators with relaxation. In their within-subject design the order of treatment (i.e., quiet relaxation or meditation) was randomly assigned to each of the 8 subjects. It was found that the breath rate and heart rate decreased during Zen meditation (cited from Woolfolk, 1975).

Becker and Shapiro (1981) studied 5 groups of subjects: Zen meditators, TM subjects, Yoga subjects and 2 groups of non meditators. The subjects were given click stimuli and the alpha showed suppression and subsequently clear habituation, with no differences among groups.

### 3.6 G TUM – MO MEDITATION

Literally, G Tum – mo means “heat”. This is an advanced Tibetan Buddhist meditation practice. The belief is that during this practice, dissolution of the vital energy (*prana*) occurs and the internal heat is ignited.

Benson et al (1982) reported changes in the temperature of the digits in 3 senior meditators. There was an increase in the digit temperature by 9.3° C during meditation. In this study the number of recording sessions is not mentioned. Also, separate non-meditation control sessions were not carried out.

### 3.7 TRANSCENDENTAL MEDITATION

In 1968, R K Wallace made the first serious investigation of the physiological effects of TM which was published in his PhD thesis, entitled “The Physiological Effects of TM: A Proposed Fourth Major State of Consciousness” (1970).

In this, 27 subjects were studied. Each subject acted as his own control. There was a pre-control period: 10 min eyes open and 10-20 min with eyes closed. This was followed by 20-40 min of meditation, after which the subjects sat with eyes closed, and then eyes open, each for 10 minutes. In this study there was no repetition of meditation sessions; neither were there non-meditation session for further comparison. EEG was recorded in 26 subjects.

The most notable change in the EEG pattern was an increase in intensity of 8-9 cycles per second waves (slow alpha) in the central and frontal regions. Depending on the subjects, there was an increase/decrease/no change in the intensity of 10-11 cps alpha. They had reported feeling drowsy at the onset of meditation and their EEG record showed a flattening of alpha activity to low voltage mixed frequency waves, especially in the 2-7 cps range.

In a later study, Wallace, Benson and Wilson (1971), described their observations on 36 subjects. The subjects acted as their own controls. The pre control period consisted of 10-30 min with eyes closed and eyes open for a similar period. After 20-30 min of meditation they were asked to stop meditating and sit with eyes closed for 10 min, and then eyes open for the same time. The average heart rate decreased during meditation by 3 beats per minute.

Rieckert (1967), cited by Wallace et al (1971), reported a significant increase in forearm blood flow during meditation. While the finger circulation showed a slight decrease. These changes were contrasted with those in a group practicing autogenic training i. e. , this group showed a significant increase in finger circulation and a slight increase in forearm circulation.

A 1972 study by Levander and others on 5 TM subjects, reported changes in the forearm blood flow measured with a water plethysmograph. There was a small but significant increase in mean forearm blood flow during TM. There was a decrease on non-TM days during the test and post-test periods.

Orme-Johnson (1973), reported a study on 16 subjects – 8 of who were meditators and 8 were controls. The meditators had a mean experience of 15 months. They studied the GSR habituation and spontaneous GSR fluctuations. In a second experiment, they studied 6 meditators (with experience of meditation ranging from 2 – 54 months) and 8 non-meditators. Though habituation was initially similar for the two groups, the meditators habituated in significantly fewer trials than non-meditators. Also, there was a low frequency of spontaneous GSR fluctuations in meditators as compared to controls.

The mean rate of spontaneous GSR was 6.14 per 10 minutes compared to 18-25 per 10 min for meditation vs. pre-control periods. The meditators had 8.7 responses per 10 min for meditation vs. pre-control periods. The meditators had 8.7 responses per 10 min during rest compared to 21.0 per 10 min for non-meditators.

Wolkowe et al., (1984) reported a significant decrease in minute ventilation following meditation. The study included 16 experienced meditators and an equal number of controls. The decrease was attributed to a decrease in the breath duration which caused a decrease in tidal volume.

In many of the studies there were inadequate controls and statistical evaluation was also not adequate. In all cases it is not possible to determine to what extent the changes can be attributed to meditation and not to other factors, such as individual variations, the response to the environment, the effect of sitting etc.

### 3.8 'OM' MEDITATION

Telles and Desiraju (1993) recorded middle latency auditory evoked potentials in 7 proficient subjects during the practice of meditation on the syllable OM, to determine whether these potentials would differ significantly from those recorded during the baseline state without practicing meditation. Similar records were also obtained in 7 "naïve" subjects, matched for age, before and during a control period which involved sitting with eyes closed, and with no special instructions for focusing their thoughts. There was considerable inter subjects variability in the different components. However, during meditation there was a small but significant reduction in the peak latency of the Nb wave (the maximum negativity occurring between 35 and 65 m sec). This reduction was observed consistently during the 3 repeat sessions of each subject, while the "naïve" subjects did not show this change. These results suggest that the inter subject variability of middle latency auditory evoked potentials do change with meditation. However, the variability of the potentials may mask subtle changes.

In another study (Telles et al., 1994) middle latency auditory evoked potentials were recorded in 18 males volunteers with ages between 25 and 45 years, 9 of whom had more than 10 years of experience in 'OM' meditation (senior subjects), whereas the other 9 had no meditation experiences (naive subjects). Both groups were studied in two types of sessions. (1) Before, during, and after 20 minutes of mentally repeating "one" (control session), and (2) a similar session, though with 20 minutes of mentally chanting 'OM' (meditation session). The senior subjects showed a statistically significant (paired t-test) increase in the peak amplitude of Na wave (the maximum negative peak between 14 and 18 msec) during meditation, while the

same subjects showed a statistically significant reduction in the Na wave peak amplitude during control sessions. In contrast, the naïve subjects had a significant decrease in the Na wave peak amplitude during meditation sessions and a no significant trend of reduction during sessions, as well. The difference between senior and naïve subjects was significant (two-way ANOVA). There was no significant changes in short latency wave V or Pa wave (the positive peak between the Na wave and 35 msec). The changes in the Na wave suggest that both meditation on a meaningful symbol, and mental repetition of a neutral changes at the same level (possibly diencephalic). However the change could be in the opposite directions and this difference could be correlated with the difference in the duration of experience in meditation between senior and naïve subjects.

The autonomic and respiratory variables were studied (Telles et al., 1995), in seven experienced meditators (with experience ranging from 5 to 20 years). Each subject was studied in two types of sessions- meditation (with a period of mental chanting of 'OM') and control (with a period of non- targeted thinking). The meditators showed a statistically significant reduction in heart rate during meditation compared to the control period (paired t test). During both types of sessions there was a comparable increase in the cutaneous peripheral vascular resistance. Keeping in mind similar results of other authors, this was interpreted as a sign of increased mental alertness, even while being physiologically relaxed (as shown by reduced heart rate).

In a later study (Telles et al., 1998) autonomic and respiratory variables were recorded in 12 volunteers in three typed of sessions (1) Before, during and after a rest period of mentally repeating a meaningful syllable 'OM' [MOM session] (2) A similar session except that the period was spent mentally repeating a neutral word, 'one' [COM session] (3) A session with non

targeted thinking [NT session]. The subjects were familiar with both syllables, and had been meditating on 'OM' for 20 days. During the test periods of both MOM and COM sessions the rate of respiration (RR) and heart rate (HR) decreased significantly (two factor ANOVA (RR), paired t- test (RR, HR) compared to the pre period. Mental repetition of 'OM' (but not 'one') caused a significant decrease in skin resistance level (SRL) (paired t - test). This was taken to mean that the subject recognized the significance of the syllable. No significant change occurred during NT sessions.

### 3.9 Buddhist Mindfulness (*vipassana*) Meditation

This meditation is derived from the Burmese Buddhist teachings. The practice begins with concentration of attention on the abdominal movements or on the movement of the air at the tip of the nose while breathing. Later, new attentional objects are added (e.g. - bodily sensations, emotions, thoughts, images and memories). The aim is to maintain a detached, non- interpretive observation of the process by which events enter awareness, not concentrating on the content.

In one of the studies on vipassana meditators Brown and associates compared the difference in visual sensitivity among practitioners and non-meditators of Buddhist mindfulness meditation. Tachistoscopic presentation of light flashes was used to test for differences in visual sensitivity among 3 groups of practitioners of Buddhist mindfulness meditation and non-meditator controls. Meditation practitioners were able to detect light flashes of shorter duration than the non-meditators. There were no differences among the meditation groups. There were no differences among the groups in ability to discriminate between closely spaced successive light flashes. The lower detection threshold for single light flashes for the meditators may reflect an enduring increase in sensitivity, perhaps the long-term effects of the practice of mindfulness

meditation on certain perceptual habit patterns. The lack of significant differences in the discrimination of successive light flashes probably reflects the resistance of other perceptual habit patterns to modification. The results support the statements found in Buddhist texts on meditation concerning the changes in perception encountered during the practice of mindfulness.

In another study (Brown et al.,) studied visual sensitivity in Buddhist mindfulness meditators. Practitioners of the mindfulness form of Buddhist meditation were tested for visual sensitivity before and immediately after a 3-month retreat during which they practiced mindfulness meditation for 16 hr. each day. A control group composed of the staff at the retreat center was similarly tested. Visual sensitivity was defined in two ways: by a detection threshold based on the duration of simple light flashes and a discrimination threshold based on the interval between successive simple light flashes. All light flashes were presented tachistoscopically and were of fixed luminance. After the retreat, practitioners could detect shorter single-light flashes and required a shorter interval to differentiate between successive flashes correctly. The control group did not change on either measure. Phenomenological reports indicate that mindfulness practice enables practitioners to become aware of some of the usually pre attentive processes involved in visual detection. The results support the statements found in Buddhist texts on meditation concerning the changes in perception encountered during the practice of mindfulness.

## CHAPTER – 4

### METHODS

#### 4.1 SUBJECTS -

14 healthy male trained *vipassana* meditators with the age range 22 – 41 years (mean  $\pm$  SD was  $29 \pm 5.19$  years) participated in the study. They had got their training of *vipassana* as part of their master's course in yogic sciences. However they were not regular in their practice.

#### 4.2 THE CRITERIA FOR SELECTING SUBJECTS-

- (1) The subjects were all males, who were found to be healthy on a routine medical examination.
- (2) The subjects who had received 10 days of foundation course on Tibetan Buddhist Mindfulness (*vipassana*) Meditation.
- (3) Subjects, who were willing to undergo 10 days of intense refreshers course in Tibetan Buddhist Mindfulness (*vipassana*) Meditation.
- (4) Subjects had to be co- operative, and willing to come to the laboratory for the scheduled 2 test sessions.

#### 4.3 DESIGN

##### Familiarization of the subjects with the laboratory environment and with the study

The subjects were given a detailed explanation about the aims of the project and methods employed. Informed consent (signed) was also obtained .Details about each subject (e.g. age, marital status, occupation) were noted. Facts related to the meditation practice were noted in

detail (how the subject was initiated into meditation, the time spent in meditation everyday and the subjective report and the experiences of the meditators).

Conditions of recordings

The subject was seated in a sound attenuated cabin without lighting. The temperature was ranging from 20-25 degree Celsius. All the recording leads were led out of the cabin and connected to the 4 – channel polygraph (Medicaid systems, Chandigarh, India) placed in the adjacent room.

Checking about meditation practice and quality

After each recording session the subject was asked to give his assessment of the quality of the session in the form of check list and an analog scale.

**DESIGN OF RECORDING SESSIONS**

	PRE	MEDITATION						POST
<b>STATES</b>	RANDOM THINKING	M-1	M- 2	M- 3	M-4	M-5	M-6	RANDOM THINKING
<b>DURATION</b>	<b>5 min</b>	5 min	5 min	5 min	5 min	5 min	5 min	<b>5 min</b>
		<b>30 min</b>						

	PRE	RANDOM THINKING						POST
<b>STATES</b>	RANDOM THINKING	C-1	C -2	C -3	C -4	C -5	C -6	RANDOM THINKING
<b>DURATION</b>	<b>5 min</b>	5 min	5 min	5 min	5 min	5 min	5 min	<b>5 min</b>
		<b>30 min</b>						

Pre : Random thinking  
M -1, 2, 3,4,5,6 : 6 episodes of 5 min meditation period.  
C-1, 2, 3,4,5,6 : 6 episodes of 5 min during random thinking period.  
Post : Random thinking

Figure – 1: Illustration of the design of the study

### Design of the experiment

The meditators were studied in “self as control” paradigm. All of them were given 60 minutes of orientation (morning and evening) for 10 days using the standard cassette of *vipassana* meditation. This was done to make sure that all subjects (a) had regular practice before the recordings were made. (b) Followed a common sequence/strategy of meditation. This is of special importance as the traditional texts describe that different strategy of mind – modifying technique can be adopted and the benefits thus obtained thus attained may vary.

All the subjects were studied in 2 sessions (1) Experimental session (meditation) (2) Control session (random thinking). Each session was of 40 minutes duration, 30 minutes were spent in meditation preceded and followed by 5 minute periods of random thinking.

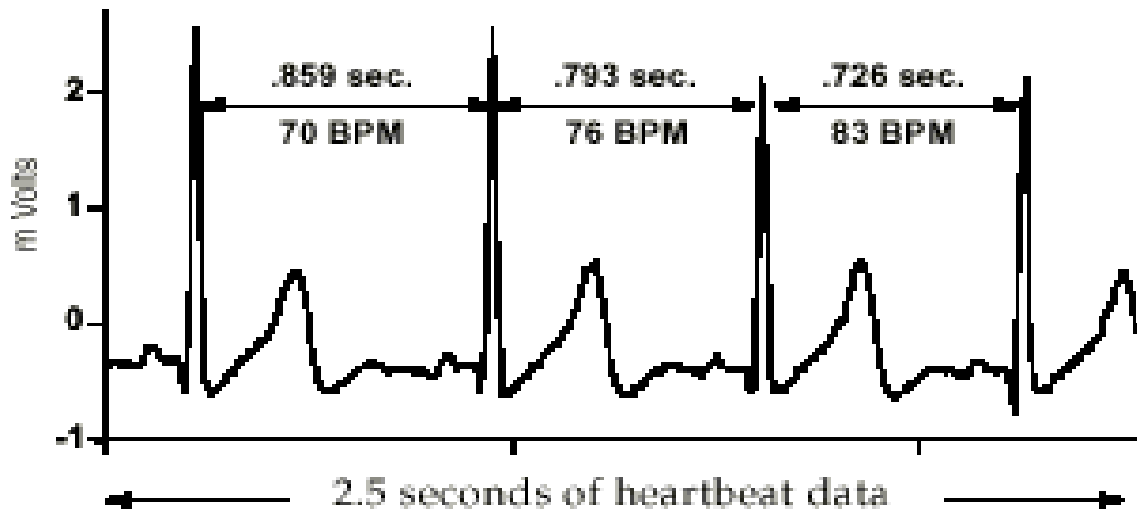
The non meditation (control) sessions, were similar in design, except that the period corresponding to the 30 minutes of meditation was spent sitting relaxed, without targeted thinking, i.e., a random thinking and with a specific instruction , not to slip into meditation.

The order of the meditation and non-meditation session was altered to neutralize the effect of first exposure to the laboratory environment. The schematic representation of design of the experiment is provided in Figure-1.

#### 4.4 ASSESSMENTS

Heart Rate Variability: A 4 – channel polygraph (Medicaid systems, Chandigarh, India) was used to record the electrocardiogram (EKG). EKG was recorded using standard limb lead I configuration. The EKG was digitized using a 12 bit analog-to-digital converter (ADC) at a sample rate of 500 Hz. The data recorded was visually inspected off-line and only noise free data was included for analysis. The HRV analysis software used was developed at the Dept. of electrical Engineering, Indian Institute of Sciences, and Bangalore. The R waves were detected to obtain a point event series of successive R-R intervals, from which the beat to beat heart rate series were computed.

The autonomic nervous system (ANS) is the portion of the nervous system that controls the body's visceral functions, including action of the heart, movement of the gastrointestinal tract and secretion by different glands, among many other vital activities. It is well known that mental and emotional states directly affect the ANS. While the rhythmic beating of the heart at rest was once believed to be monotonously regular, we now know that the rhythm of a healthy heart under resting conditions is actually surprisingly *irregular*. These moment-to-moment variations in heart rate are easily overlooked when average heart rate is calculated. Heart rate variability (HRV), derived from the electrocardiogram (ECG), is a measurement of these naturally occurring, beat-to-beat changes in heart rate. (Figure-2).

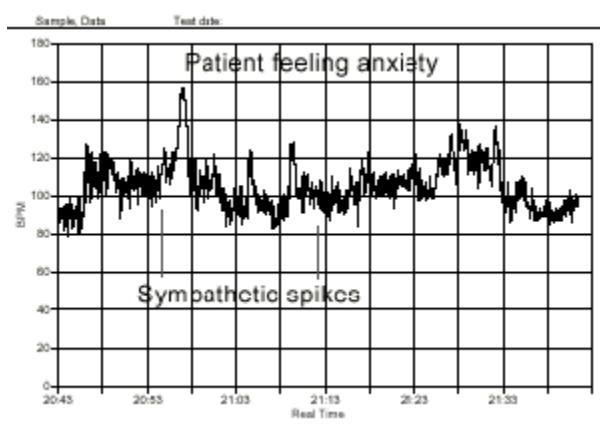


**figure 2. heart rate variability is a measure of the beat-to-beat changes in heart rate.**

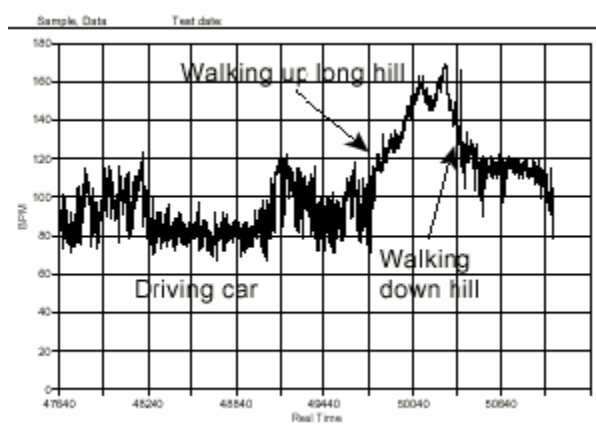
HRV is an important indicator of both physiological resiliency and behavioral flexibility, reflecting the individual's capacity to adapt effectively to stress and environmental demands. It has become apparent that while a large degree of instability is detrimental to efficient physiological functioning, too little variation can also be pathological. An optimal level of variability within an organism's key regulatory systems is critical to the inherent flexibility and adaptability that epitomize healthy function.

The normal variability in heart rate is due to the synergistic action of the two branches of the ANS, which act in balance through neural, mechanical, humoral and other physiological mechanisms to maintain cardiovascular parameters in their optimal ranges and to permit appropriate reactions to changing external or internal conditions. In a healthy individual, thus, the heart rate estimated at any given time represents the net effect of the parasympathetic (vagus) nerves, which slow heart rate, and the sympathetic nerves, which accelerate it. These changes are influenced by emotions, thoughts and physical exercise. Our changing heart rhythms affect not

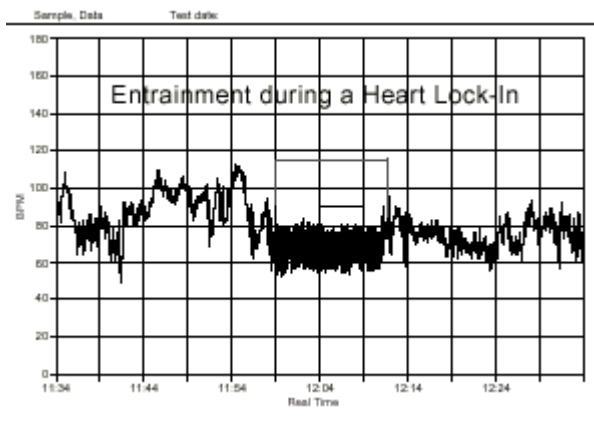
only the heart but also the brain's ability to process information, including decision-making, problem-solving and creativity. They also directly affect how we feel. Thus, the study of heart rate variability is a powerful, objective and noninvasive tool to explore the dynamic interactions between physiological, mental, emotional and behavioral processes. Examples of hour-long HRV tachnograms recorded in individuals under various conditions are given below-



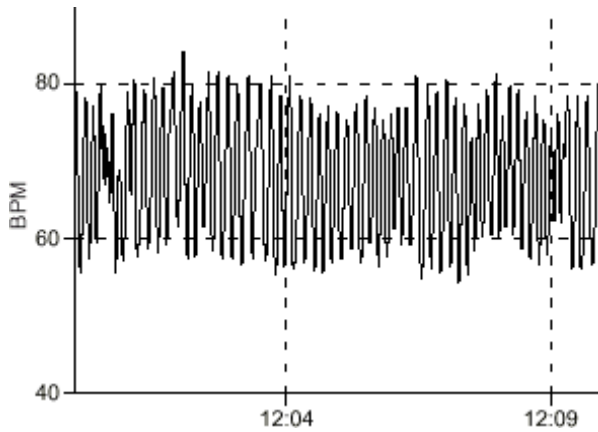
**Figure -3 Heart rhythm of a 33-year-old male experiencing anxiety. The prominent spikes are due to pulses of activity in the sympathetic nervous system.**



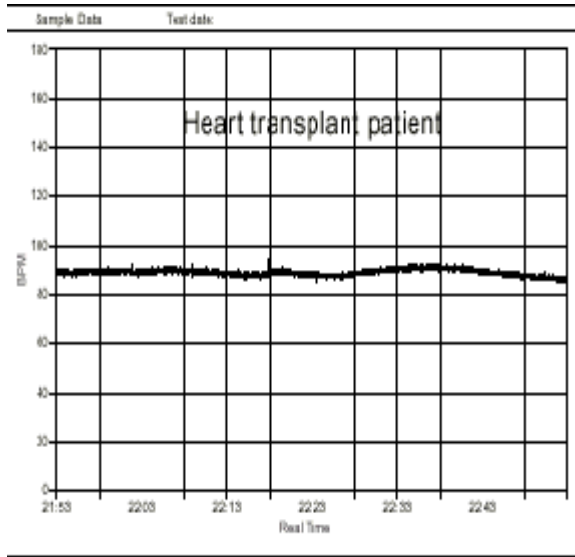
**Figure -4: Heart rhythm of a healthy 30-year-old male driving car and then hiking uphill.**



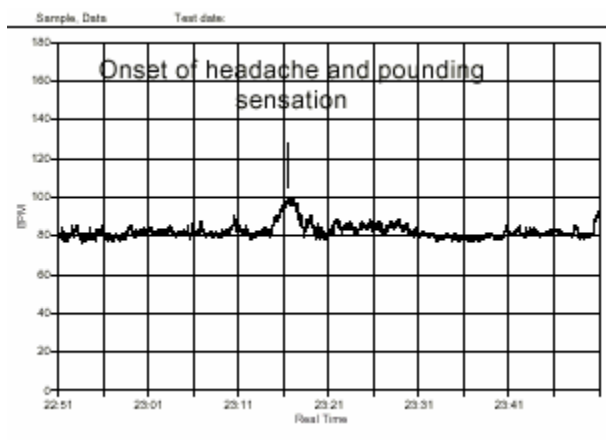
**Figure-5: Entrainment during a Heart Lock-in. Entrainment is reflective of autonomic nervous system balance and is commonly experienced when using the Freeze-Frame and Heart Lock-in techniques.**



**Figure – 6 : An enlarged view of the section outlined by the box in the previous graph.**



**figure-7: Heart rhythm of a heart transplant recipient. There is the lack of variability in heart rate, due to loss of autonomic nervous system input to the heart.**



**Figure -8: Heart rhythm of a 44-year-old female with low heart rate variability while suffering from headaches and pounding sensation in her head.**

The mathematical transformation (Fast Fourier Transform) of HRV data into power spectral density (PSD) is used to discriminate and quantify sympathetic and parasympathetic activity and total autonomic nervous system activity. Power spectral analysis reduces the HRV signal into its constituent frequency components and quantifies the relative power of these components.

The power spectrum is divided into three main frequency ranges (Pic-9). The very low frequency range (VLF) (0.0033 to 0.04 Hz), representing slower changes in heart rate, is an index of sympathetic activity, while power in the high frequency range (HF) (0.15 to 0.4 Hz), representing quicker changes in heart rate, is primarily due to parasympathetic activity. The frequency range around the 0.1 Hz region is called the low frequency (LF) band and is also often referred to as the baroreceptor band, because it reflects the blood pressure feedback signals sent from the heart back to the brain, which also affect the HRV waveform. The LF band is more complex, as it can reflect a mixture of sympathetic and parasympathetic activity. According to guidelines of the Task Force of the European Society of cardiology and the North American society of Pacing and Electrophysiology, the low frequency values were expressed as normalized units.

#### 4.5 INTERVENTION

##### Tibetan Buddhist Mindfulness (*Vipassana*) meditation

Also known as Insight Awareness or Mindfulness Meditation, *Vipassana* is a very ancient meditation technique of India, laudatory references to which are found even in the Rig-Veda. Long lost to humanity, it was rediscovered twenty-five centuries ago by Goutama Buddha.

##### The foundations of mindfulness

The truth of suffering reveals that all forms of becoming, all the various elements of existence comprised in the "five aggregates" or groups of existence -- also called the "five categories which are the objects of clinging" (*panc'upadana-kkhandha*) -- are inseparable from suffering as long as they remain objects of grasping or clinging. All corporeality, all feelings and sensations,

all perceptions, all mental formations and consciousness, being impermanent, are a source of suffering, are conditioned phenomena and hence not-self (*anicca, dukkha, anatta*). Ceaseless origination and dissolution best characterize the process of existence called life, for all elements of this flux of becoming continually arise from conditions created by us and then pass away, giving rise to new elements of being according to one's actions or kamma.

All suffering originates from craving, and our very existence is conditioned by craving, which is threefold: the craving for sense pleasures (*kama-tanha*), craving for continued and renewed existence (*bhava-tanha*), and craving for annihilation after death (*vibhava-tanha*). This is the truth of the origin of suffering.

The attainment of perfect happiness, the breaking of the chain of rebirths and suffering through the realization of *Nibbana*, is possible only through the utter extirpation of that threefold craving. This is the truth of suffering's cessation.

The methods of training for the liberation from all suffering are applied by following the Noble Eightfold Path :

- I. Right Understanding.
- II. Right Thought.
- III. Right Speech.
- IV. Right Action.
- V. Right Living.
- VI. Right Exertion.
- VII. Right Mindfulness.
- VIII. Right Concentration of Mind.

The Noble Eightfold Path consists of three types of training summed up in: virtuous conduct (*sila*), concentration (*samadhi*) and wisdom (*panna*). This is the truth of the way that leads to the cessation of suffering.

The prevalence of suffering and absence of freedom and happiness is due to man's subjection to the three roots of all unskill and evil, and all unwholesome actions (*akusalakamma*), viz. lust, hatred and delusion (*lobha, dosa, moha*).

Virtuous conduct casts out lust. The calm of true concentration and mental culture conquers hatred. Wisdom or right understanding, also called direct knowledge resulting from meditation, dispels all delusion. All these three types of training are possible only through the cultivation of constant mindfulness (*sati*), which forms the seventh link of the Noble Eightfold Path. Mindfulness is called a controlling faculty (*indriya*) and a spiritual power (*bala*), and is also the first of the seven factors of enlightenment (*satta bojjhanga*). Right Mindfulness (*samma-sati*) has to be present in every skillful or karmically wholesome thought moment (*kusalacitta*). It is the basis of all earnest endeavour (*appamada*) for liberation, and maintains in us the sense of urgency to strive for enlightenment or *Nibbana*.

In Tibetan Buddhist mindfulness (*Vipassana*) Meditation, the subject sits in a comfortable posture and undergoes the process of meditation in the following steps;

**(a). *Anapana-sati* (Mindfulness of Breathing)**

When practising mindfulness of breathing, attention should be focused at the tip of the nose or at the point of the upper lip immediately below where the current of air can be felt. The meditator's attention should not leave this "focusing point" from where the in-coming and out-going breaths

can be easily felt and observed. The meditator may become aware of the breath's route through the body but he should not pay attention to it. At the beginning of the practice, the meditator should concentrate only on the in-breaths and out-breaths, and should not fall into any reflections about them. It is only at a later stage that he should apply himself to the arousing of knowledge and other states connected with the concentration.

It has been recommended and praised by the Enlightened One thus: "This concentration through mindfulness of breathing, when developed and practised much, is both peaceful and sublime, it is an unadulterated blissful abiding, and it banishes at once and stills evil unprofitable thoughts as soon as they arise." Though of such a high order, the initial stages of this meditation are well within the reach of a beginner though he be only a lay student.

**(b). Tibetan Buddhist mindfulness (*Vipassana*)**

*Vipassana* – literally means "clear-seeing," but more often translated as insight meditation -- is said to be a method using a modicum of tranquility to foster moment-to-moment mindfulness of the inconstancy of events as they are directly experienced in the present. This mindfulness creates a sense of dispassion toward all events, thus leading the mind to release from suffering.

*Vipassana* is a way of self-transformation through self-observation. It focuses on the deep interconnection between mind and body, which can be experienced directly by disciplined attention to the physical sensations that form the life of the body, and that continuously interconnect and condition the life of the mind. It is this observation-based, self-exploratory

journey to the common root of mind and body that dissolves mental impurity, resulting in a balanced mind full of love and compassion.

The attention in this process is moved systematically from head to feet and feet to head, observing every part of the body and every sensation in an order. This is observed objectively. One does not stay more than few minutes at a given part. One observes different parts separately with different sensations. Then one observes the parts having similar subtle sensations simultaneously. One keeps on moving the attention in different ways. The practice should not be mechanical in nature.

### **(c) Metta**

Love exists in itself, not relying on owning or being owned. Like the pearl, love can only buy itself, because love is not a matter of currency or exchange. No one has enough to buy it but everyone has enough to cultivate it. *Metta* reunites us with what it means to be alive and unbound.

This is the end of session of meditation where there is no mental or physical effort. Then the attention is focused on subtle sensations in the body, and the mind is filled with thoughts of goodwill for others.

In practicing metta one does not have to make a certain feeling happen. In fact, during the practice one sees and feels differently at different times. Any momentary emotional tone is far less relevant than considerable power of intention as one harness these phrases. As one repeats,

"May I be happy; may all beings be happy," one is planting seeds by forming this powerful intention in the mind. The seed will bear fruit in its own time.

#### **4.6 DATA ANALYSIS**

Data were analyzed using the statistical package for social status (SPSS Version 10.0).

**Step 1:** The baseline values for pre meditation and pre non meditation were seen for normal distribution by using Shapiro-wilk test (Table-9).

**Step 2:** The multiple comparisons between the baseline values and the values recorded during the meditation session and the post values were done using paired t- test (Table-10, 11,12, 13).

**Step 3:** The multiple comparisons between the baseline values and the values recorded during the non-meditation (random) session and the post values were done using paired t- test. (Table-14, 15, 16, 17: Appendix 3)



## CHAPTER – 5

### RESULTS

The group means values and standard deviation (SD) for all the 14 subjects are given in Table No-1.

#### Paired t-test:

There was a significant reduction in heart rate in the second phase of the non meditation session ( $t=3.899$ ,  $p= 0.002$ ), third phase of non meditation ( $t=2.676$ ,  $p=0.019$ ) and fifth phase of non meditation ( $t=2.688$ ,  $p=0.019$ ). (Table-17).

There was no such significant change during meditation sessions and other non meditation sessions. There was also no significant change in low and high frequency powers.

**Table-1: The group mean±SD for the Meditation & Non-Meditation Session.**

<u><i>Meditation session</i></u>			<u><i>Non-meditation session</i></u>	
<i>States</i>	<i>HR in beats/min. (M±SD)</i>	<i>LF/HF ratio (M±SD)</i>	<i>HR in beats/min. (M±SD)</i>	<i>LF/HF ratio (M±SD)</i>
Pre	75.8±10.8	0.8±0.4	76.3±10.4	0.8±0.6
Test 1	77.1±8.7	0.7±0.3	74.0±7.6	0.9±0.9
Test 2	73.5±12.4	0.7±0.3	73.2±9.3***	0.7±0.2
Test 3	73.6±9.6	0.7±0.2	72.8±10.4**	0.8±0.3
Test 4	75.9±10.9	0.8±0.4	72.6±12.7	0.7±0.3
Test 5	75.8±10.3	0.7±0.3	71.9±9.5	0.8±0.2
Test 6	72.1±79.3	0.9±0.6	74.4±11.0	0.7±0.2
Post	74.6±11.5	1.3±1.4	73.3±9.6	0.7±0.2

\*\*\*p=0.002 \*\*p=0.019, paired t-test test, comparing meditation and non-meditation session.

HR- Heart rate, LF/HF ratio- low frequency / high frequency power ratio.

## CHAPTER – 6

### DISCUSSION

The present study demonstrated a significant decrease in the heart rate during a random thinking session, with no change in the Tibetan Buddhist Mindfulness (*Vipassana*) meditation session in 14 volunteers.

Early research on meditation was carried out on Transcendental Meditation (Wallace, Benson & Wilson, 1971). This research showed that TM produced a decrease in heart rate and overall sympathetic activity. This led to the idea that meditation is a state of low sympathetic activity. This led to the idea that meditation is a state of low sympathetic activity and arousal.

It was subsequently shown that in certain meditation techniques the heart rate increased in contrast to the results described in TM. For example during Zen Buddhist meditation the heart rate increased but there were also signs of reduced mental arousal (viz, an increase in the alpha waves in the electroencephalogram (Hirai, 1960). Similarly, Ananda Marga Meditation also showed heart rate acceleration in response to stimuli (Corby et al., 1978). Brahmakumaris Raja Yoga Meditation also resulted in an increase in the heart rate (Telles & Desiraju, 1993).

What is important to remember is that all these reports showed an increase in heart rate which was within the physiological range of variation. Also in several cases, the changes in heart rate were seen simultaneously with other changes which suggested reduced arousal e.g. the studies of Hirai (1974) on Zen Buddhism or of Telles, Nagarathna & Nagendra (1995) on OM

meditation. This resulted in meditation being described as a state of 'alertful rest'. The present study may also be interpreted similarly, that is, the decrease in heart rate which occurred during the random thinking sessions appears to have been prevented by the practice of Tibetan Buddhist Mindfulness (*Vipassana*) meditation.

Further research is needed to establish whether other autonomic, respiratory or metabolic variables would demonstrate that in this study, also meditation can be described as a state of 'alertful rest'.

## CHAPTER - 7

### SUMMARY AND CONCLUSIONS

The study was aimed to determine the effect of Tibetan Buddhist Mindfulness meditation (*Vipassana*) on the heart rate variability, a specific indicator of autonomic nervous system.

14 healthy trained male '*Vipassana*' meditators whose age ranged from 22 to 41 years (mean  $\pm$ SD 29.0  $\pm$  5.19) were assessed for heart rate variability during meditation and random thinking sessions. The design was self as control. As the data was found to be normally distributed (Shapiro - Wilk test), Paired t- test was done for analysis. The result showed no change in heart rate whereas there was a decrease in heart rate during second, third and fifth sessions of nonmeditation. There was no change in the low frequency to high frequency ratio of the heart rate variability spectrum.

It can be suggested from the study that Tibetan Buddhist Mindfulness meditation (*Vipassana*) has no effect on heart rate variability, a specific indicator of autonomic nervous system in trained '*Vipassana*' meditators and ten days intensive practiced in the tradition is necessary to get the desired results.

## CHAPTER - 8

## **LIMITATION OF THE STUDY**

- 1) Inadequate number subjects.
- 2) Absence of traditional practitioners of Tibetan buddhist mindfulness  
(*vipassana*) Meditation .
- 3) Absence of repeat intervention sessions.
- 4) Absence of inter individual analysis.

## **SUGGESTIONS FOR FUTURE WORK**

1. The study can be repeated with experienced Tibetan Buddhist Mindfulness meditation (*Vipassana*) meditators who have undergone intensive training in the tradition.
2. More subjects can be assessed in the future study.
3. More number of specific autonomic indicators i.e. Skin resistance, Finger plethysmogram amplitude and respiratory rate can be used for assessments.

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