

CHAPTER 3.0

3.0 REVIEW OF SCIENTIFIC LITERATURE ON *YOGIC PRACTICES*

The present chapter systematically reviews scientific literature studies which are related to the current study. Thus, the whole section is divided into three subsections: (i) Scientific studies on *guṇās* and related variables, (ii) Review of research on *yogic practices*, and (iii) *Yoga* studies using Electro Photonic Imaging (EPI) technology.

3.1 STUDIES ON IMPACT OF *YOGA* ON THE THREE *GUṆĀS*

Wolf (1999) developed the *Vedic Personality Inventory* (VPI) based on the three *guṇās* derived from the *Vedic* literature of India. Reliability analyses shows the VPI has good item consistency ($\alpha > 0.90$ for all three scales) and produced evidence of construct validity (Macdonald & Friedman, 2009). For each scale of *guṇa*, a higher score reflects a greater predominance of these attributes. Additional psychometric support for the VPI has been revalidated, and it found to correlate in a theoretically expected manner with measures of daily spiritual experiences and psychopathology (Stempel et al., 2006).

The activity and consciousness of human being manifest in the three *guṇās*. A randomised control trial (RCT) of the effect of integrated *yoga* on *guṇās* (*yogic personality*) showed a significant increase in *sattva* score when compared to physical exercises. Meanwhile, it also showed improved general health status which includes physical and mental domains (Deshpande et al., 2008).

Another pre-post intervention study on integrated *yoga* practices, which including postures, breathing exercise, relaxation techniques, meditation, chanting and lectures was implemented in 108 health adults for one month (Khemka et al., 2011). It is observed that there were significant changes in all psychological and health variables except *sattva*, which however, did not reach significance. The results demonstrated that *sattva* correlated positively with emotional intelligence indicating that *sattvic* personality has better self-control. It also showed that emotional intelligence correlates significantly with general health variables and both of them negatively correlated with *tamas*. This indicates that long-term *yoga* practice improves *guṇa* personality and may stabilize emotional quotient (Khemka et al., 2011).

In addition, an RCT on *guṇās* and self-esteem (Deshpande et al., 2009) found *sattva* improved and *tamas* decreased significantly in *yoga* group but not in the physical exercise group. The effect size for self-esteem in *yoga* group is more than for control group in the three domains of global self-esteem, body and physical appearance and moral and self-esteem. Tikhe et al (2012) found the effect of *yogic* life resulted in significantly decreased *rajas* and *tamas*, while significantly improved of *sattva*. The predominance of *sattva* paves way for better academic excellence in university students.

Based on previous findings it is revealed that the effect of integrated *yoga* module positively influences complete personality growth. The improvement of *sattva* leads to psychological health, cultivate healthy self-respect and general health. It is commonly believed that reduced dominance of *rajas* and *tamas* leads to prevent psychological disturbance and prevents chronic diseases (Khemka et al., 2011).

3.2 SCIENTIFIC STUDIES ON VARIOUS PSYCHOPHYSIOLOGICAL BENEFITS OF THE COMPONENT OF YOGA PRACTICES

Yoga traditionally combines physical postures, breathing, meditative components, and ethics, which together facilitates the union of the body, mind, and spirit for health and wellbeing (Gard et al., 2014). There is accumulating evidence reporting increased use of various components of *yoga* as a complementary health approach for mental and physical well-being (Büssing et al., 2012, Ross et al., 2013). Wheeler et al. (2019) investigated the effects of separating the limbs (i.e. *āsana*, *prāṇāyāma*, meditation, and listening to a lecture about *yoga*) of *yoga*. They found that a short duration of 20 min intervention of individual limbs was equally effective in reducing mild state anxiety and improving mood, but the effectiveness in reducing anxiety and its physiological responses need a longer duration of the intervention. This study raises the question of whether individual components of *yoga* can be analysed separately.

There are studies of individual elements of *yoga* available presently. The physical postures (*āsanas*) cause significant improvements ($p < 0.05$) for all participants in diastolic blood pressure, trunk flexibility, muscular strength and endurance, perceived stress, and overall health perception. However, a significant increase in anxiety was observed (Cowen & Adams, 2005). Specific postures such as *sūrya namaskāra* sequences showed a significant decrease in resting pulse rate and blood pressure whereas increases cardiorespiratory fitness and respiratory capacity after six

months of intervention (Bhutkar et al., 2008). A single-centre randomized control study indicates that *sūrya namaskāra* was effective in increase in physical relaxation, calm the mind, reduce the stress dispositions of somatic stress, worry and negative emotion (Godse et al., 2015).

Prāṇāyāma (breathing exercises) has demonstrated many health benefits (Jayawardena et al., 2020). It was observed that the immediate effect of slow pace *bhastrika prāṇāyāma* for 5 minutes significantly decreases the systolic and diastolic blood pressure with a small reduction in the heart rate compare to control (Pramanik et al., 2009). As for reducing blood pressure, mindfulness with paced breathing practice may have beneficial effects in the short term that may lead to lowered risks of stroke in the long term (Brenner et al., 2020). Alternate nostril *prāṇāyāma* enhances activity of the parasympathetic nervous system significantly (Sinha et al., 2013). It also evident that *prāṇāyāma* calms the mind and body, reduces restlessness, fear, stress and anxiety. A recent RCT pilot study indicates that *Dirgha* (long) Three-Part *prāṇāyāma* for patients with chronic obstructive pulmonary disease improves the quality of life, exercise tolerance and a slight improvement in respiratory capacity during two weeks of intervention (Kaminsky et al., 2017).

Empirical evidence for the effects of various approaches of meditation on psychophysiological factors has been extensively studied in recent years. Earlier study of Transcendental Meditation practice reported significantly decreased oxygen consumption and heart rate, increased skin resistance, and the electroencephalogram showed specific changes of alpha-wave activity in certain frequencies (Wallace, 1970). A fMRI study has assessed brain activity engaged in meditation by novice and expert Buddhist meditators. The outcomes showed that “cultivating positive emotion changes the activation of neural circuits previously related to empathy and theory of mind in response to emotional stimuli” (Lutz et al., 2008). The effects of an 8-week course in mindfulness meditation has demonstrated reduction in the symptoms of depression and anxiety, ruminative thinking tendencies, and modifying negative cognitive patterns (Ramel et al., 2004). As shown in an RCT, mindfulness meditation significantly decreases distress, distractive and ruminative thoughts/behaviors, as well as increases positive states of mind over time, compared to control group (Jain et al., 2007). There is growing evidence that “mindfulness meditation might cause brain plasticity regions changes in the structure and function involved in the regulation of attention, emotion and self-awareness” (Tang et al., 2015).

Most experiments on *yoga* focus on the incorporation of postures, breathing exercises and meditation components which have been broadly studied. They covered multiple aspects of

physical and mental health. A pilot study evaluated the effects of a *yoga*-based program which comprising *āsanas*, *prāṇāyāma*, meditation, and in addition to three to five hours of daily didactic course work in regard to the development of life skills to integrate the *yoga* practice into daily life activities (Gard et al., 2012). This four-month residential program showed significantly increase in quality of life, mindfulness, self-compassion, and decreases in perceived stress in young adults. Further, the results revealed that quality of life and perceived stress are mediated by mindfulness and self-compassion. These preliminary findings implicate that cultivation of subjective well-being improves positive emotions and prevention of mental illness in young adults. In a qualitative study of women with depression, it was found *yoga* served both as a self-care and relational technique, reflecting *yoga* ethics (Kinser et al., 2013). Practice of *yoga* more than usual may have an indirect effect on attitudes of compassion and non-harmfulness found on the *yamās* and *niyamās* (Kishida et al., 2019). The ethical aspects of *yoga* in the previously mentioned results remain to be studied. The studies presented above are only a small number of researches in *yoga* related to and leading to the present problem on hand, namely, teaching and practice of ethics as enumerated in *yoga* literature.

3.3 STUDIES ON ELECTRO PHOTONIC IMAGING (EPI)

3.3.1 INTRODUCTION

Electrophotonic analysis is based on Electro Photonic Imaging (EPI) technique, known as Gas Discharge Visualization (GDV) as well. Electro Photonic Imaging technology is developed by a worldwide team led by Dr Konstantin Korotkov. It is a scientific method based on the principles of quantum biophysics (Korotkov et al., 2004). This method for investigating human functional energy states are based on the stimulation of photon and electron emissions from the surface of the skin (Figure 1) whilst transmitting short electrical pulses (Korotkov, 2014).

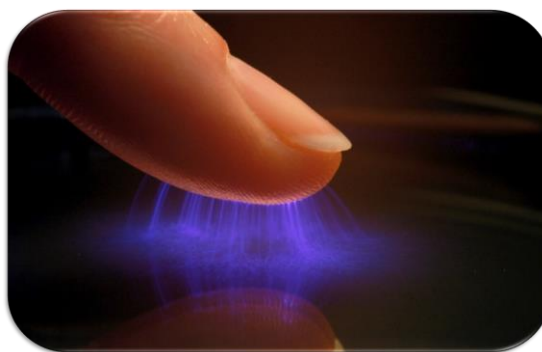


Figure 1: Electrical energy emissions from finger

The Bio-Well device is based on EPI technology that allows assessing the psychophysical and spiritual conditions using the fingertips (Korotkov, 2017). This product consists of a desktop camera and accompanying software (Figure 2), which allows a user to quickly and easily conduct human energy scans.

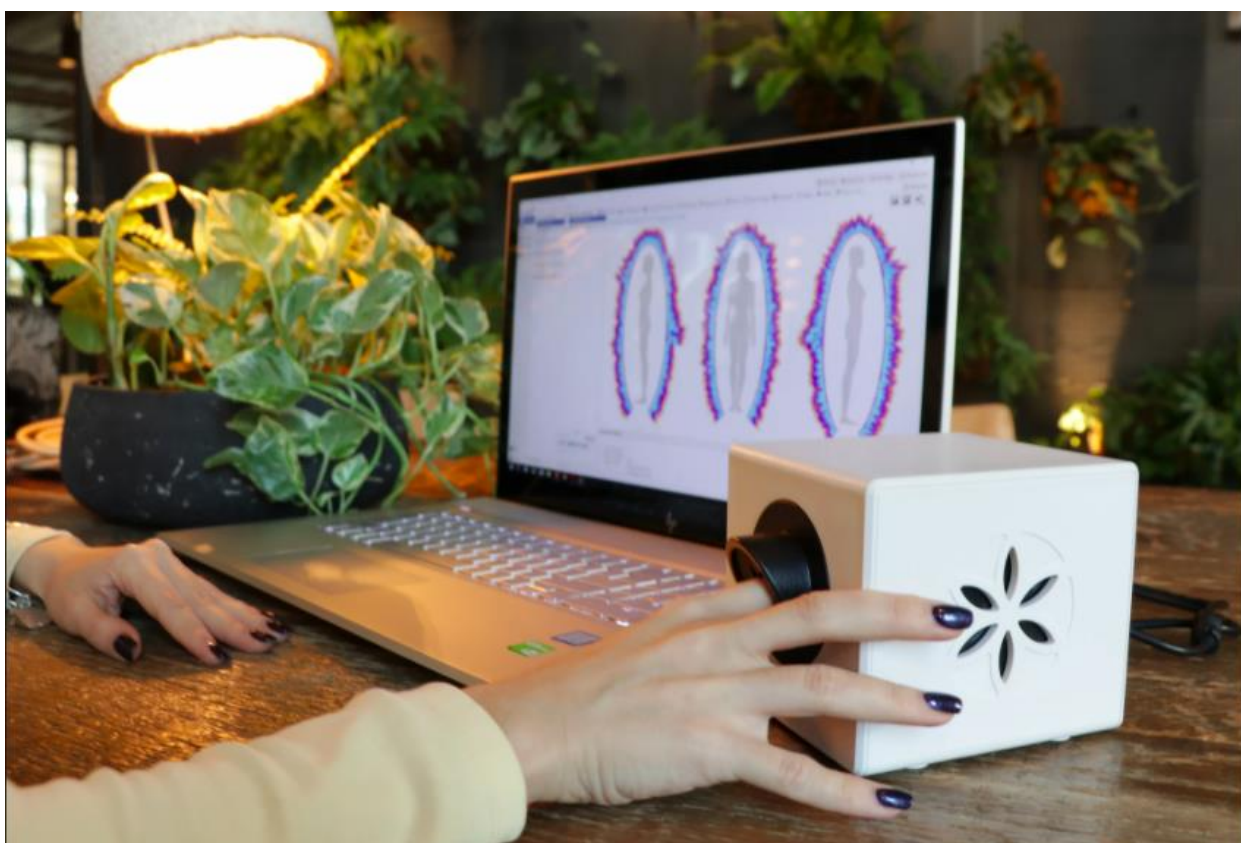


Figure 2: Bio-Well device with a CCD camera

When scanning is carried out, a weak electrical current of less than a millisecond is applied to the fingertips. The human body's response to this stimulus is to emit an "electron cloud" composed of electrons and photons. The electronic "glow" of this discharge is captured by a specialized Charge Coupled Device (CCD) camera system and then translated into graphical representations to provide information of energy level, stress level and vitality evaluations (Figure 3). EPI data readings (Bio-grams) are obtained from 10 images of fingers of both hands, and the image is based on the theory of the Acupuncture points. The EPI readings reflect the state of physical, mental, emotional and spiritual health of a person's well-being. Many scientific and clinical case studies have been verified for more than 25 years in different countries using this device. It has high accuracy and repeatability as reported through many studies (Korotkov, 2021).

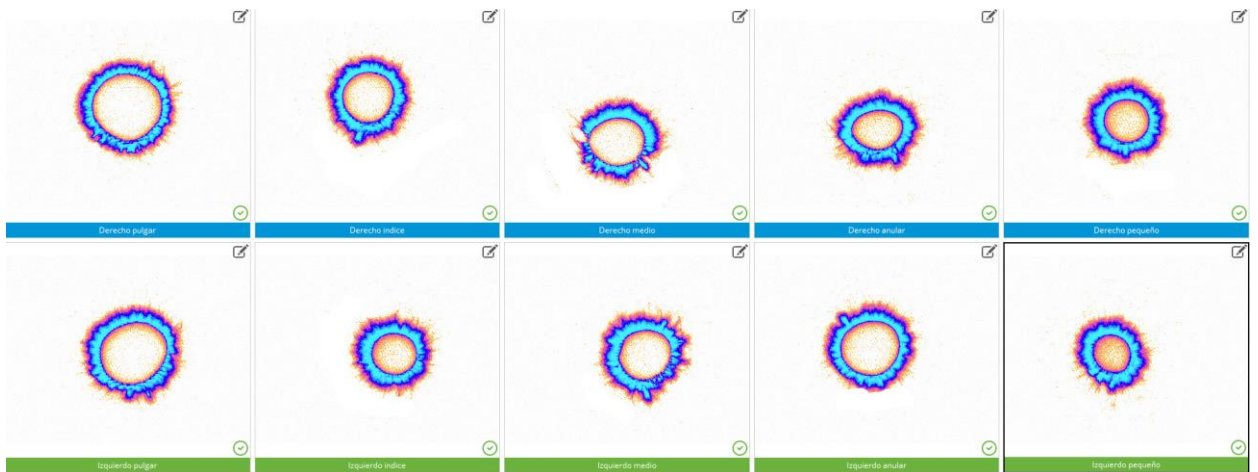


Figure 3: Photographs Bio-gram of 10 fingertips picturing energy release

Bio-Well allows one to analysis the Human Energy Field (HEF), which reflect the states of mental, emotional and spiritual processes (Figure 4). This is the most sensitive methods for measuring the subtle process of a person's consciousness. A healthy person's energy field is of a uniform and optimal size, while in a good emotional state. A person with ill healthy lacks energy and the energy field is seen with brakes, holes, or strong out-bursts.

Energy 59 Joules ($\times 10^{-2}$) Balance 97%

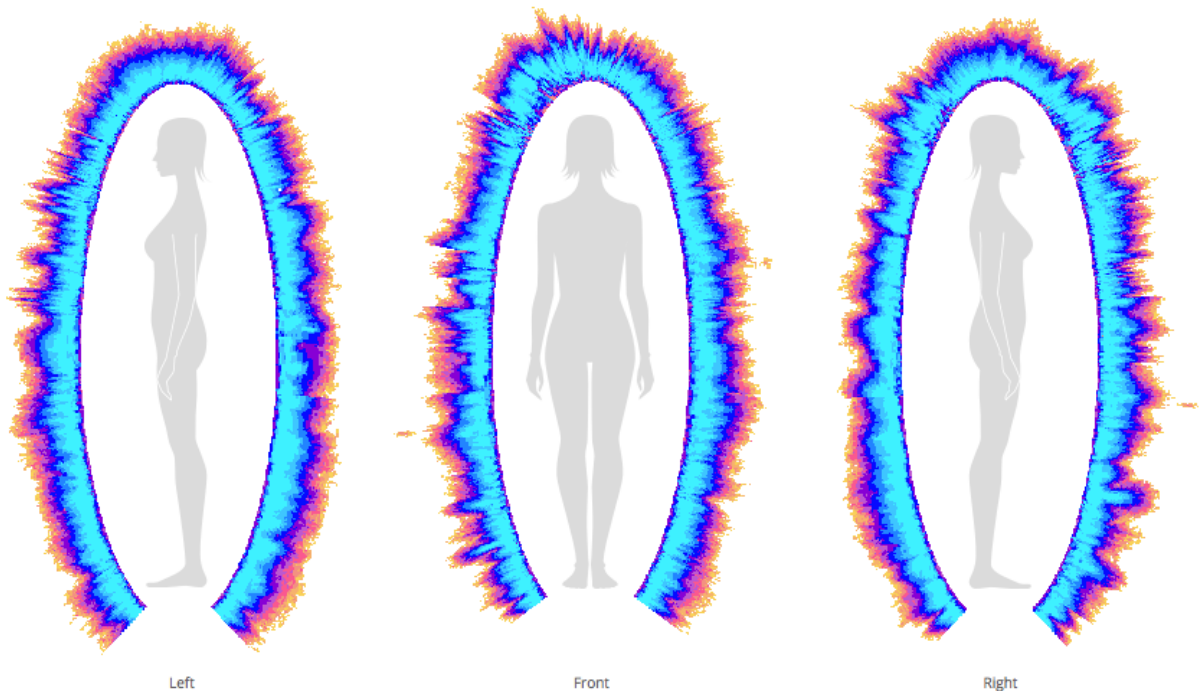


Figure 4: State of health human energy field (uniform and without breaks)

The Health Status (HS) is designed for analyzing the functional state of the human body, by calculating the integral parameters of energy distribution in the organs of the body. The green zone in Fig. 5 represents an optimal energy level. The inner circles are the areas of energy deficiency (low energy state). The outer circles are the areas of energy excess (hyper-energy state). The Energy Reserve (ER) program represents energy reserve of different organs of the body. Figure 5 shows a comparison of the HS and ER. When the Energy Reserve outline is larger than the Health Status outline, is said to be beneficial (Korotkov, 2017).

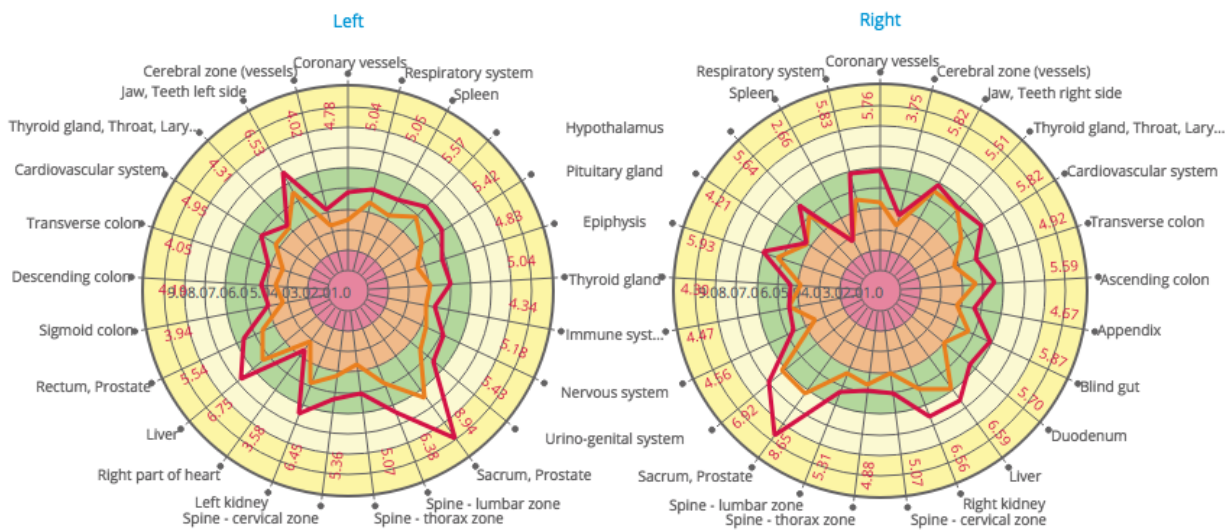


Figure 5: Health Status (orange line) and Energy Reserve (red line) in the human body

In addition to access stress score with a combination of questionnaires or scales in most *yoga* experiments, we observed EPI technology is another direct and efficacious instrument to evaluate the stress level in a person. Emotional pressure which characterizes stress levels has a 0 to 10 scale score (Figure 6). Stress and anxiety have a very strong impact on the Human Energy Field.

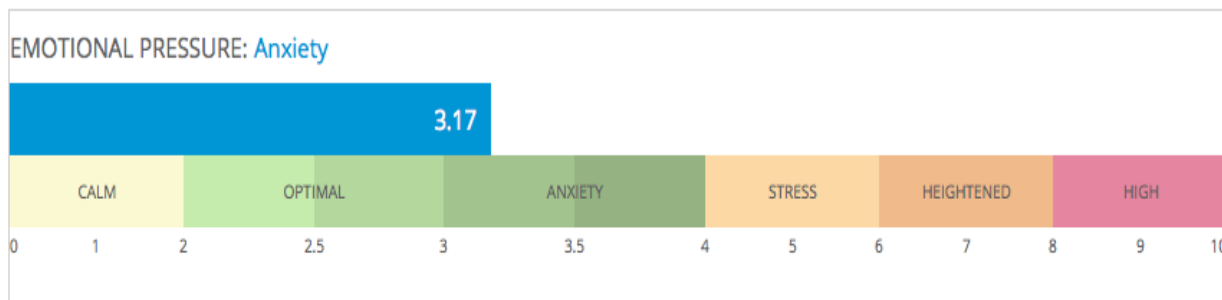


Figure 6: Emotional pressure

It is possible to quantitatively estimate the energy and alignment of the *cakrās* using the Bio-Well device and software. The *cakra* assessment is based on the processing of bio-grams of ten fingers. In the calculation of each *cakra*, the software generates the values of asymmetry, and interprets *cakra* energy based on properties associated with *cakrās*. The *cakra* aligning closer to the spinal cord (*suṣumṇā*) indicates good psychological and spiritual conditions (Korotkov, 2017).

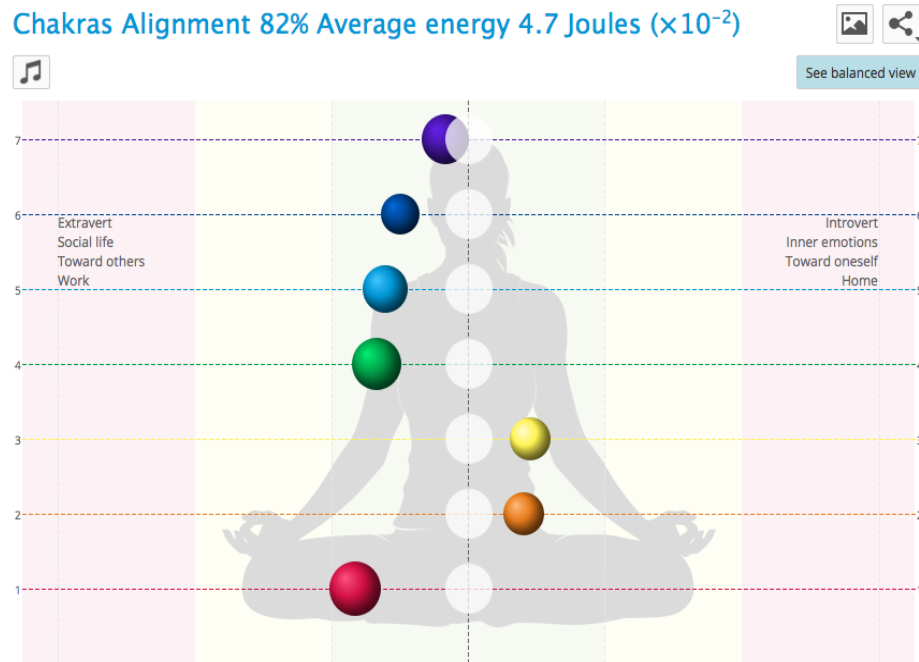


Figure 7: Poor alignment of the *cakrās*

3.3.2 APPLICATION OF EPI TECHNIQUE IN YOGA RESEARCH

Evaluation of practice of *yoga* on subtler level may give us better insight about the condition of one's overall health status. Several studies have examined the psychophysiological changes in different elements of *yoga* practice measured by EPI technique. A recent pilot study by Deo et al. (2015) evaluated the effects of *Ānapānasati* meditation on 64 healthy subjects for 5 days. The measured EPI parameter include Integral area (IA, a measure of general health index), activation coefficient (AC, a measure of stress level), and integral entropy (IE, a measure of disorderliness of energy). Results showed significant changes in IA (physiological) in both right and left side of the human body, which indicates high reserve of energy in meditators. Similarly, at psychophysiological level high functional energy reserve also observed. Activation coefficient (AC) showed a positive decrease indicating more relaxed state of mind, possibly due to stimulate of the parasympathetic system. There are no significant changes in IE parameter, but decreased on the left side which indicates less energy disorder after meditation over time.

Effect of the *yoga*-based lifestyle-related experiments on energy parameter outcomes supports the notion that *yoga* promotes positive health and prevent lifestyle illnesses. Ninety-four healthy participants were engaged in a four weeks of integrated *yoga* program. At the psychophysiological level, the findings showed a significant decrease in AC, increase in IA, the left side IE decrease but not significant. The study also found these EPI outcomes were reproducible (Kushwah et al., 2015). Another study conducted by Kushwah et al. (2016) suggests that cyclic meditation brings about similar results of significantly reduced stress level and improved general health index, and the disorderliness is significantly decreased in right side.

The EPI technique also contributes to monitoring the health status in the field of complementary and alternative medicine. A 7-day specific type-2 diabetes camp evaluated the effect of *yoga* in normal, prediabetic and diabetic patients by utilizing EPI. The EPI parameters considered for analysis included area, intensity, form coefficient, entropy, fractality, liver, immune organs, pancreas, coronary vessels, cerebral vessels, left kidney and right kidney. Results in the first study observed significant difference in average intensity between normal and diabetes, diabetes and prediabetes; form coefficient in normal and diabetes; immune organs in normal and diabetes, and diabetes and prediabetes. In the second study, the results were related to immune organs. In the third pre-post study, the significant changes were in the area, form coefficient, entropy, liver, pancreas, coronary vessels, cerebral vessels, left and right kidney (Bhat et al., 2017). These finding can help the patients to know the overall energy of communication, the level of stress, and trends of disorderliness in the organ systems.

Latest RCT assessed the energy difference between the immediate effect of *yoga* and Indian aesthetic dance by using Bio-Well device. In this study, the measured parameters were emotional pressure (also termed as activation coefficient), the communication energy level of various organ systems, and entropy in the human energy field (Hegde et al., 2020). The outcome parameters found a significant decrease in the level of stress in *yoga* group. The energy level of the organ systems comprising respiratory, endocrine, musculoskeletal, digestive, cardiovascular, nervous and immune systems were observed significantly improved in Indian aesthetic dance group. In *yoga* group, significant improvement in respiratory, musculoskeletal, nervous system, cardiovascular, endocrine, and immune system were observed. The entropy level had significant difference in both *yoga* and dance groups compared to control group (Hegde et al., 2020). These findings pointed out the subtle energy level of physical and psychological state can be detected by

Bio-Well device, and this portable device is a safe, effective and non-invasive tool for measuring the bio-energy of a person.

In sum, based on various components of *yoga* studies suggest that *yoga* is beneficial to body, mind, spirit wellness in healthy and unhealthy individuals. Most *yogic* studies offered one plausible mechanism: that the effect of *yoga* may stimulate and tone the parasympathetic nervous system and promote to suppress the activation in sympathetic nerves system (Gard et al., 2014). Other possible mechanisms such as the neurophysiological changes leading to psychological and spiritual growth need more focus on long-term practices.

A summary of select papers on the scientific research on yogic practices is presented in Tables 2, 3 and 4. There are thousands of papers published in the above area of *yoga* research; we present only those that have a bearing on the subject of this thesis.

In chapter 4, the aim and objectives regarding to the present study will be discussed.

3.4 SUMMARY OF SCIENTIFIC RESEARCH ON *YOGIC* PRACTICES

Table 2: Studies on *yoga* impact the three *guṇās*

Author / Year of Publication	Participants	Design	Variable Studied	Findings
Deshpande et al., 2008	226	Randomised control trial, Integrated <i>yoga</i> module: <i>āsana</i> , <i>prāṇāyāma</i> , meditation, notional correction and devotional sessions	<i>Sattva</i> , <i>rajas</i> , and <i>tamas</i> , somatic symptoms (SS), anxiety and insomnia (AI), social dysfunction (SF), severe depression (SP)	<i>Sattva</i> showed a significant improvement. There was significant decrease in SS, AI, SF and SP of general health.
Khemka et al., 2011	108	Pre-post study, Integrated <i>yoga</i> module: postures, breathing exercise, relaxation techniques, meditation, chanting and lectures	<i>Sattva</i> , <i>rajas</i> , and <i>tamas</i> , sustained attention, emotional intelligence (EQ), general health (GHQ)	There were significant changes in all variables except <i>sattva</i> that did not reach significance.
Deshpande et al., 2009	226	Randomised control trial, Integrated <i>yoga</i> module: <i>āsana</i> , <i>prāṇāyāma</i> , meditation, notional correction and devotional sessions	<i>Sattva</i> , <i>rajas</i> , and <i>tamas</i> , Self-esteem questionnaire (SEQ): competency (COM), global self-esteem (GSE), moral and self-esteem (MSE), social esteem (SET), family self-esteem (FSE), body and physical appearance (BPA), and the lie scale (LIS)	<i>Sattva</i> improved and <i>tamas</i> decreased was significant in <i>yoga</i> group.
Tikhe et al 2012	68	Pre-post study, Integrated <i>yoga</i> module: postures, <i>prāṇāyāma</i> , relaxation techniques, meditation, chanting, lectures	<i>Sattva</i> , <i>rajas</i> , and <i>tamas</i>	Significant decrease in the score of <i>tamas</i> and <i>rajas</i> , and increase in <i>sattva</i> .

Table 3: Studies on the effects of various *yoga* components

Author / Year of Publication	Participants	Design	Variable Studied	Findings
Wheeler et al., 2019	117	A pilot study, <i>Yoga</i> postures, breathing, meditation, listening to a lecture	Heart rate, Blood pressure, Mood, State anxiety, Psychological stress	The findings indicated that postures, breathing, meditation, and lecture were equally effective in reducing anxiety and improving mood.
Cowen & Adams, 2005	26	A pilot study, <i>Aṣṭāṅga yoga</i> , <i>Hāṭha yoga</i> class	Physical fitness assessments, Perceived Stress Scale, Health Survey, General Well Being Schedule	The <i>Aṣṭāṅga yoga</i> group has significant decrease in diastolic blood pressure and perceived stress, and increase upper body and trunk dynamic muscular strength and endurance, flexibility, and health perception.
Bhutkar et al., 2008	78	A pilot study, <i>Sūrya namaskāra</i>	Pulse rate, blood pressure, lung functions, cardiorespiratory efficiency	Significant decrease in the pulse rate and blood pressure, improvements of the lung functions and cardiorespiratory efficiency.
Godse et al., 2015	124	Randomised control trial, <i>Sūrya namaskāra</i>	Smith Stress, Symptoms Inventory, Smith relaxation, disposition inventory, SRDI–stress subscale	Improve on physical relaxation, mental quiet, at ease/peace, rested and refreshed, strength and awareness and joy, and lower on sleepiness, and stress dispositions–somatic stress, worry, and negative emotion.
Pramanik et al., 2009	49	Pre-post study, <i>Bhastrikā prāṇāyāma</i>	Blood pressure, Heart rate	Significant decrease in the systolic and diastolic blood pressure with a slight reduction in the heart rate.
Sinha et al., 2013	27	Pre-post study, Alternate nostril breathing	Deep breathing test (the E:I ratio), Orthostatic tolerance test (30:15 ratio)	Significantly tone the parasympathetic nervous system.
Kaminsky et al., 2017	43	Randomised control trial, Dirgha three-part breathing	6-minutes-walk distance (6MWD), interquartile range (IQR), specific airway conductance (sGaw), inspiratory time to total breathing cycle time ratio (Ti/Ttot),	Increase in 6MWD, slight improvements in inspiratory capacity and air trapping.

			alveolar volume to total lung capacity ratio (VA/TLC)	
Wallace, 1970	15	Pre-post study, Transcendental meditation	Oxygen consumption, Heart rate, Skin resistance, Electroencephalograph measurements	Significant reduce oxygen consumption and heart rate, the electroencephalograph showed specific changes in certain frequencies.
Lutz et al., 2008	32	Pre-post study, Compassion meditation	Pupil diameter, Activation of limbic regions, Right temporoparietal junction (TPJ), Right posterior superior temporal sulcus (pSTS)	Increase activation in the insula, amygdala, TPJ, and pSTS for the experts.
Jain et al., 2007	104	Randomised control trial, Mindfulness meditation	Believe system inventory, Daily emotion report, Positive states of mind, Index of core spiritual experiences	Meditation group significant decrease in distress, distractive and ruminative thoughts/behaviors, increases in positive states of mind over time.
Gard et al., 2012	101	A pilot study, Incorporate <i>yoga</i> practice	Quality of Life Inventory (QOLI) Perceived Stress Scale (PSS) Five Facet Mindfulness Questionnaire (FFMQ) Self-Compassion Scale (SCS)	Significant increase in quality of life, mindfulness, and self-compassion, decreases in perceived stress. It also support that mindfulness and self-compassion mediate the effects of <i>yoga</i> on quality of life and perceived stress.
Kishida et al., 2019	104	Intensive longitudinal design, 21-day <i>yoga</i> practice	Mindfulness, (Self-)compassion, Social connectedness	Participants demonstrated moderate to high levels of mindfulness, self-compassion, and compassion, with the highest between-person means observed in social connectedness.

Table 4: Studies on yoga using EPI

Author / Year of Publication	Participants	Design	Variable Studied	Findings
Deo et al., 2015	64	A pilot study <i>Ānapānasati</i> meditation	Integra area (IA) Activation coefficient (AC) Integral entropy (IE)	Significant changes in IA in both the right and left side of the human body. Positive reduced AC. Integral entropy was decreased on the left-side.
Kushwah et al., 2015	94	Pre-post study Integrated <i>yoga</i> program	Integra area (IA) Activation coefficient (AC) Integral entropy (IE)	Significant changes in IA and AC at the psychophysiological level.
Kushwah et al., 2016	66	Pre-post study Cyclic meditation	Integra area (IA) Activation coefficient (AC) Integral entropy (IE)	Significant increase in IA, decrease AC and the right side of IE.
Bhat et al., 2017	102	Pre-post Stop diabetes movement (SDM) <i>yoga</i> module	The EPI parameters selected for analysis included area, intensity, form coefficient, entropy, fractality, liver, immune organs, pancreas, coronary vessels, cerebral vessels, left kidney and right kidney	Results in the first study showed a significant difference in EPI parameters between normal, prediabetes and diabetes. In the second study, the result showed a significant difference in the immune organs. In the third pre-post study, the significant changes were in the parameters of area, form coefficient, entropy, liver, pancreas, coronary vessels, cerebral vessels, left and right kidney.
Hegde et al., 2020	91	Randomised control trial <i>Yoga</i> Indian traditional dance	Emotional pressure, Communication energy level of various organ systems Entropy in the human energy field	<i>Yoga</i> group has significant decrease stress level, and in the energy level of the organ systems significant improvement in respiratory, musculoskeletal, nervous system, cardiovascular, endocrine, and immune system. The dance group also improves most of the energy level parameter. The entropy level has significant difference in both <i>yoga</i> and dance groups compared to control group.