CHAPTER-2

REVIEWS OF RELATED LITERATURES

2.1 INTRODUCTION:

The research title “Effects of Vethathiri Maharishi’s Nine-Centre Meditation on Physiological, Psychological and Radiological Variables of the Students” was selected by the researcher after analyzing previous studies on the effects of yoga carried out by other researchers till Dec, 2011, before the study was started in Jan, 2012. The research was enhanced further by analyzing similar studies carried out till Jul, 2015.

2.2 REVIEWS OF PREVIOUS STUDIES:

Arambula P, Peper E, Kawakami M, Gibney KH, (2001) This study explores the physiological correlates of a highly practiced Kundalini Yoga meditator. Thoracic and abdominal breathing patterns, heart rate (HR), occipital parietal electroencephalograph (EEG), skin conductance level (SCL), and blood volume pulse (BVP) were monitored during pre-baseline, meditation, and post-baseline periods. Visual analyses of the data showed a decrease in respiration rate during the meditation from a mean of 11 breaths/min for the pre and 13 breaths/min for the post-baseline to a mean of 5 breaths/min during the meditation, with a predominance of abdominal/diaphragmatic breathing. There was also more alpha EEG activity during the meditation (M = 1.71 microV) compared to the pre- (M = .47 microV) and post-baseline (M = .78 microV) periods, and an increase in theta EEG activity immediately following the meditation (M = .62 microV) compared to the pre-baseline and meditative periods (each with M = .26 microV). These findings suggest that a shift in breathing patterns may contribute to the development of alpha EEG, and those patterns need to be investigated further.

Azam MA, Katz J, Fashler SR, Changoor T, Azargive S, Ritvo P, (2015). Heart rate variability (HRV) is a vagal nerve-mediated biomarker of cardiac function used to investigate chronic illness, psychopathology, stress and more recently, attention-regulation processes such as meditation. This study investigated HRV in relation to maladaptive perfectionism, a stress-related personality factor, and mindfulness meditation, a stress coping practice expected to elevate HRV, and thereby promote relaxation. Maladaptive perfectionists (n=21) and Controls
(n=39) were exposed to a lab-based assessment in which HRV was measured during (1) a 5-minute baseline resting phase, (2) a 5-minute cognitive stress-induction phase, and (3) a post-stress phase. In the post-stress phase, participants were randomly assigned to a 10-minute audio-instructed mindfulness meditation condition or a 10-minute rest condition with audio-description of mindfulness meditation. Analyses revealed a significant elevation in HRV during meditation for Controls but not for Perfectionists. These results suggest that mindfulness meditation promotes relaxation following cognitive stress and that the perfectionist personality hinders relaxation possibly because of decreased cardiac vagal tone. The results are discussed in the context of developing psycho-physiological models to advance therapeutic interventions for distressed populations.

**Barnes VA, Orme-Johnson DW, (2012).** The pathogenesis and progression of cardiovascular diseases are thought to be exacerbated by stress. Basic research indicates that the Transcendental Meditation technique produces acute and longitudinal reductions in sympathetic tone and stress reactivity. In adolescents at risk for hypertension, the technique has been found to reduce resting and ambulatory blood pressure, left ventricular mass, cardiovascular reactivity, and to improve school behavior. Research on adults with mild or moderate essential hypertension has reported decreased blood pressure and reduced use of anti-hypertensive medication. The technique has also been reported to decrease symptoms of angina pectoris and carotid atherosclerosis, to reduce cardiovascular risk factors, including alcohol and tobacco use, to markedly reduce medical care utilization for cardiovascular diseases, and to significantly decrease cardiovascular and all-cause morbidity and mortality. These findings have important implications for inclusion of the Transcendental Meditation program in efforts to prevent and treat cardiovascular diseases and their clinical consequences.

**Beheshtipoor N, Bagheri S, Hashemi F, Zare N, Karimi M, (2015).** The problems caused by hemophilia lead to impairments of the quality of life in patients with hemophilia. This study aimed to investigate the effects of yoga on quality of life in the children and adolescents with hemophilia in Shiraz, Iran. This semi-experimental study with pre- and post-test design was performed on 27 boys between 8 and 16 years old who suffered from hemophilia. The patients were divided into two groups. The number of bleedings, absences from school, and referrals to the clinic was evaluated. The demographic data were collected through interviews and using the
patients' records in the hemophilia center. Besides, the quality of life was assessed through the Haemo-QoL questionnaire. Then, the yoga intervention was performed for 14 weeks and the data were collected in three stages. The collected data were entered into the SPSS statistical software, version 18 and were analyzed using non-parametric Friedman test. After the intervention, significant differences were observed in the mean scores of quality of life dimensions and the number of bleedings, school absences, and referrals to the hemophilia clinic (P<0.001). Thus, yoga may improve the hemophilia children’s and adolescents' perception of quality of life without the risk of injury. This intervention also seemed to be effective in reducing the number of bleedings, referrals to the hemophilia clinic, and absences from school.

Carlson LE, Speca M, Faris P, Patel KD, (2007) This study investigated the ongoing effects of participation in a mindfulness-based stress reduction (MBSR) program on quality of life (QL), symptoms of stress, mood and endocrine, immune and autonomic parameters in early stage breast and prostate cancer patients.

Methods: Forty-nine patients with breast cancer and 10 with prostate cancer enrolled in an eight-week MBSR program that incorporated relaxation, meditation, gentle yoga and daily home practice. Demographic and health behaviors, QL, mood, stress symptoms, salivary cortisol levels, immune cell counts, intracellular cytokine production, blood pressure (BP) and heart rate (HR) were assessed pre- and post-intervention, and at 6- and 12-month follow-up.

Results: Fifty-nine, 51, 47 and 41 patients were assessed pre- and post-intervention and at 6- and 12-month follow-up, respectively, although not all participants provided data on all outcomes at each time point. Linear mixed modeling showed significant improvements in overall symptoms of stress which were maintained over the follow-up period. Cortisol levels decreased systematically over the course of the follow-up. Immune patterns over the year supported a continued reduction in Th1 (pro-inflammatory) cytokines. Systolic blood pressure (SBP) decreased from pre- to post-intervention and HR was positively associated with self-reported symptoms of stress.

Conclusions: MBSR program participation was associated with enhanced quality of life and decreased stress symptoms, altered cortisol and immune patterns consistent with less stress and mood disturbance, and decreased blood pressure. These pilot data represent a preliminary
investigation of the longer-term relationships between MBSR program participation and a range of potentially important biomarkers.

**Chang CH, Lo PC, (2013).** Remarkable changes in cardio-respiratory interactions are frequently experienced by Chan meditation practitioners following years of practice. This study compares the results of our study on cardio-respiratory interactions for novice (control group) and experienced (experimental group) Chan meditation practitioners. The effectual co-action between the cardiac and respiratory systems was evaluated by the degree of cardio-respiratory phase synchronization (CRPS). In addition, an adaptive-frequency-range (AFR) scheme to reliably quantify heart rate variability (HRV) was developed for assessing the regulation of sympathetic-parasympathetic activity and the efficiency of pulmonary gas exchange. The enhanced HRV method, named HRVAFR, can resolve the issue of overestimating HRV under the condition of slow respiration rates, which is frequently encountered in studies on Chan meditation practitioners. In the comparison of the three data sets collected from the two groups, our findings resulted in innovative hypotheses to interpret the extraordinary process of the rejuvenation of cardio-respiratory functions through long-term Dharma-Chan meditation practice. Particularly, advanced practitioners exhibit a continuously high degree of cardio-respiratory phase synchronization, even during rapid breathing. Based on our post-experimental interview with advanced practitioners, the activation of inner Chakra energy, during the course of Chan-detachment practice, frequently induces perceptible physiological-mental reformation, including an efficient mechanism for regulating cardio-respiratory interactions.

**Chatterjee S, Mondal S, (2014)** Growth hormone (GH) and dehydroepiandrosterone sulfate (DHEAS) secretion decline with advancing age and are associated with the symptoms of aging. Yogic texts claimed that regular practice of yoga may restore and maintain general endocrinological properties in the human body. Objective of the Study: To observe the effect of yogic training for twelve weeks on basal level of GH and DHEAS in middle aged group.

Method: Forty-five untrained volunteers were divided into two groups, that is, yoga practicing (experimental: male 15, age 42.80 ± 7.43 yrs; female 8, age 44.75 ± 8.40 yrs) and waitlisted control group (male 15, age 41.67 ± 7.87 yrs; female 7, age 45.43 ± 7.00 yrs). The experimental group underwent combined yogic practices daily in the morning for 6 days/week for 12 weeks,
whereas control group continued their usual routine activities. Standing height, body weight, body mass index, and basal level of GH and DHEAS were measured before commencement and after six and twelve weeks of yogic training period. The repeated measure ANOVA was used for data analysis.

Results: 12 weeks of yogic training produces a significant increase in GH and DHEAS for both male and female groups as compared to their baseline data, whereas no as such changes were observed in the control group.

Conclusion: Combined approach of graded yogic training may be beneficial for maintaining the basal level of GH and DHEAS in the human body, thus promoting healthy aging.

Chen TL, Mao HC, Lai CH, Li CY, Kuo CH, (2009) The purpose of this study was to investigate the effect of yoga exercise on the health-related physical fitness of school-age children with asthma. The study employed a quasi-experimental research design in which 31 voluntary children (exercise group 16; control group15) aged 7 to 12 years were purposively sampled from one public elementary school in Taipei County. The yoga exercise program was practiced by the exercise group three times per week for a consecutive 7 week period. Each 60-minute yoga session included 10 minutes of warm-up and breathing exercises, 40 minutes of yoga postures, and 10 minutes of cool down exercises. Fitness scores were assessed at pre-exercise (baseline) and at the seventh and ninth week after intervention completion. A total of 30 subjects (exercise group 16; control group 14) completed follow-up. Results included: 1. Compared with children in the general population, the study subjects (n = 30) all fell below the 50th percentile in all five physical fitness items of interest. There was no significant difference in scores between the two groups at baseline (i.e., pre-exercise) for all five fitness items. 2. Research found a positive association between exercise habit after school and muscular strength and endurance among asthmatic children. 3. Compared to the control group, the exercise group showed favorable outcomes in terms of flexibility and muscular endurance. Such favorable outcomes remained evident even after adjusting for age, duration of disease and steroid use, values for which were unequally distributed between the two groups at baseline. 4. There was a tendency for all item-specific fitness scores to increase over time in the exercise group. The GEE analysis showed that yoga exercise indeed improved BMI, flexibility, and muscular endurance.
After 2 weeks of self-practice at home, yoga exercise continued to improve BMI, flexibility, muscular strength, and cardiopulmonary fitness.

**Chimkode SM, Kumaran SD, Kanhere VV, Shivanna R, (2015)** Introduction: In view of people embracing sedentary life style, and the effectiveness of treatment becoming less, the role of regular exercise especially 'yoga' seems to be a beneficial and economical adjuvant in the management of the Type 2 diabetes mellitus (T2DM).

Objectives: To assess the beneficial effects of yoga on blood glucose levels in normal and T2DM volunteers. Materials and Methods: A prospective case-control study was conducted in the Department of Physiology and Diabetic clinic of a tertiary care teaching hospital over period of two years. The study subjects consisted of 30 male diabetic patients attending diabetic clinic and 30 non-diabetic male volunteers constituted control group. The patients in the age group of 36 to 55 years with T2DM of at least one year duration and those on diabetic diet and oral hypoglycemic agents were included in the study group. The age matched healthy male volunteers who had come to join yoga training at yoga centre were included in the control group. All the participants were trained by yoga experts and subjected to regular practice under supervision for six months. In all the participants fasting (FBS) and post-prandial blood sugar (PPBS) was estimated before, during (at three months) and after (six months) yoga training. Paired Student t-test was used to estimate difference in means calculated before and after yoga training in a same group. A p-value of <0.05 was considered as statistically significant.

Results: The distribution of age, mean height and mean weight among both the groups were comparable. The reduction in mean values of FBS and PPBS at the end of six months was highly significant (p <0.001) in both the groups when compared with the mean values before and during (three months) yoga practice. The reduction in these values at three months during yoga was highly significant in T2DM group when compared with mean values before yoga (p <0.001), but it was insignificant (p<0.05) in control group.

Conclusion: The results of the present study demonstrated that the yoga is effective in reducing the blood glucose levels in patients with T2DM.

**De Castro JM, (2015)** Contemplative practices can have profound effects on mindfulness and on physical, sensory and mystical experiences. Individuals who self-reported meditation, yoga,
contemplative prayer, or a combination of practices and their patterns of practice were compared for mindfulness, Kundalini effects, and mystical experiences. The results suggest that the amount of practice but not the pattern and social conditions of practice influences mindfulness and possibly mystical experiences. Meditation, yoga, contemplative prayer, or a combination of practices all were found to be associated with enhancements of mindfulness, Kundalini effects, and mystical experiences, but meditation had particularly strong associations and may be the basis of the associations of yoga and prayer with these outcomes. The results further suggest that the primary association of contemplative practices is with the real time awareness and appreciation of sensory and perceptual experiences which may be the intermediary between disparate practices and mindfulness, Kundalini effects, and mystical experiences.

Dillbeck MC, Vesely SA, (1986). This study assesses variation in frontal bilateral EEG coherence among normal subjects during trials of a concept learning task; the task used a concept-reversal paradigm found from prior research to distinguish frontal lobe patients from normal adults. Subjects were either participants in the Transcendental Meditation (TM) program or controls matched for age, sex, and intellectual ability, and additional experimental factors were whether or not the subject gained information on a given trial and whether or not the trial occurred before, during, or after the shift of concept. It was hypothesized that: (1) higher frontal EEG coherence (alpha and beta frequencies) would be associated with trials on which information was gained; (2) higher coherence in the same frequencies would be found in the two concept-solution periods in contrast to the concept-reversal period that divided them; and (3) these patterns would be more clearly expressed among TM program participants. Each hypothesis received partial support. The first hypothesis was true only for TM program participants for alpha coherence, and only during the first concept-solution period for beta coherence. The second hypothesis was true for alpha coherence only, and the third hypothesis received support for alpha coherence. Results were not attributable to muscle or eye artifacts. However, a different response style was found to the change in concept among the two groups; control subjects displayed greater arousal (muscle artifact) during the concept-reversal period, while TM program participants displayed less arousal.

Gaskins RB, Jennings E, Thind H, Becker BM, Bock BC, (2014) Background: College students are vulnerable to a critical period in developmental maturation, facing rigorous
academic work and learning how to function independently. Western aerobic exercise (WAE), such as running and bicycling, has been shown to improve mood and relieve stress. However, college students often have low levels of physical activity. Yoga is an ancient physical and mental practice that may affect mood and stress. However, rigorous studies examining the psychological effects of yoga are rare in peer reviewed Western journals. The aim of this research was to establish preliminary evidence for the acute effects of Vinyasa yoga on affect and stress in young-adult College students.

Methods: Twenty healthy college students aged 18 years and older were recruited to participate in this pilot study. Participants attended a Vinyasa yoga class at a local studio twice weekly for 8 weeks. Affect and stress were assessed before and after each yoga session. Measures included the Positive and Negative Affective Schedule (PANAS) and the Cohen Perceived Stress scale.

Results: Positive affect scores increased significantly (p < 0.05) for 14 of the 16 yoga sessions (mean increase = 23.2%). Negative affect decreased significantly from pre- to post yoga (p < 0.05) for 15 of the 16 sessions (mean decrease = 22%). Repeated measures ANOVAs examining pre-post composite scores across all 8 weeks showed significant changes in PANAS, but not stress scores.

Conclusions: Findings suggest that yoga practice is associated with acute improvements in affect in a young-adult college population. Future research is needed to examine the extent to which different types of yoga address the needs of different college sub-populations (e.g., eating disordered, overweight/obese, sedentary, and smokers).

Gopal A, Mondal S, Gandhi A, Arora S, Bhattacharjee J (2011) Background: Stress is often associated with an increased occurrence of autonomic, cardiovascular, and immune system pathology. This study was done to evaluate the impact of stress on psychological, physiological parameters, and immune system during medical term -academic examination and the effect of yoga practices on the same.

Materials and methods: The study was carried out on sixty first-year MBBS students randomly assigned to yoga group and control group (30 each). The yoga group underwent integrated yoga practices for 35 minutes daily in the presence of trained yoga teacher for 12 weeks. Control group did not undergo any kind of yoga practice or stress management. Physiological parameters
like heart rate, respiratory rate, and blood pressure were measured. Global Assessment of Recent Stress Scale and Spielbergers State Anxiety score were assessed at baseline and during the examination. Serum cortisol levels, IL-4, and IFN-γ levels were determined by enzyme-linked immunosorbent assay technique.

Result: In the yoga group, no significant difference was observed in physiological parameters during the examination stress, whereas in the control group, a significant increase was observed. Likewise, the indicators of psychological stress showed highly significant difference in control group compared with significant difference in yoga group. During the examination, the increase in serum cortical and decrease in serum IFN-γ in yoga group was less significant (P<0.01) than in the control group (P<0.001). Both the groups demonstrated an increase in serum IL-4 levels, the changes being insignificant for the duration of the study.

Conclusion: Yoga resists the autonomic changes and impairment of cellular immunity seen in examination stress.

Graves LE, Ridgers ND, Williams K, Stratton G, Atkinson G, Cable NT, (2010) Background: Active video games (exergames) increase energy expenditure (EE) and physical activity (PA) compared with sedentary video gaming. The physiological cost and enjoyment of exergaming in adolescents, and young and older adults have not been documented, nor compared with aerobic exercise. This study compared the physiological cost and enjoyment of exergaming on Wii Fit with aerobic exercise in 3 populations.

Methods: Cardio-respiratory and enjoyment measurements were compared in 14 adolescents, 15 young adults, and 13 older adults during handheld inactive video gaming, Wii Fit activities (yoga, muscle conditioning, balance, aerobics), and brisk treadmill walking and jogging.

Results: For all groups EE and heart rate (HR) of Wii Fit activities were greater than handheld gaming (P < .001) but lower than treadmill exercise (P <or= .001). Wii aerobics elicited moderate intensity activity in adolescents, young adults, and older adults with respective mean (SD) metabolic equivalents of 3.2 (0.7), 3.6 (0.8), and 3.2 (0.8). HR during Wii aerobics fell below the recommended intensity for maintaining cardio-respiratory fitness. Group enjoyment rating was greater for Wii balance and aerobics compared with treadmill walking and jogging (P <or= .05).
Conclusions: Wii Fit appears an enjoyable exergame for adolescents and adults, stimulating light-to-moderate intensity activity through the modification of typically sedentary leisure behavior.

Hebert R, Lehmann D, (1977) In a survey of the EEG characteristics of persons practicing the Transcendental Meditation technique, 21 of 78 people demonstrated intermittent prominent bursts of frontally dominant theta activity. On the average across subjects, the theta bursts occurred about every 2 min, had an average duration of 1.8 sec, and an average maximal amplitude of 135 μV. Typically, the bursts were preceded and followed by alpha rhythm. Subject reports elicited during theta bursts indicated pleasant states with intact situational orientation and no subjective experiences related to sleep. Fifty-four non-meditating controls showed no theta bursts during relaxation and sleep onset. It is hypothesized that theta burst may be the manifestation of a state adjustment mechanism which comes into play during prolonged low-arousal states, and which may be related to EEG patterns of relaxation in certain behavioral conditions.

Hooke MC, Gilchrist L, Foster L, Langevin M, Lee J, (2015). Survivors of childhood cancer may experience persistent symptoms, including fatigue, sleep disturbance, and balance impairment. Yoga is a complementary therapy that improves fatigue, sleep, and quality of life in adult cancer survivors. Using a one group, repeated measures design, we evaluated the feasibility of a yoga program and assessed if cancer survivor participants ages 10 to 17 years (n = 13) had significantly less fatigue and anxiety, and better balance and sleep, after a 6-week yoga intervention compared with a 6-week pre-intervention wait period. Study recruitment was challenging with a 32% enrollment rate; yoga attendance was 90%. None of the scores for anxiety, fatigue, sleep, and balance had significant changes during the wait period. After the 6-week yoga program, children (n = 7) had a significant decrease in anxiety score (P = .04) while adolescent scores (n = 7) showed a decreasing trend (P = .10). Scores for fatigue, sleep, and balance remained stable post-intervention. Fatigue and balance scores were below norms for health children/adolescents while sleep and anxiety scores were similar to healthy peers.

Kaley-Isley LC, Peterson J, Fischer C, Peterson E, (2010) Yoga is being used by a growing number of youth and adults as a means of improving overall health and fitness. There is also a progressive trend toward use of yoga as a mind-body complementary and alternative medicine
intervention to improve specific physical and mental health conditions. To provide clinicians with therapeutically useful information about yoga, the evidence evaluating yoga as an effective intervention for children and adolescents with health problems is reviewed and summarized. A brief overview of yoga and yoga therapy is presented along with yoga resources and practical strategies for clinical practitioners to use with their patients. The majority of available studies with children and adolescents suggest benefits to using yoga as a therapeutic intervention and show very few adverse effects. These results must be interpreted as preliminary findings because many of the studies have methodological limitations that prevent strong conclusions from being drawn. Yoga appears promising as a complementary therapy for children and adolescents. Further information about how to apply it most effectively and more coordinated research efforts are needed.

Khalsa MK, Greiner-Ferris JM, Hofmann SG, Khalsa SB, (2015) Cognitive behavioral therapy (CBT) is an effective treatment for generalized anxiety disorder, but there is still room for improvement. The aim of the present study was to examine the potential benefit of enriching CBT with Kundalini yoga (Y-CBT). Participants consisted of treatment resistant clients at a community mental health clinic. A total of 32 participants enrolled in the study and 22 completed the programme. After the Y-CBT intervention, pre-post comparisons showed statistically significant improvements in state and trait anxiety, depression, panic, sleep and quality of life. Results from this preliminary study suggest that Y-CBT may have potential as a promising treatment for those suffering from generalized anxiety disorder.

Key Practitioner Messages: Yoga-enhanced cognitive behavioral therapy (Y-CBT) may be a promising new treatment for those suffering from generalized anxiety disorder. Y-CBT may also reduce depression in those suffering from generalized anxiety. Y-CBT may reduce depression and anxiety in a clinic population where clients suffer from multiple diagnoses including generalized anxiety disorder.

Khalsa SS, Rudrauf D, Damasio AR, Davidson RJ, Lutz A, Tranel D, (2008) Attention to internal body sensations is practiced in most meditation traditions. Many traditions state that this practice results in increased awareness of internal body sensations, but scientific studies evaluating this claim are lacking. We predicted that experienced meditators would display performance superior to that of non-meditators on heartbeat detection, a standard noninvasive
measure of resting interoceptive awareness. We compared two groups of meditators (Tibetan Buddhist and Kundalini) to an age- and body mass index-matched group of non-meditators. Contrary to our prediction, we found no evidence that meditators were superior to non-meditators in the heartbeat detection task, across several sessions and respiratory modulation conditions. Compared to non-meditators, however, meditators consistently rated their interoceptive performance as superior and the difficulty of the task as easier. These results provide evidence against the notion that practicing attention to internal body sensations, a core feature of meditation, enhances the ability to sense the heartbeat at rest.

Khare KC, Nigam SK, (2000) Electroencephalographic patterns were studied in 30 normal healthy individuals practicing meditation and compared with 10 normal healthy controls not practicing meditation. In this study, we found prominent alpha wave activity and increase its voltage in meditators as compared to controls. Meditators had significantly more alpha rhythm as compared to control group. Percentage of alpha waves was higher in persons performing meditation with good coherence which suggested good homogeneity, uniformity and increased orderliness of brain.

Kim TS, Park JS, Kim MA, (2008). The purpose of this research is to examine the relation of meditation to power and well-being in Korean adults. Using a quasi-experimental design, meditation was provided through a Chakra meditation music program over a 4 week period. The Power as Knowing Participation in Change Tool and the Well-Being Picture Scale were used, after being translated into Korean. Statistically significant interaction effects of power and group (p<.001), and well-being and group (p<.05) were found. Meditation has a potential to facilitate power and well-being in the human and environmental field patterning process.

Lo PC, Chang CH, (2013). His paper reports the results of our investigation of the effects of Chan meditation on brain electrophysiological behaviors from the viewpoint of spatially nonlinear interdependence among regional neural networks. Particular emphasis is laid on the alpha-dominated EEG (electroencephalograph). Continuous-time wavelet transform was adopted to detect the epochs containing substantial alpha activities. Nonlinear interdependence quantified by similarity index S(X|Y), the influence of source signal Y on sink signal X, was applied to the nonlinear dynamical model in phase space reconstructed from multichannel EEG. Experimental group involved ten experienced Chan-Meditation practitioners, while control group included ten
healthy subjects within the same age range, yet, without any meditation experience. Nonlinear interdependence among various cortical regions was explored for five local neural-network regions, frontal, posterior, right-temporal, left-temporal, and central regions. In the experimental group, the inter-regional interaction was evaluated for the brain dynamics under three different stages, at rest (stage R, pre-meditation-background recording), in Chan meditation (stage M), and the unique Chakra-focusing practice (stage C). Experimental group exhibits stronger interactions among various local neural networks at stages M and C compared with those at stage R. The intergroup comparison demonstrates that Chan-meditation brain possesses better cortical inter-regional interactions than the resting brain of control group.

**Lynton H, Kligler B, Shiflett S, (2007)** This article presents a systematic review of the literature pertaining to the use of yoga in stroke rehabilitation. In addition, we present the results of a small pilot study designed to explore the hypothesis that a Kundalini yoga practice of 12 weeks would lead to an improvement in aphasia as well as in fine motor coordination in stroke patients.

Method: The 3 participants attended yoga classes twice a week for 12 weeks, before and after which they were tested on the O'Connor Tweezer Dexterity test, a timed test where the participant places pins in a Peg-Board with tweezers, and the Boston Aphasia Exam for speech.

Results: All 3 participants showed improvement on both measures.

Conclusion: The small sample size makes it impossible to draw definite conclusions, but the positive trends in this study suggest that further research should be done to examine the effects of Kundalini yoga on specific illnesses or medical conditions.

**Malathi A, Damodaran A, (1999)** A student under optimal stress brings out his best. However extremes of stress can result in stress induced disorders and deteriorating performance. Can yoga be of benefit in stress induced effects in medical students? The present study was conducted in first MBBS students (n = 50) to determine the benefit if any of yogic practices on anxiety status during routine activities and prior to examination. Feedback scores were assessed to determine how the students were benefited by the practices. Anxiety status as assessed by Spillberger's anxiety scale showed a statistically significant reduction following practice. In addition the anxiety score which rose prior to exams showed a statistically significant reduction on the day of exam after practice. These results point to the beneficial role of yoga in not only causing
reduction in basal anxiety level but also attenuating the increase in anxiety score in stressful state such as exams. The results of the exam indicated a statistically significant reduction in number of failures in yoga group as compared to the control group. The improvement in various parameters such as better sense of well being, feeling of relaxation, improved concentration, self confidence, improved efficiency, good interpersonal relationship, increased attentiveness, lowered irritability levels, and an optimistic outlook in life were some of the beneficial effects enjoyed by the yoga group indicated by feedback score.

**Manchanda SC, Madan K, (2014)** Yoga is a holistic mind-body intervention aimed at physical, mental, emotional and spiritual well being. Several studies have shown that yoga and/or meditation can control risk factors for cardiovascular disease like hypertension, type II diabetes and insulin resistance, obesity, lipid profile, psychosocial stress and smoking. Some randomized studies suggest that yoga/meditation could retard or even regress early and advanced coronary atherosclerosis. A recent study suggests that transcendental meditation may be extremely useful in secondary prevention of coronary heart disease and may reduce cardiovascular events by 48% over a 5-year period. Another small study suggests that yoga may be helpful in prevention of atrial fibrillation. However, most studies have several limitations like lack of adequate controls, small sample size, inconsistencies in baseline and different methodologies, etc. and therefore large trials with improved methodologies are required to confirm these findings. However, in view of the existing knowledge and yoga being a cost-effective technique without side effects, it appears appropriate to incorporate yoga/meditation for primary and secondary prevention of cardiovascular disease.

**Nidhi R, Padmalatha V, Nagarathna R, Amritanshu R, (2013)** Objectives: The objectives of this trial were to compare the effects of a holistic yoga program with the conventional exercise program in adolescent polycystic ovarian syndrome (PCOS).

Design: This was a prospective, randomized, active controlled trial. Setting: Ninety (90) adolescent (15-18 years) girls from a residential college in Andhra Pradesh who satisfied the Rotterdam criteria were randomized into two groups.

Intervention: The yoga group practiced a holistic yoga module, while the control group practiced a matching set of physical exercises (1 hour/day, for 12 weeks).
Outcome Measures: Anti-müllerian hormone (AMH-primary outcome), luteinizing hormone (LH), follicle-stimulating hormone (FSH), testosterone, prolactin, body-mass index (BMI), hirsutism, and menstrual frequency were measured at inclusion and after 12 weeks.

Results: Mann-Whitney test on difference score shows that changes in AMH (Y=-2.51, C=-0.49, p=0.006), LH, and LH/FSH ratio (LH: Y=-4.09, C=3.00, p=0.005; LH/FSH: Y=-1.17, C=0.49, p=0.015) were significantly different between the two intervention groups. Also, changes in testosterone (Y=-6.01, C=2.61, p=0.014) and Modified Ferriman and Gallway (mFG) score (Y=-1.14, C=+0.06, p=0.002) were significantly different between the two groups. On the other hand, changes in FSH and prolactin post-intervention were non-significantly different between the two groups. Also, body weight and BMI showed non-significantly different changes between the two groups, while changes in menstrual frequency were significantly different between the two groups (Y=0.89, C=0.49, p=0.049).

Conclusions: A holistic yoga program for 12 weeks is significantly better than physical exercise in reducing AMH, LH, and testosterone, mFG score for hirsutism, and improving menstrual frequency with non-significant changes in body weight, FSH, and prolactin in adolescent PCOS.

Pan W, Zhang L, Xia Y, (1994). The differences in EEG theta waves between concentrative and non-concentrative Qigong states were studied by means of power spectrum analysis and EEG mapping. The adult subjects included 20 practitioners of concentrative Qigong, 30 practitioners of non-concentrative Qigong and 23 control subjects. The results showed frontal mid-line theta rhythm was related to concentrative Qigong state. As the theta rhythm has been suggested to be one of the normal EEG patterns occurring in mental concentration, it is concluded that the theta rhythm is an indicator of mental concentration during Qigong state. This finding clarifies the implication of the theta rhythms appearing in Qigong and other meditation.

Parshad O, Richards A, Asnani M, (2011). Objectives: Yoga improves cardiovascular health in both healthy individuals and those with diagnosed heart disease. This study compares changes in some cardiovascular parameters before and after the practice of Yoga in healthy medical students.

Methods: Sixty-four healthy medical students (57 females and 7 males), mean age 21.3 +/- 2.6 years, attending a Special Study Module 'Role of Dhyana Yoga in Stress Management',
participated in this study. Systolic (SYS) and Diastolic (DIA) blood pressure, Heart Rate (HR), Stroke Volume (SV), Cardiac output (CO), Total Peripheral Resistance (TPR), Interbeat Interval (IBI), Left Ventricular Ejection Time (LVET), Arterial Compliance (Cwk) and Ascending Aorta Impedance (Zao) were measured before and after six weeks of yogic exercises. Various exercises included asanas (Postures), pranayama (Breathing), and dhyana (Meditation). Data were analyzed using Stata for Windows.

Results: two-tailed paired t-test revealed that practice of yoga caused significant increases in HR (p < 0.05), SV (p < 0.01), CO (p < 0.001) and Cwk (p < 0.01) and decreases in TPR (p < 0.001), IBI (p < 0.05) and Zao (p < 0.001) after practicing yoga for 6 weeks as compared to before yoga practice. No significant differences were, however observed in SYS, DIA, Mean arterial blood pressure (MAP) and LVET. Conclusions: Practice of yoga even for a short period showed ability to improve most of the cardiovascular functions. Regular practice of yoga for a longer period may further improve these functions and possibly result in improved management of their daily stress.

Radin DI, Vieten C, Michel L, Delorme A, (2011) Advanced meditators occasionally report experiences of timelessness, or states of awareness that seem to transcend the usual boundaries of the subjective present. This type of experience was investigated in eight experienced meditators and eight matched controls by measuring 32 channels of EEG before, during, and after exposure to unpredictable light and sound stimuli. The experiment postulated that if some aspect of consciousness extends beyond the present moment, then pre-stimulus electro-cortical signals should differ depending on stimuli that were about to be selected by a truly random process, and that if such experiences were catalyzed through meditation practice, then pre-stimulus differences should be more apparent in meditators than in non-meditators. Each of the 32 EEG channels was baseline adjusted on each trial by the electrical potential averaged between two- and one-second pre-stimulus, then for each channel the average potential was determined from one-second pre-stimulus to stimulus onset. The resulting means across subjects in each group were compared by stimulus type using randomized permutation procedures and corrected for multiple comparisons. Within the control group, no EEG channels showed significant pre-stimulus differences between light versus sound stimulus conditions, but within the meditator group five of 32 channels resulted in significant differences (P < .05, two tailed). Comparisons
between control and meditator groups showed significant pre-stimulus differences prior to audio tone stimuli in 14 of 32 channels (P < .05, two tailed, of which eight channels were P < .005, two tailed). This outcome successfully replicates effects reported in earlier experiments, suggesting that sometimes the subjective sense of awareness extending into the future may be ontologically accurate.


Design: A within-subject analysis comparing pre- to post-treatment scores on two standard measures of childhood behavioral problems was used. Settings and Location: The intervention and data analysis occurred at a tertiary care, medical school teaching hospital.

Subjects: Twenty-four (24) children aged 3-16 years with a diagnosis of an ASD comprised the study group. Intervention: The efficacy of an 8-week multi-modal yoga, dance, and music therapy program based on the relaxation response (RR) was developed and examined.

Outcome measures: The study outcome was measured using The Behavioral Assessment System for Children, Second Edition (BASC-2) and the Aberrant Behavioral Checklist (ABC).

Results: Robust changes were found on the BASC-2, primarily for 5-12-year-old children. Unexpectedly, the post-treatment scores on the A-typicality scale of the BASC-2, which measures some of the core features of autism, changed significantly (p=0.003).

Conclusions: A movement-based, modified RR program, involving yoga and dance, showed efficacy in treating behavioral and some core features of autism, particularly for latency-age children.

Rubik B, (2011) objectives: This study had two aims: (1) to explore the inner experiences associated with increased production of gamma brainwaves in an initial neuro-feedback experience; and (2) to measure and compare neuro-feedback-enhanced increased output from the
prefrontal cortical region of meditators and non-meditators, using the Peak Brain Happiness Trainer neuro-feedback system.

Design: This was a controlled pilot study; it involved a single session per subject.

Setting: The research was conducted in a non-profit laboratory in the United States.

Subjects: There were 12 adults in 2 groups (N = 12): 6 practitioners of Transcendental Meditation and six controls.

Measures: The measures were self-assessed inner experiences and measurements of clarified gamma output at the pre-frontal cortical region.

Results: (1) Self-assessed descriptions were comparable for both groups; (2) the associations of 16 supplied descriptors with the initial neuro-feedback experience were comparable for both groups and showed highest scores for "happy" (p < 0.0001) and "loving" (p < 0.0001), and lowest scores for "stressed" (p < 0.0001) and "disappointed" (p < 0.0001); (3) baseline measures were comparable for both groups; (4) both groups were able to increase gamma brainwaves using neuro-feedback (p < 0.01); and (5) meditators produced greater increases over controls (p = 0.02).

Conclusions: The inner experience associated with increased clarified gamma amplitude from the prefrontal cortex apparently involves positive emotions of happiness and love, along with reduced stress. Meditators achieved greater increases in the gamma band from the pre-frontal cortical region over controls during an initial neuro-feedback session.

Shang C, (2001). The emerging paradigms in medicine can be seen through mind-body interactions. Observations in many meditative traditions suggest a series of objective indicators of health beyond absence of disease. Several of the physical signs have been confirmed by research or are consistent with modern science. Further correlation with long term health outcome is needed. Integration of meditation with conventional therapy has enriched psychotherapy with parallels drawn between the Nine Step Qigong and Freudian developmental psychology. A unified theory of the Chakra system and the meridian system widely used in traditional mind-body interventions and acupuncture is presented in terms of modern science based on the morphogenetic singularity theory. Acupuncture points originate from the organizing centers in morphogenesis. Meridians and Chakras are related to the under-differentiated,
interconnected cellular network that regulates growth and physiology. This theory explains the distribution and non-specific activation of organizing centers and acupuncture points; the high electric conductance of the meridian system; the polarity effect of electro-acupuncture; the side-effect profile of acupuncture; and the ontogeny, phylogeny, and physiologic function of the meridian system and Chakra system. It also successfully predicted several findings in conventional biomedical science. These advances have implications in many disciplines of medicine.

Shannahoff-Khalsa DS, (2004) The ancient system of Kundalini yoga includes a vast array of meditation techniques and many were discovered to be specific for treating the psychiatric disorders as we know them today. One such technique was found to be specific for treating obsessive-compulsive disorder (OCD), the fourth most common psychiatric disorder, and the tenth most disabling disorder worldwide. Two published clinical trials are described here for treating OCD using a specific Kundalini yoga protocol. This OCD protocol also includes techniques that are useful for a wide range of anxiety disorders, as well as a technique specific for learning to manage fear, one for tranquilizing an angry mind, one for meeting mental challenges, and one for turning negative thoughts into positive thoughts. Part of that protocol is included here and published in detail elsewhere. In addition, a number of other disorder-specific meditation techniques are included here to help bring these tools to the attention of the medical and scientific community. These techniques are specific for phobias, addictive and substance abuse disorders, major depressive disorders, dyslexia, grief, insomnia and other sleep disorders.


Design and setting: The research was conducted as part of the Australian Longitudinal Study on Women's Health (ALSWH) which was designed to investigate multiple factors affecting the health and well being of women over a 20-year period. Participants: The younger (28-33 years) (n=8885) and mid-aged (56-61 years) (n=10,324) cohorts of the ALSWH who completed Survey 5 in 2006 and 2007 respectively.

Results: This study estimates that 35% of Australian women aged 28-33 and 27% of Australian women aged 56-61 use yoga or meditation. Younger women with back pain (OR=1.28; 95% CI:
1.08, 1.52) and allergies (OR=1.25; 95% CI: 1.06, 1.49) were more likely to use yoga or meditation, while younger women with migraines or headaches (OR=0.73; 95% CI: 0.62, 0.87) were less likely to use yoga or meditation. Mid-age women with low iron (OR=1.68; 95% CI: 1.29, 2.19) and bowel problems (OR=1.37; 95% CI: 1.13, 1.65) were more likely to use yoga or meditation, while mid age women with hypertension (OR=0.62; 95% CI: 0.52, 0.76) were less likely to use yoga or meditation.

Conclusion: A large percentage of the female populations are using yoga or meditation. Given that women who regularly use yoga or meditation positively associated with measures of mental and physical health, there is a need for further research to examine the experiences and potential benefits of these mind-body practices for women's health.

Van der Zwan JE, de Vente W, Huizink AC, Bögels SM, de Bruin EI, (2015) In contemporary western societies stress is highly prevalent, therefore the need for stress-reducing methods is great. This randomized controlled trial compared the efficacy of self-help physical activity (PA), mindfulness meditation (MM), and heart rate variability biofeedback (HRV-BF) in reducing stress and its related symptoms. We randomly allocated 126 participants to PA, MM, or HRV-BF upon enrollment, of which 76 agreed to participate. The interventions consisted of psycho-education and an introduction to the specific intervention techniques and 5 weeks of daily exercises at home. The PA exercises consisted of a vigorous-intensity activity of free choice. The MM exercises consisted of guided mindfulness meditation. The HRV-BF exercises consisted of slow breathing with a heart rate variability biofeedback device. Participants received daily reminders for their exercises and were contacted weekly to monitor their progress. They completed questionnaires prior to, directly after, and 6 weeks after the intervention. Results indicated an overall beneficial effect consisting of reduced stress, anxiety and depressive symptoms, and improved psychological well-being and sleep quality. No significant between-intervention effect was found, suggesting that PA, MM, and HRV-BF are equally effective in reducing stress and its related symptoms. These self-help interventions provide easily accessible help for people with stress complaints.

Venkatesh S, Raju TR, Shivani Y, Tompkins G, Meti BL, (1997) Twelve senior Kundalini (Chakra) meditators were assessed during meditation session and non-meditation or control session using Phenomenology of Consciousness Inventory. The data has been analyzed using
structural analysis to measure the altered state of consciousness and the identity state by comparing meditative state with non-meditative state. The structural analysis of pattern of consciousness during the meditative state revealed altered experience in perception (percentile rank PR = 90), meaning (PR = 82) and time sense (PR = 87), while positive affect dimension showed increased joy (PR = 73) and love (PR = 67). The imagery vividness (PR = 72), self-awareness (PR = 77), rationality (PR = 73) and arousal (PR = 69) were found to be structurally different from the ordinary state. With regards to identity state meditative experience was found to produce statistically significant changes in terms of intensity in meaning (P < 0.05), time sense (P < 0.05), joy (P < 0.05), love (P < 0.05) and state of awareness (P < 0.01). Our results indicate that long term practice of meditation appears to produce structural as well as intensity changes in phenomenological experiences of consciousness.

Wang DJ, Rao H, Korczykowski M, Wintering N, Pluta J, Khalsa DS, Newberg AB, (2011) Our goal in this study was to advance the understanding of the neural pathways of meditation by addressing the cerebral blood flow (CBF) responses associated with two different meditation practices performed by the same individuals and how such changes related to the "stress" circuits in the brain. Ten experienced meditators performed two types of meditation, a "focused-based" practice and a "breath-based" practice. Subjects were scanned using perfusion functional magnetic resonance imaging (fMRI) during a baseline state, both meditation states, and a post meditation baseline state. Using general linear model, we found that the frontal regions, anterior cingulate, limbic system and parietal lobes were affected during meditation and that there were different patterns of CBF between the two meditation states. We observed strong correlations between depth of meditation and neural activity in the left inferior forebrain areas including the insula, inferior frontal cortex, and temporal pole. There were persistent changes in the left anterior insula and the pre-central gyrus even after meditation was stopped. This study revealed changes in the brain during two different meditation practices in the same individuals and that these changes correlated with the subjective experiences of the practitioners.

Woodyard C, (2011) The objective of this study was to assess the findings of selected articles regarding the therapeutic effects of yoga and to provide a comprehensive review of the benefits of regular yoga practice. As participation rates in mind-body fitness programs such as yoga continue to increase, it is important for health care professionals to be informed
about the nature of yoga and the evidence of its many therapeutic effects. Thus, this manuscript provides information regarding the therapeutic effects of yoga as it has been studied in various populations concerning a multitude of different ailments and conditions. Therapeutic yoga is defined as the application of yoga postures and practice to the treatment of health conditions and involves instruction in yogic practices and teachings to prevent reduce or alleviate structural, physiological, emotional and spiritual pain, suffering or limitations. Results from this study show that yogic practices enhance muscular strength and body flexibility, promote and improve respiratory and cardiovascular function, promote recovery from and treatment of addiction, reduce stress, anxiety, depression, and chronic pain, improve sleep patterns, and enhance overall well-being and quality of life.

Yu X, Fumoto M, Nakatani Y, Sekiyama T, Kikuchi H, Seki Y, Sato-Suzuki I, Arita H, (2011) To gain insight into the neuro-physiological mechanisms involved in Zen meditation, we evaluated the effects of focused attention (FA) on breathing movements in the lower abdomen (Tanden) in novices. We investigated hemodynamic changes in the prefrontal cortex (PFC), an attention-related brain region, using 24-channel near-infrared spectroscopy during a 20-minute session of FA on Tanden breathing in 15 healthy volunteers. We found that the level of oxygenated hemoglobin in the anterior PFC was significantly increased during FA on Tanden breathing, accompanied by a reduction in feelings of negative mood compared to before the meditation session. Electroencephalography (EEG) revealed increased alpha band activity and decreased theta band activity during and after FA on Tanden breathing. EEG changes were correlated with a significant increase in whole blood serotonin (5-HT) levels. These results suggest that activation of the anterior PFC and 5-HT system may be responsible for the improvement of negative mood and EEG signal changes observed during FA on Tanden breathing.