

## **CHAPTER II**

### **REVIEW OF RELATED LITERATURE**

Familiarity with the literature related to any problem helps the scholar to discover what is already known, what others have attempted to find out, what methods of approach have been promising or disappointing and what problems remain unsolved. The review would enable the investigator to have a deep insight, clear perspective and a better understanding of the chosen problem and various factors connected with her study. The related literature were presented in the following heads:

1. Effects of Yogic Practices on Physiological Variables
2. Effects of Yogic Practices on Psychological Variables
3. Effects of Yogic Diet

#### **2.1 EFFECTS OF YOGIC PRACTICES ON PHYSIOLOGICAL VARIABLES**

Manchanda SC and Madan K. (2014) documented that 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.

Hunter SD et al. (2013) reported that Bikram yoga is an exotic form of physical activity combining hatha yoga and thermal therapy that could positively impact metabolic health. Although this increasingly popular alternative exercise may be ideal for obese adults due to its low impact nature, few studies have elucidated the health benefits associated with it. As an initial step, we determined the effect of Bikram yoga on glucose tolerance. Fourteen young lean and 15 older obese subjects completed an 8-week Bikram yoga intervention in which classes were completed 3 times per week. Glucose tolerance was assessed using a 75 g oral glucose tolerance test. The area under the glucose curve following the oral glucose tolerance test was significantly reduced as a result of the Bikram Yoga intervention in older obese ( $P < 0.05$ ) but not in young lean subjects. We concluded that a

short-term Bikram yoga intervention improved glucose tolerance in older obese, but not in young lean adults.

Kim TS, Part JS and Kim MA. (2008) studied the relation of meditation to power and well-being. 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 chakrameditation 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.

Mascaro JS, et al. (2012) studied the Compassion meditation enhances empathic accuracy and related neural activity. This study employed a randomized, controlled and longitudinal design to investigate the effect of a secularized analytical compassion meditation program, cognitive-based compassion training (CBCT), on empathic accuracy. Twenty-one healthy participants received functional MRI scans while completing an empathic accuracy task, the Reading the Mind in the Eyes Test (RMET), both prior to and after completion of either CBCT or a health discussion control group. Upon completion of the study interventions, participants randomized to CBCT and were significantly more likely than control subjects to have increased scores on

the RMET and increased neural activity in the inferior frontal gyrus (IFG) and dorsomedial prefrontal cortex (dmPFC). Moreover, changes in dmPFC and IFG activity from baseline to the post-intervention assessment were associated with changes in empathic accuracy. These findings suggest that CBCT may hold promise as a behavioral intervention for enhancing empathic accuracy and the neurobiology supporting it.

Ross A, et al. (2012) studied the frequency of yoga practice predicts health: results of a national survey of yoga practitioners. Yoga shows promise as a therapeutic intervention, but relationships between yoga practice and health are underexplored. Cross-sectional, anonymous internet surveys distributed to 4307 randomly selected from 18,160 individuals at 15 US Iyengar yoga studios; 1045 (24.3%) surveys completed. Mean age 51.7 ( $\pm$  11.7) years; 84.2% female. Frequency of home practice favorably predicted ( $P < .001$ ): mindfulness, subjective well-being, BMI, fruit and vegetable consumption, vegetarian status, sleep, and fatigue. Each component of yoga practice (different categories of physical poses, breath work, meditation, philosophy study) predicted at least 1 health outcome ( $P < .05$ ). Home practice of yoga predicted health better than years of practice or class frequency. Different physical poses and yoga techniques may have unique health benefits.

Balaji PA, Varne SR, Ali SS (2012) Studied the Physiological effects of yogic practices and transcendental meditation in health and disease. Yoga is an ancient Indian way of life, which includes changes in mental attitude, diet,

and the practice of specific techniques such as yoga asanas (postures), breathing practices (pranayamas), and meditation to attain the highest level of consciousness. Medline search was done to review relevant articles in English literature on evaluation of physiological effects of yogic practices and TM. Data were constructed; issues were reviewed and found that there were considerable health benefits, including improved cognition, respiration, reduced cardiovascular risk, body mass index, blood pressure, and diabetes. Yoga also influenced immunity and ameliorated joint disorders.

Fox KC, et al. (2012) Meditation experience predicts introspective accuracy. The accuracy of subjective reports, especially those involving introspection of one's own internal processes, remains unclear, and research has demonstrated large individual differences in introspective accuracy. It has been hypothesized that introspective accuracy may be heightened in persons who engage in meditation practices, due to the highly introspective nature of such practices. They undertook a preliminary exploration of this hypothesis, examining introspective accuracy in a cross-section of meditation practitioners (1-15,000 hrs experience). Introspective accuracy was assessed by comparing subjective reports of tactile sensitivity for each of 20 body regions during a 'body-scanning' meditation with averaged, objective measures of tactile sensitivity (mean size of body representation area in primary somatosensory cortex; two-point discrimination threshold) as reported in prior research. Expert meditators showed significantly better introspective accuracy than novices;

overall meditation experience also significantly predicted individual introspective accuracy. These results suggest that long-term meditators provide more accurate introspective reports than novices.

Dolgoff- Kaspar R et al. (2012) studied the effect of laughter yoga on mood and heart rate variability in patients awaiting organ transplantation. Research shows that laughter has myriad health benefits, yet the medical community has not implemented it formally as a treatment. Patients awaiting organ transplantation have significant physical disabilities and are at risk for psychological distress. Attenuated heart rate variability (HRV) is a risk factor for a negative long-term outcome in some patients. The study intended to evaluate the clinical utility of laughter yoga in improving psychological and physiological measures in outpatients awaiting organ transplantation. Positive results would indicate promising areas to pursue in a follow-up study. Six participants met for 10 sessions over 4 weeks. The research team measured each participant's heart rate, HRV, blood pressure (BP), and immediate mood before and after the laughter and control interventions. The team assessed participants' longer-term mood (anxiety and depression) at the study's initiation, after a no-treatment control week, and at the end of the study. The study occurred at the Department of Surgery and Medicine at the University of Arizona Health Sciences Center, Tucson. Participants were patients awaiting transplants (three heart and three lung), two women and four men (ages 51-69 y). Participants had received no major surgery in the 3 months prior to the intervention, did not have

a hernia or uncontrolled hypertension, and did not fall into the New York Heart Association function class. The 20-minute laughter intervention involved breathing and stretching exercises, simulated laughter (ie, unconditional laughter that is not contingent on the environment), chanting, clapping, and a meditation. The 20-minute control intervention involved the study's personnel discussing health and study-related topics with the participants. The research team measured BP, heart rate, and HRV and administered the Profile of Mood States, Beck Anxiety Inventory, and Beck Depression Inventory-II to evaluate immediate and longer-term mood. The team had planned quantitative statistical analysis of the data at the study's initiation but did not complete it because the number of enrolled participants was too low for the analysis to be meaningful. The team visually examined the data, however, for trends that would indicate areas to examine further in a follow-up study. Participants showed improved immediate mood (vigor-activity and friendliness) and increased HRV after the laughter intervention. Both the laughter and control interventions appeared to improve longer-term anxiety. Two participants awaiting a lung transplant dropped out of the study, and no adverse events occurred. This pilot study suggests that laughter yoga may improve HRV and some aspects of mood, and this topic warrants further research.

Tang YY, et al. (2012) studied Mechanisms of white matter changes induced by meditation. Using diffusion tensor imaging, several recent studies have shown that training results in changes in white matter efficiency as

measured by fractional anisotropy (FA). In their work, they found that a form of mindfulness meditation, integrative body-mind training (IBMT), improved FA in areas surrounding the anterior cingulate cortex after 4-wk training more than controls given relaxation training. Reductions in radial diffusivity (RD) have been interpreted as improved myelin but reductions in axial diffusivity (AD) involve other mechanisms, such as axonal density. We now report that after 4-wk training with IBMT, both RD and AD decrease accompanied by increased FA, indicating improved efficiency of white matter involves increased myelin as well as other axonal changes. However, 2-wk IBMT reduced AD, but not RD or FA, and improved moods. Our results demonstrate the time-course of white matter neuro plasticity in short-term meditation. This dynamic pattern of white matter change involving the anterior cingulate cortex, a part of the brain network related to self-regulation, could provide a means for intervention to improve or prevent mental disorders.

Lohan and Rajesh (2002) studied the effect of asanas and pranayamas on physical and physiological components of boys between age group 12-16 years. One hundred and twenty subjects were equally divided into asana, pranayama, combined and controlled groups. Ten weeks training programme was given to test the abdominal strength, speed, agility, power and endurance by using AAPHER Youth fitness test battery and blood pressure, heart rate, vital capacity and pulse rate. Pre test and post test scores were analysed by using ANACOVA. It was concluded that physical and physiological fitness was



improved by the training of selected yogic exercise. The combined group of asanas and prayanama showed significant improvement in the physical and physiological fitness parameters.

Mandanmohan, et al. (2003) conducted a study on effect of yoga training on handgrip, respiratory pressures and pulmonary function, i.e. maximum expiratory pressure (MEP), maximum inspiratory pressure (MIP), forced expiratory volume (FEV), forced expiratory volume in first second (FEV1) and peak expiratory flow rate (PEFR). 20 school children in the age group of 12 to 15 years were given yoga training (asanas and pranayamas) for 6 months. 20 age and gender-matched students formed the control group. Yoga training produced statistically significant ( $P < 0.05$ ) increase in HGS and HGE. MEP, MIP, FEV, FEV1 and PEFR also increased significantly ( $P < 0.001$ ) after the yoga training. In contrast, the increase in these parameters in the control group was statistically insignificant. Our study shows that yoga training for 6 months improves lung function, strength of inspiratory and expiratory muscles as well as skeletal muscle strength and endurance. It is suggested that yoga be introduced at school level in order to improve physiological functions, overall health and performance of students.

Madan Mohan, et al.(2000) studied the effects of yoga training on cardiovascular response to exercise and the time course of recovery after the exercise. Cardiovascular response to exercise was determined by Harvard step test using a platform of 45 cm height. The subjects were asked to step up and

down the platform at a rate of 30/min for a total duration of 5 min or until fatigue, whichever was earlier. Heart rate (HR) and blood pressure response to exercise were measured in supine position before exercise and at 1, 2, 3, 4, 5, 7 and 10 minutes after the exercise. Rate-pressure product [ $RPP = (HR \times SP)/100$ ] and double product ( $DoP = HR \times MP$ ), which are indices of work done by the heart were also calculated. Exercise produced a significant increase in HR, systolic pressure, RPP & DoP and a significant decrease in diastolic pressure. After two months of yoga training, exercise induced changes in these parameters were significantly reduced. It is concluded that after yoga training a given level of exercise leads to a milder cardiovascular response, suggesting better exercise tolerance..

Ray, et al. (2001) undertook a study to observe any beneficial effect of yogic practices during training period on the young trainees. 54 trainees of 20-25 years age group were divided randomly in two groups i.e. yoga and control group. Yoga group (23 males and 5 females) was administered yogic practices for the first five months of the course while control group (21 males and 5 females) did not perform yogic exercises during this period. From the 6th to 10th month of training both the groups performed the yogic practices. Physiological parameters like heart rate, blood pressure, oral temperature, skin temperature in resting condition, responses to maximal and submaximal exercise, body flexibility were recorded. Psychological parameters like personality, learning, arithmetic and psychomotor ability, mental well being

were also recorded. Various parameters were taken before and during the 5th and 10th month of training period. Initially there was relatively higher sympathetic activity in both the groups due to the new work/training environment but gradually it subsided. Later on at the 5th and 10th month, yoga group had relatively lower sympathetic activity than the control group. There was improvement in performance at submaximal level of exercise and in anaerobic threshold in the yoga group. Shoulder, hip, trunk and neck flexibility improved in the yoga group. There was improvement in various psychological parameters like reduction in anxiety and depression and a better mental function after yogic practices.

Madanmohan et al (2005) undertook a comparative study of the effect of short term (three weeks) training in savitri (slow breathing) and bhastrika (fast breathing) pranayams on respiratory pressures and endurance, reaction time, blood pressure, heart rate, rate-pressure product and double product. Thirty student volunteers were divided into two groups of fifteen each. Group I was given training in savitri pranayam that involves slow, rhythmic, and deep breathing. Group II was given training in bhastrika pranayam, which is bellows-type rapid and deep breathing. Parameters were measured before and after three week training period. Savitri pranayam produced a significant increase in respiratory pressures and respiratory endurance. In both the groups, there was an appreciable but statistically insignificant shortening of reaction time. Heart rate, rate-pressure product and double product decreased in savitri pranayam

group but increased significantly in bhastrika group. It is concluded that different types of pranayams produce different physiological responses in normal young volunteers.

Mohan, M. et al.(2004) studied the effect of inspiratory and expiratory phases of normal quiet breathing, deep breathing and savitri pranayam type breathing on heart rate and mean ventricular QRS axis was investigated in young, healthy untrained subjects. Pranayam type breathing produced significant cardioacceleration and increase in QRS axis during the inspiratory phase as compared to eupnea. On the other hand, expiratory effort during pranayam type breathing did not produce any significant change in heart rate or QRS axis. The changes in heart rate and QRS axis during the inspiratory and expiratory phases of pranayam type breathing were similar to the changes observed during the corresponding phases of deep breathing.

Chaya et al (2006) , investigated the net change in the basal metabolic rate (BMR) of individuals actively engaging in a combination of yoga practices (asana or yogic postures, meditation and pranayama or breathing exercises) for a minimum period of six months, at a residential yoga education and research center at Bangalore. The measured BMR of individuals practicing yoga through a combination of practices was compared with that of control subjects who did not practice yoga but led similar lifestyles. This study shows that there is a significantly reduced BMR, probably linked to reduced arousal, with the long

term practice of yoga using a combination of stimulatory and inhibitory yogic practices.

Satyanaranaya, (1992) .Santhi Kriya is a mixture of combined yogic practices of breathing and relaxation. Preliminary attempts were made to determine the effect of Santhi Kriya on certain psychophysiological parameters. Eight healthy male volunteers of the age group  $25.9 \pm 3$  (SD) years were subjected to Santhi Kriya practice daily for 50 minutes for 30 days. The volunteer's body weight, blood pressure, oral temperature, pulse rate, respiration, ECG and EEG were recorded before and after the practice on the 1st day and subsequently on 10th, 20th and 30th day of their practice. They were also given a perceptual acuity test to know their cognitive level on the 1st day and also at the end of the study i.e., on the 30th day. Results indicate a gradual and significant decrease in the body weight from 1st to 30th day (P less than 0.001) and an increase in alpha activity of the brain (P less than 0.001) during the course of 30 days of Santhi Kriya practice. Increase of alpha activity both in occipital and pre-frontal areas of both the hemispheres of the brain denotes an increase of calmness. This study also revealed that Santhi Kriya practice increases oral temperature by 3 degrees F and decreases respiratory rate significantly (P less than 0.05) on all practice days. Other parameters were not found to be altered significantly. It is concluded that the Santhi Kriya practice for 30 days reduces body weight and increases calmness.

Murugesan, Govindarajulu and Bera (2000) selected thirty three (N = 33) hypertensives, aged 35-65 years, from Govt. General Hospital, Pondicherry, were examined with four variables viz, systolic and diastolic blood pressure, pulse rate and body weight. The subjects were randomly assigned into three groups. The exp. group-I underwent selected yoga practices, exp. group-II received medical treatment by the physician of the said hospital and the control group did not participate in any of the treatment stimuli. Yoga imparted in the morning and in the evening with 1 hr/session. day-1 for a total period of 11-weeks. Medical treatment comprised drug intake every day for the whole experimental period. The result of pre-post test with ANCOVA revealed that both the treatment stimuli (i.e., yoga and drug) were effective in controlling the variables of hypertension.

Bharshankar, et al. (2003) examined the effect of yoga on cardiovascular function in subjects above 40 yrs of age. Pulse rate, systolic and diastolic blood pressure and Valsalva ratio were studied in 50 control subjects (not doing any type of physical exercise) and 50 study subjects who had been practicing yoga for 5 years. From the study it was observed that significant reduction in the pulse rate occurs in subjects practicing yoga ( $P < 0.001$ ). The difference in the mean values of systolic and diastolic blood pressure between study group and control group was also statistically significant ( $P < 0.01$  and  $P < 0.001$  respectively). The systolic and diastolic blood pressure showed significant positive correlation with age in the study group ( $r_1$  systolic = 0.631

and  $r_1$  diastolic = 0.610) as well as in the control group ( $r_2$  systolic = 0.981 and  $r_2$  diastolic = 0.864). The significance of difference between correlation coefficient of both the groups was also tested with the use of Z transformation and the difference was significant (Z systolic= 4.041 and Z diastolic= 2.901). Valsalva ratio was also found to be significantly higher in yoga practitioners than in controls ( $P < 0.001$ ). Our results indicate that yoga reduces the age related deterioration in cardiovascular functions.

Raghuraj et al. (1998), studied on the heart rate variability (HRV) is an indicator of the cardiac autonomic control. Two spectral components are usually recorded, viz. high frequency (0.15-0.50 Hz), which is due to vagal efferent activity and a low frequency component (0.05-0.15 Hz), due to sympathetic activity. The present study was conducted to study the HRV in two yoga practices which have been previously reported to have opposite effects, viz, sympathetic stimulation (kapalabhati, breathing at high frequency, i.e., 2.0 Hz) and reduced sympathetic activity (nadisuddhi, alternate nostril breathing). Twelve male volunteers (age range, 21 to 33 years) were assessed before and after each practice on separate days. The electrocardiogram (lead I) was digitized on-line and off-line analysis was done. The results showed a significant increase in low frequency (LF) power and LF/HF ratio while high frequency (HF) power was significantly lower following kapalabhati. There were no significant changes following nadisuddhi. The results suggest that kapalabhati modifies the autonomic status by increasing sympathetic activity

with reduced vagal activity. The study also suggests that HRV is a more useful psychophysiological measure than heart rate alone.

Tran, Holly, Iashbrook, Amsterdam (2001) , had conducted a study on the effect of hatha yoga practice elicited improvement on the health – related aspects of physical fitness. Ten healthy, untrained volunteers (nine female and one male), ranging in age from 18-27 years, were tested on muscular strength and endurance, flexibility, cardiorespiratory fitness, body composition and pulmonary functions. Training was given two days in a week for a period of eight weeks. It was found out that regular hatha yoga can elicit improvement in the health – related aspects of physical fitness.

The effect of yoga training on reaction time, respiratory endurance and muscular strength was investigated by Madanmohan et al.(1993) . Twenty seven subjects were given yoga training for 12 weeks to test the visual and auditory reaction time, maximum expiratory pressure, maximum inspiratory pressure, 40 mm kg test, breath holding time after expiration, breath holding time after inspiration, and hand grip strength. It was concluded that yoga practice for 12 weeks results in significant reduction in visual and auditory reaction times and significant increase in respiratory pressures, breath holding time and hand grip strength.



## **2.2 EFFECTS OF YOGASANAS ON PSYCHOLOGICAL VARIABLES**

Dhananjai S et al. (2013) documented that Yoga practice has been effectively prescribed in conjunction with other medical and yogic procedures in the management of severe psychosomatic diseases, including cancer, bronchial asthma, colitis, peptic and ulcer. It improves strength and flexibility, and may help control physiological variables such as blood pressure, lipids, respiration, heart rate, and metabolic rate to improve overall exercise capacity. The aim of this study is to evaluate the effects of Yogic Practice on anxiety/depression associated with obesity Patients were recruited from the Department of Physiology, C.S.M. Medical University (erstwhile KGMU), Lucknow, Uttar Pradesh, India. A total of 272 subjects were divided into two groups: 1) group of 205 subjects (with yogic practice) and 2) a control group of 67 subjects (with aerobic exercise). Assessment of anxiety and depression were done by Hamilton Rating Scale. This study supports yoga as an effective tool with no diet restriction to improve anxiety and depression symptoms as well as obesity in obese subjects. Incorporating yogic asana in the treatment protocol of patients suffering from anxiety and depression may prove beneficial in the long run.

Braun TD et al. (2012) reported that The increasing prevalence of overweight and obesity in humans is a growing public health concern in the United States. Concomitants include poor health behaviors and reduced psychological well-being. Preliminary evidence suggests yoga and treatment

paradigms incorporating mindfulness, self-compassion (SC), acceptance, non-dieting, and intuitive eating may improve these ancillary correlates, which may promote long-term weight loss. Methods: We explored the impact of a 5-day residential weight loss program, which was multifaceted and based on Kripalu yoga, on health behaviors, weight loss, and psychological well-being in overweight/obese individuals. Thirty-seven overweight/obese program participants (age 32-65, BMI<25) completed validated mind-fulness, SC, lifestyle behavior, and mood questionnaires at baseline, post-program, and 3-month follow-up and reported their weight 1 year after program completion. Results: Significant improvements in nutrition behaviors, SC, mindfulness, stress management, and spiritual growth were observed immediately post-program (n = 31, 84% retention), with medium to large effect sizes. At 3-month follow-up (n = 18, 49% retention), most changes persisted. Physical activity and mood disturbance had improved significantly post-program but failed to reach significance at 3-month follow-up. Self-report weight loss at 1 year (n = 19, 51% retention) was significant. Conclusion: These findings suggest a Kripalu yoga-based, residential weight loss program may foster psychological well-being, improved nutrition behaviors, and weight loss. Given the exploratory nature of this investigation, more rigorous work in this area is warranted.

Iliceto P et al. (2012) explored gender-related differences concerning anger expression and interpersonal relationships in a sample of

overweight/obese subjects. The convenience sample consisted of 40 overweight/obese subjects (18 women, 22 men) who were administered self-report questionnaires to assess eating disorders (EDI-2), anger levels (STAXI) and self/other perception as a measure of interpersonal relationships (9AP). Women had higher scores on the EDI-2 subscales of Bulimia (7.22 vs. 2.20:  $z=7.61$ ;  $p<.001$ ), Body Dissatisfaction (15.56 vs. 12.14:  $z=1.88$ ;  $p=.03$ ), Interoceptive Awareness (9.89 vs. 5.28:  $z=4.06$ ;  $p<.001$ ), Ineffectiveness (11.00 vs 5.22:  $z=4.91$ ;  $p <.001$ ) and Perfectionism (6.33 vs. 3.26:  $z=4.13$ ;  $p<.001$ ) compared to norms. The overweight/obese men departed from the norms on fewer subscales. Both women and men tended to turn feelings of anger inward toward themselves, suppressing their anger. Also, women obtained lower scores for Self Empathy (29.06 vs. 40.15:  $z = - 2.30$ ;  $p = .01$ ) and Other Empathy (16.44 vs. 27.10:  $z = - 2.00$ ;  $p= .02$ ) whereas overweight/ obese men obtained lower scores for Other Empathy (20.77 vs. 28.47:  $z=-2.00$ ;  $p=.02$ ). Overweight/obese subjects have a tendency to turn feelings of anger inward on to themselves together with impaired interpersonal relationships, especially in women. An adequate clinical assessment in all obese individuals trying to identify the contribution of psychological factors to the perceived distress is critical.

Bryan S, Pinto Zipp G, Parasher R. (2012) studied the effect of yoga on psychological variables and exercise adherence a randomized, controlled pilot study. Physical inactivity is a serious issue for the American public. Because of conditions that result from inactivity, individuals incur close to \$1 trillion

USD in health-care costs, and approximately 250 000 premature deaths occur per year. Researchers have linked engaging in yoga to improved overall fitness, including improved muscular strength, muscular endurance, flexibility, and balance. Researchers have not yet investigated the impact of yoga on exercise adherence.

**Objective** The research team assessed the effects of 10 weeks of yoga classes held twice a week on exercise adherence in previously sedentary adults.

**Design** The research team designed a randomized controlled pilot trial. The team collected data from the intervention (yoga) and control groups at baseline, midpoint, and posttest (posttest 1) and also collected data pertaining to exercise adherence for the yoga group at 5 weeks posttest (posttest 2).

**Setting** The pilot took place in a yoga studio in central New Jersey in the United States. The pretesting occurred at the yoga studio for all participants. Midpoint testing and post testing occurred at the studio for the yoga group and by mail for the control group. Participants were 27 adults (mean age 51 y) who had been physically inactive for a period of at least 6 months prior to the study.

**Interventions** The intervention group (yoga group) received hour-long hatha yoga classes that met twice a week for 10 weeks. The control group did not participate in classes during the research study; however, they were offered complimentary post research classes.

**Outcome Measures** The study's primary outcome measure was exercise adherence as measured by the 7-day Physical Activity Recall. The secondary measures included (1) exercise self-efficacy as measured by the Multidimensional Self-Efficacy for Exercise Scale, (2) general well-being as measured by the General Well-Being Schedule, (3) exercise-

group cohesion as measured by the Group Environment Questionnaire (GEQ), (4) acute feeling response as measured by the Exercise-induced Feeling Inventory (EFI), and (5) two open-ended questions coded for emerging themes and subcategories. Results The analysis revealed that the yoga group's mean hours of physical activity at 10 weeks reflected a significant increase in exercise adherence from baseline ( $P < .012$ ) and a significant difference from the control group ( $P < .004$ ). At 5 weeks post-intervention, no significant change had occurred in the yoga group's exercise adherence ( $P = .906$ ). Exercise self-efficacy changed significantly from baseline to midpoint ( $P < .029$ ). The general wellbeing data demonstrated a significant interaction effect ( $P < .001$ ), resulting from an increase in general well-being in the intervention group and a decrease in general well-being in the control group. In addition, the yoga group's cohesion score was consistent with the norms on two constructs of the GEQ: Attraction to Group Task and Group Integration Task. The EFI revealed that the yoga participants "felt strongly" that their experiences in yoga were peaceful, happy, upbeat, and enthusiastic and that they felt revived following the yoga classes. Qualitative analysis of data revealed self-reported improvements in exercise behaviors, stress management, and eating habits. Conclusions Ten weeks of yoga classes twice a week significantly increased previously inactive participants' adherence to physical activity. Additionally, the findings suggest that a mind-body exercise program may be an effective intervention in the fight against physical inactivity.

Ray US, et al. (2012) studied the effect of yogic exercise on physical and mental health of young fellowship course trainees. A study was undertaken to observe any beneficial effect of yogic practices during training period on the young trainees. 54 trainees of 20-25 years age group were divided randomly in two groups i.e. yoga and control group. Yoga group (23 males and 5 females) was administered yogic practices for the first five months of the course while control group (21 males and 5 females) did not perform yogic exercises during this period. From the 6th to 10th month of training both the groups performed the yogic practices. Physiological parameters like heart rate, blood pressure, oral temperature, skin temperature in resting condition, responses to maximal and submaximal exercise, body flexibility were recorded. Psychological parameters like personality, learning, arithmetic and psychomotor ability, mental well being were also recorded. Various parameters were taken before and during the 5th and 10th month of training period. Initially there was relatively higher sympathetic activity in both the groups due to the new work/training environment but gradually it subsided. Later on at the 5th and 10th month, yoga group had relatively lower sympathetic activity than the control group. There was improvement in performance at submaximal level of exercise and in anaerobic threshold in the yoga group. Shoulder, hip, trunk and neck flexibility improved in the yoga group. There was improvement in various psychological parameters like reduction in anxiety and depression and a better mental function after yogic practices.

Vandana B., et al. (2011) conducted a study on Meditation induces a positive response during stress events in young Indian adults . Relaxation techniques like meditation have been found to be beneficial in reducing stress. The aim of the study was to find out the effect of the Integrated Amrita Meditation (IAM) technique on the response to life changes. The IAM technique, progressive muscle relaxation (PMR) technique, and the Life Changes Questionnaire (LCQ) were used. LCQ was culturally adapted to the Indian population. One hundred and fifty subjects were randomized into IAM, PMR, and Control groups. LCQ scores were documented in all groups at 0 h, 48 h, 2 months, and 8 months after the training. Within groups, comparison was done by the paired t-test and between groups by ANCOVA. The new LCQ was analyzed using split-half reliability and was found to be having a correlation coefficient 0.96. On within group analysis, the IAM group showed a significant decrease in LCQ scores ( $P = 0.004$ ) in the second visit which was maintained in the third ( $P = 0.003$ ) and fourth visits ( $P = 0.001$ ). Within the PMR group, there was a significant decrease ( $P = 0.006$ ) in the third visit and fourth visits ( $P = 0.001$ ). No significant change was seen within the control group in any of the visits. The decrease in LCQ scores in the IAM group was significant at the end of 8 months when compared to the Control group ( $P < 0.05$ ) whereas the decrease in the PMR group was not significant in comparison with the control group. The IAM technique is an efficient tool in reducing stress as measured by LCQ.

Shim CS and Lee YS. (2012) conducted a study to find the effect of Yoga-focused prenatal program on stress, anxiety, self confidence and labour pain in pregnant women within vitro fertilization treatment. The purpose of this study was to identify the effects of a Yoga-focused prenatal program on the stress, anxiety, self confidence and labor pain of pregnant women who had in vitro fertilization (IVF) treatment. A quasi experimental study with a non-equivalent control group pretest-posttest design was used. The data collection period and meditation program were between January 9 and August 31, 2009. Forty-six women who were pregnant following IVF, and were between 12-20 weeks gestation, participated in the study (23 experimental group, 23 control group). Data were analyzed using Chi-square test, Mann-Whitney U Test, ANCOVA, and Cronbach's alpha coefficients with the SPSS 12.0 for Windows Program. Although the sample size was limited, women who participated in the program showed statistically significant improvements in stress, anxiety, labor pain, and labor confidence for women pregnant after IVF. The result indicate that this 12-week Yoga-focused educational program can be utilized for women pregnant following IVF to reduce their stress, anxiety, and labor pain, and to increase delivery confidence. It is suggested that the Yoga-focused educational program be offered to every pregnant woman.

Yadav RK, et al. (2012) studied the Efficacy of a short-term yoga-based lifestyle intervention in reducing stress and inflammation: preliminary results. The study was to assess the efficacy of this intervention in reducing



stress and inflammation in patients with chronic inflammatory diseases. Design: This study reports preliminary results from a nonrandomized prospective ongoing study with pre-post design. Setting/location: The study was conducted at the Integral Health Clinic, an outpatient facility conducting these yoga-based lifestyle intervention programs for prevention and management of chronic diseases. Subjects: Patients with chronic inflammatory diseases and overweight/obese subjects were included while physically challenged, and those on other interventions were excluded from the study. Intervention: A pretested intervention program included asanas (postures), pranayama (breathing exercises), stress management, group discussions, lectures, and individualized advice. Outcome measures: There was a reduction in stress (plasma cortisol and  $\beta$ -endorphin) and inflammation (interleukin [IL]-6 and tumor necrosis factor [TNF]- $\alpha$ ) at day 0 versus day 10. Results: Eighty-six (86) patients (44 female, 42 male,  $40.07 \pm 13.91$  years) attended this program. Overall, the mean level of cortisol decreased from baseline to day 10 ( $149.95 \pm 46.07$ ,  $129.07 \pm 33.30$  ng/mL;  $p=0.001$ ) while  $\beta$ -endorphins increased from baseline to day 10 ( $3.53 \pm 0.88$ ,  $4.06 \pm 0.79$  ng/mL;  $p=0.024$ ). Also, there was reduction from baseline to day 10 in mean levels of IL-6 ( $2.16 \pm 0.42$ ,  $1.94 \pm 0.10$  pg/mL,  $p=0.036$ ) and TNF- $\alpha$  ( $2.85 \pm 0.59$ ,  $1.95 \pm 0.32$  pg/mL,  $p=0.002$ ). Conclusions: This brief yoga-based lifestyle intervention reduced the markers of stress and inflammation as early as 10 days in patients with chronic diseases; however, complete results of this study will confirm whether this program has utility as complementary and alternative therapy.

Li AW and Goldsmith CA.(2012) studied the effect of yoga on Stress and anxiety. The study have been implicated as contributors to many chronic diseases and to decreased quality of life, even with pharmacologic treatment. Efforts are underway to find non-pharmacologic therapies to relieve stress and anxiety, and yoga is one option for which results are promising. The focus of this review is on the results of human trials assessing the role of yoga in improving the signs and symptoms of stress and anxiety. Of 35 trials addressing the effects of yoga on anxiety and stress, 25 noted a significant decrease in stress and/or anxiety symptoms when a yoga regimen was implemented; however, many of the studies were also hindered by limitations, such as small study populations, lack of randomization, and lack of a control group. Fourteen of the 35 studies reported biochemical and physiological markers of stress and anxiety, but yielded inconsistent support of yoga for relief of stress and anxiety. Evaluation of the current primary literature is suggestive of benefits of yoga in relieving stress and anxiety, but further investigation into this relationship using large, well-defined populations, adequate controls, randomization and long duration should be explored before recommending yoga as a treatment option.

Blom K. et al. (2012) studied the hypertension analysis of stress reduction using Mindfulness Meditation and Yoga (the Harmony Study) . Hypertension (HTN) is a leading risk factor for preventable cardiovascular disease, with over one in five adults affected worldwide. Lifestyle modification is a key strategy for the prevention and treatment of HTN. Stress has been associated with greater cardiovascular risk, and stress management is a

recommended intervention for hypertensives. Stress reduction through relaxation therapies has been shown to have an effect on human physiology, including lowering blood pressure (BP). However, individualised behavioural interventions are resource intensive, and group stress management approaches have not been validated for reducing HTN. The HARMONY Study is a pilot randomised controlled trial designed to determine if mindfulness-based stress reduction (MBSR), a standardised group therapy, is an effective intervention for lowering BP in stage 1 unmedicated hypertensives. METHODS AND ANALYSIS: Men and women unmedicated for HTN with mean Hg or 24 h ABP daytime ambulatory blood pressure (ABP)  $\geq 135/85$  mm Hg are included in the study. Subjects are randomised to  $\geq 130/80$  mm receive MBSR immediately or after a wait-list control period. The primary outcome measure is mean awake and 24 h ABP. The primary objective of the HARMONY Study is to compare ABP between the treatment and wait-list control arm at the 12-week primary assessment period. Results from this study will determine if MBSR is an effective intervention for lowering BP in early unmedicated hypertensive's. ETHICS AND DISSEMINATION: This research project was approved by the Sunnybrook Research Ethics Board and the University Health Network Research Ethics Board (Toronto, Canada). Planned analyses are in full compliance with the principles of the Declaration of Helsinki. Data collection will be completed by early spring 2012. Primary and secondary analysis will commence immediately after data monitoring is completed; dissemination plans include preparing publications for submission during the summer of 2012.

Streeter CC, et al. (2012) studied the effects of Yoga on the autonomic nervous system, gamma-amino butyric-acid and all stasis in epilepsy, depression and post-traumatic stress disorder. The study proposed to explain the benefits of yoga practices in diverse, frequently co morbid medical conditions based on the concept that yoga practices reduce all static loads in stress response systems such that optimal homeostasis is restored. It is hypothesized that stress induces (1) imbalance of the autonomic nervous system (ANS) with decreased parasympathetic nervous system (PNS) and increased sympathetic nervous system (SNS) activity, (2) underactivity of the gamma amino-butyric acid (GABA) system, the primary inhibitory neurotransmitter system, and (3) increased allostatic load. It is further hypothesized that yoga-based practices (4) correct underactivity of the PNS and GABA systems in part through stimulation of the vagus nerves, the main peripheral pathway of the PNS, and (5) reduce allostatic load. Depression, epilepsy, post traumatic stress disorder (PTSD), and chronic pain exemplify medical conditions that are exacerbated by stress, have low heart rate variability (HRV) and low GABAergic activity, respond to pharmacologic agents that increase activity of the GABA system, and show symptom improvement in response to yoga-based interventions. The observation that treatment resistant cases of epilepsy and depression respond to vagal nerve stimulation corroborates the need to correct PNS underactivity as part of a successful treatment plan in some cases. According to the proposed theory, the decreased PNS and GABAergic activity that underlies stress-related disorders can be corrected by yoga practices

resulting in amelioration of disease symptoms. This has far-reaching implications for the integration of yoga-based practices in the treatment of a broad array of disorders exacerbated by stress.

Shankarapillai R., Nair MA and George R (2012) examined the effect of yoga in stress reduction for dental students performing their first periodontal surgery: The dental students experience a lot of stress, which increase when they perform their first surgical procedure. Yoga as an anxiolytic tool in anxiety reduction has been practiced over centuries in India. To assess the efficacy of yoga in reducing the state trait anxiety of dental students before their first periodontal surgery performance. A randomized controlled study using a two-way split plot design (pre-post-test) was conducted in the department of periodontics, Pacific Dental College, Udaipur, India. One hundred clinical dental students who were ready to perform their first periodontal surgery were selected. Students were randomly assigned to two groups and were given a 60-min session on stress reduction. Group A, yogic intervention group, were instructed to do yoga and their performances were monitored for a period of one week and Group B, control group, were given a lecture on stress reduction without any yoga instructions. The investigator who was unaware of the groups had taken the state trait anxiety score of the students three times a) before assigning them to each group, b) prior to the surgical procedure and c) immediately after the performance of surgery. The statistical results showed a significant reduction in the VAS and state trait anxiety of Group A compared to

Group B (ANOVA;  $P < 0.001$ ). This study concludes that Yogic breathing has a significant effect on the reduction of state trait anxiety level of dental students.

Benavides S and Caballero J. (2009) examined that the Ashtanga yoga for children and adolescents for weight management and psychological well-being. The objective of this pilot study was to determine the effect of yoga on weight in youth at risk for developing type 2 diabetes. Secondly, the impact of participation in yoga on self-concept and psychiatric symptoms was measured. Weight was measured before and after the program. All participants completed self-concept, anxiety, and depression inventories at the initiation and completion of the program. Fourteen predominately Hispanic children, ages 8-15, completed the program. The average weight loss was 2kg. Weight decreased from  $61.2 \pm 20.2$ kg to  $59.2 \pm 19.2$ kg ( $p = 0.01$ ). Four of five children with low self-esteem improved, although two had decreases in self-esteem. Ashtangayoga may be beneficial as a weight loss strategy in a predominately Hispanic population.

Sarris J et al. (2012) stated that complementary medicine, exercise, meditation, diet, and lifestyle modification for anxiety disorders. Use of complementary medicines and therapies (CAM) and modification of lifestyle factors such as physical activity, exercise, and diet are being increasingly considered as potential therapeutic options for anxiety disorders. The objective of this metareview was to examine evidence across a broad range of CAM and lifestyle interventions in the treatment of anxiety disorders. In early 2012 we conducted a literature search of PubMed, Scopus, CINAHL, Web of Science,

PsycInfo, and the Cochrane Library, for key studies, systematic reviews, and metaanalyses in the area. Their paper found that in respect to treatment of generalized anxiety or specific disorders, CAM evidence revealed current support for the herbal medicine Kava. One isolated study shows benefit for naturopathic medicine, whereas acupuncture, yoga, and Tai chi have tentative supportive evidence, which is hampered by overall poor methodology. The breadth of evidence does not support homeopathy for treating anxiety. Strong support exists for lifestyle modifications including adoption of moderate exercise and mindfulness meditation, whereas dietary improvement, avoidance of caffeine, alcohol, and nicotine offer encouraging preliminary data. In conclusion, certain lifestyle modifications and some CAMs may provide a beneficial role in the treatment of anxiety disorders.

Brown and Gerbarg (2005) found Yogic breathing is a unique method for balancing the autonomic nervous system and influencing psychologic and stress-related disorders. Part I of this series presented a neurophysiologic theory of the effects of Sudarshan Kriya Yoga (SKY). Part II will review clinical studies, our own clinical observations, and guidelines for the safe and effective use of yoga breath techniques in a wide range of clinical conditions. Although more clinical studies are needed to document the benefits of programs that combine pranayama (yogic breathing) asanas (yoga postures), and meditation, there is sufficient evidence to consider Sudarshan Kriya Yoga to be a beneficial, low-risk, low-cost adjunct to the treatment of stress, anxiety, post-traumatic

stress disorder (PTSD), depression, stress-related medical illnesses, substance abuse, and rehabilitation of criminal offenders. SKY has been used as a public health intervention to alleviate PTSD in survivors of mass disasters. Yoga techniques enhance well-being, mood, attention, mental focus, and stress tolerance. Proper training by a skilled teacher and a 30-minute practice every day will maximize the benefits. Health care providers play a crucial role in encouraging patients to maintain their yoga practices.

Schell, Alolio and Schonake (1994) conducted a study on physiological and psychological effects of Hatha – Yoga exercise in healthy women. They measured heart rate, blood pressure, the hormones cortisol, prolactin and growth hormone and certain psychological parameters in a yoga practicing group and a control group of young female volunteers prior and after the experimental period. There were no substantial differences between the groups concerning endocrine parameters and blood pressure. The heart rate was significantly different in yoga group having a significant decrease in heart rate during the yoga practice. In the personality inventory the yoga group showed markedly higher scores in life satisfaction and lower scores in excitability, aggressiveness, openness, emotionality and somatic complaints. Significant differences could also be observed concerning coping with stress and mood at the end of the experiment. The yoga group had significant higher scores in high spirits and extravertedness.



Berger, Owen and Man (1993) determined the exercise and mental health literature and then examined the influence of rational difference on the acute mood benefits of swimming on women college students (N=70) from Czechoslovakia and the United States. They completed the POMS before and after class on three occasions. The United States swimming classes met for 50 minutes twice a week throughout a 14 weeks semester Czechoslovakian swimming classes met for 90 minutes once a week throughout a biweek semester in comparison with their respective controls. Czechoslovakian swimmers reported greater mood changes than the United States swimmers. The Czechoslovakian and United States swimmers reported mood improvement on tension, depression, anger, vigor and confusion.

Chan, et al. (2001) made a study to determine the relationship between the psychometric profile and health related fitness of Chinese youths in Hong Kong. They selected 1,615 Chinese school boys as subjects. The physical self description questionnaire suggested by Marsh et al (1994) was used to provide psychometric profiles. Anaerobic fitness estimated from mile run, flexibility scores from sit and reach test, push up scores, curl up scores and percentage of body fat were also collected as health related fitness factors. The results indicated that health related fitness is highly related to psychometric items such as perceived sport competence, perceived activity level, perception of body fat and global physical self concept. These results indicated the promotion of psychometric self perception of youth. The fact that male adolescents have

more positive physical self perception than female signify the need to reevaluate the social values concerning physical fitness and perception that were placed on youth.

Harinath et al.(2004) had conducted the study on Effects of Hatha yoga and Omkar meditation on cardiorespiratory performance, psychologic profile, and melatonin secretion. Thirty healthy men in the age group of 25-35 years volunteered for the study. They were randomly divided in two groups of 15 each. Group 1 subjects served as controls and performed body flexibility exercises for 40 minutes and slow running for 20 minutes during morning hours and played games for 60 minutes during evening hours daily for 3 months. Group 2 subjects practiced selected yogic asanas (postures) for 45 minutes and pranayama for 15 minutes during the morning, whereas during the evening hours these subjects performed preparatory yogic postures for 15 minutes, pranayama for 15 minutes, and meditation for 30 minutes daily, for 3 months. Orthostatic tolerance, heart rate, blood pressure, respiratory rate, dynamic lung function (such as forced vital capacity, forced expiratory volume in 1 second, forced expiratory volume percentage, peak expiratory flow rate, and maximum voluntary ventilation), and psychologic profile were measured before and after 3 months of yogic practices. Serial blood samples were drawn at various time intervals to study effects of these yogic practices and Omkar meditation on melatonin levels. Yogic practices for 3 months resulted in an improvement in cardiorespiratory performance and psychologic profile. The plasma melatonin

also showed an increase after three months of yogic practices. The systolic blood pressure, diastolic blood pressure, mean arterial pressure, and orthostatic tolerance did not show any significant correlation with plasma melatonin. However, the maximum night time melatonin levels in yoga group showed a significant correlation ( $r = 0.71$ ,  $p < 0.05$ ) with well-being score. These observations suggest that yogic practices can be used as psychophysiological stimuli to increase endogenous secretion of melatonin, which, in turn, might be responsible for improved sense of well-being.

The purpose of Virtanen et al. (2003) study was to determine whether psychological factors are associated with heart rate variability (HRV), blood pressure variability (BPV), and baroreflex sensitivity (BRS) among healthy middle-aged men and women. A population-based sample of 71 men and 79 women (35-64 years of age) was studied. Five-minute supine recordings of ECG and beat-to-beat photoplethysmographic finger systolic arterial pressure and diastolic arterial pressure were obtained during paced breathing. Power spectra were computed using a fast Fourier transform for low-frequency (0.04-0.15 Hz) and high-frequency (0.15-0.40 Hz) powers. BRS was calculated by cross-spectral analysis of R-R interval and systolic arterial pressure variabilities. Psychological factors were evaluated by three self-report questionnaires: the Brief Symptom Inventory, the shortened version of the Spielberger State-Trait Anger Expression Inventory, and the Toronto Alexithymia Scale. It was found anxiety and hostility are related to reduced BRS and increased low-frequency

power of BPV. Reduced BRS reflects decreased parasympathetic outflow to the heart and may increase BPV through an increased sympathetic predominance.

Anies (1998) studied the effect of exercise on mood states of sedentary females. 66 female students of All Saints College, Trivandrum participated in this study. Mood states was first induced by POMS questionnaire and responses were collected prior to the training programme and the same questionnaire was administered after the exercise programme of a total of 12 sessions extending over a period of 4 weeks having 3 sessions per week with a duration of 45 minutes. Mood states was measured using POMS questionnaire before and after exercise. Results showed significant difference between pre test and post test where the sedentary female have positive influence upon their mood states due to the exercise programme given.

Teller (1993) in his study stated that yoga therapy is the only way to perfect health. It strengthens and activates the natural resistance of the body and mind. In a group of forty physical education teachers the completion of three months of yoga training produced significant improvement in general health and also evidence of decreased autonomic arousal and more of psycho-physiological relaxation (heart rate and respiratory rate reaction) and improved somatic steadiness (decreased errors in the steadiness test).

### 2.3 STUDIES ON YOGA DIET

Rioux J et al. (2014) developed and tested the feasibility of a whole-systems lifestyle intervention for obesity treatment based on the practices of Ayurvedic medicine/ Yoga therapy. A comprehensive diet, activity, and lifestyle modification program based on principles of Ayurvedic medicine/yoga therapy with significant self-monitoring of lifestyle behaviors. The 3-month program was designed to change eating and activity patterns and to improve self-efficacy, quality of life, well-being, vitality, and self-awareness around food choices, stress management, and barriers to weight loss. Changes in body weight, body mass index; body fat percentage, fat/lean mass, waist/hip circumference and ratio, and blood pressure. Diet and exercise self-efficacy scales; perceived stress scale; visual analog scales (VAS) of energy, appetite, stress, quality of life, well-being, and program satisfaction at all time points. Twenty-two adults attended an in-person Ayurvedic screening; 17 initiated the intervention, and 12 completed the 3-month intervention. Twelve completed follow-up at 6 months and 11 completed follow-up at 9 months. Mean weight loss at 3 months was 3.54 kg (SD 4.76); 6 months: 4.63 kg, (SD 6.23) and 9 months: 5.9 kg (SD 8.52). Self-report of program satisfaction was more than 90% at all time points. An Ayurveda-/yoga-based lifestyle modification program is an acceptable and feasible approach to weight management. Data collection, including self-monitoring and conventional and Ayurvedic

outcomes, did not unduly burden participants, with attrition similar to that of other weight loss studies.

Telles S et al. (2010) reported that Obese persons often find physical activity difficult. The effects of a yoga and diet change program, emphasizing breathing techniques practiced while seated, was assessed in obese persons. A single group of 47 persons were assessed on the first and last day of a yoga and diet change program, with 6 days of the intervention between assessments. The assessments were: body mass index (BMI), waist and hip circumferences, mid-arm circumference, body composition, hand grip strength, postural stability, serum lipid profile and fasting serum leptin levels. Participants practiced yoga for 5 hours every day and had a low fat, high fiber, vegetarian diet. Last and first day data were compared using a t-test for paired data. Following the 6-day residential program, participants showed a decrease in BMI (1.6 percent), waist and hip circumferences, fat-free mass, total cholesterol (7.7 percent decrease), high density lipoprotein (HDL) cholesterol (8.7 percent decrease), fasting serum leptin levels (44.2 percent decrease) and an increase in postural stability and hand grip strength ( $p < 0.05$ , all comparisons). A 6-day yoga and diet change program decreased the BMI and the fat-free mass. Total cholesterol also decreased due to reduced HDL levels. This suggests that a brief, intensive yoga program with a change in diet can pose certain risks. Benefits seen were better postural stability, grip strength (though a 'practice

effect' was not ruled out), reduced waist and hip circumferences and a decrease in serum leptin levels.

Carei TR, et al. (2010) , assessed the effect of individualized yoga treatment on eating disorder outcomes among adolescents receiving outpatient care for diagnosed eating disorders (anorexia nervosa, bulimia nervosa, eating disorder not otherwise specified). A total of 50 girls and 4 boys aged 11-21 years were randomized to an 8-week trial of standard care vs. individualized yoga plus standard care. Of these, 27 were randomized to standard care and 26 to yoga plus standard care (attrition: n = 4). Standard care (every other week physician and/or dietician appointments) was required to meet ethical guidelines. The No Yoga group was offered yoga after study completion as an incentive to maintain participation. Outcomes evaluated at baseline, end of trial, and 1-month follow-up included Eating Disorder Examination (EDE), Body Mass Index (BMI), Beck Depression Inventory, State-Trait Anxiety Inventory, and Food Preoccupation questionnaire. The Yoga group demonstrated greater decreases in eating disorder symptoms. Specifically, the EDE scores decreased over time in the Yoga group, whereas the No Yoga group showed some initial decline but then returned to baseline EDE levels at week 12. Food preoccupation was measured before and after each yoga session, and decreased significantly after all sessions. Both groups maintained current BMI levels and decreased in anxiety and depression over time. Individualized yoga treatment decreased EDE scores at 12 weeks, and significantly reduced food

preoccupation immediately after yoga sessions. Yoga treatment did not have a negative effect on BMI. Results suggest that individualized yoga therapy holds promise as adjunctive therapy to standard care.

McIver S, et al. (2009) examined the experience of a 12-week yoga treatment program for binge eating among a sample of 25 women who were obese. Qualitative analysis revealed a positive shift experienced by the women during the program, summarized by a general structural description: disconnection versus connection. Women's comments suggested that the program appeared to encourage a healthy reconnection to food, as well as the development of physical self-empowerment, through cultivating present-moment awareness. Specifically, women perceived an overall reduction in the quantity of food they consumed, decreased eating speed, and an improvement in food choices throughout the program. The women also reported feeling more connected to and positive about their physical well-being. These evolving outcomes were summarized through two major themes: the way their physicality changed, and the way their food consumption changed over time. Findings provide insights relevant to therapeutic processes that might occur within eating disorder interventions that draw on meditation-based approaches.

McIver S, et al. (2009) examined the efficacy of a 12-week yoga program aimed at reducing binge eating severity. A randomised trial was undertaken assigning participants to yoga (n=45) or wait-list control (n=45) groups. Of these, 25 in each group were analysed. A community-based sample



of women between 25 and 63 years of age who identified with diagnostic criteria for binge eating disorder (BED) and a BMI>25 were recruited for the study. Primary outcomes included the Binge Eating Scale (BES) and International Physical Activity Questionnaire (IPAQ). Secondary outcomes comprised measures for BMI, hips and waist. For the yoga group, self-reported reductions in binge eating and increases in physical activity were statistically significant. Small yet statistically significant reductions for BMI, hips and waist measurement were obtained. The wait-list control group did not improve significantly on any measures. In conjunction with formal weekly sessions, home-based yoga programs are potentially efficacious for the treatment of binge eating.

Framson C, et al. (2009) reported that "Mindful eating" describes a nonjudgmental awareness of physical and emotional sensations associated with eating. This article reports the development of a mindful eating questionnaire (MEQ) to support rigorous scientific inquiry into this concept. An item pool was developed based on hypothesized domains of mindful eating. A cross-sectional survey examined associations of MEQ scores with demographic and health-related characteristics. The MEQ was distributed to seven convenience samples between January and May 2007, with an overall response rate of 62% (n=303). Participants were mostly women (81%) and white (90%), and had a mean age of 42+/-14.4 years (range 18 to 80 years). Exploratory factor analysis was used to identify factors, which were defined as the mean of items scored

one to four, where four indicated higher mindfulness; the mean of all factors was the summary MEQ score. Multiple regression analysis was used to measure associations of demographic characteristics, obesity, yoga practice, and physical activity with MEQ scores. Domains of the final 28-item questionnaire were: disinhibition, awareness, external cues, emotional response, and distraction. The mean MEQ score was  $2.92 \pm 0.37$ , with a reliability (Cronbach's alpha) of .64. The covariate-adjusted MEQ score was inversely associated with body mass index (3.02 for body mass index  $<25$  vs 2.54 for body mass index  $>30$ ,  $P < 0.001$ ). Yoga practice, but neither walking nor moderate/intense physical activity, was associated with higher MEQ score. In this study sample, the MEQ had good measurement characteristics. Its negative association with body mass index and positive association with yoga provide evidence of construct validity. Further evaluation in more diverse populations is warranted.

Dittmann KA and Freedman MR. (2009) evaluated attitudes about body image and eating in women practicing postural yoga. Study 1 described scores from questionnaires on variables related to body awareness, intuitive eating, spirituality, and reasons for practicing. Scores were favorable on all measures with significant correlations ( $p < .01$ ) among all main variables except between spiritual readiness and intuitive eating, and between BMI and both body awareness and spiritual readiness. Reasons for practicing did not affect scores. Study 2 evaluated interviews in a sub-sample. Qualitative data reported

improvements in body satisfaction and disordered eating due in part to yoga and its associated spirituality.

Sabet Sarvestani R, et al. (2009) evaluated the effects of behaviour modification on anthropometric indices and to explore if behaviour modification could improve eating behaviour in adolescents. Obesity is currently the most important nutritional disease of children and adolescents. To date, several attempts to achieve weight loss in children have been made, but little is known about their effects on improving eating behaviours. Sixty obese adolescent girls participated in a behaviour modification program which was held for 16 weeks in 2007. The participants were randomly selected from two different schools and were assigned to an experimental and control group (30 participants each). Anthropometric indices and eating behaviours were assessed before and after the program. Eating behaviour was assessed using the Dutch Eating Behaviour Questionnaire. There were statistically significant differences in changes in body weight (-2.75 kg vs. 0.62 kg), body mass index (-1.07 kg/m<sup>2</sup> vs. 0.24 kg/m<sup>2</sup>) and arm circumference (-2.31 cm vs. 0.5 cm) in the experimental group in contrast to controls ( $P < 0.001$ ). There were also statistically significant differences in scores for eating behaviour, emotional eating (0.63, 0.17), external eating (0.99, 0.05) and restrained eating (0.72, 0.03) in the experimental vs. the control group respectively ( $P < 0.001$ ).

CONCLUSION: Nurses, more than other healthcare professionals, can address

obesity in adolescents and they should not concentrate solely on weight reduction, but also encourage children to acquire a healthy lifestyle.

Douglass L.(2009) explored the uses of yoga as an experiential adjunct to other forms of therapy in the treatment of eating disorders in residential and outpatient settings. Supported by other treatment modalities, yoga can be an effective method for increasing self-awareness, reflection and the ability to self-soothe. Like other interventions, yoga has potential misuses. These misuses are uncovered with suggestions made as to how therapists can support the practice of yoga in residential and outpatient settings.

Smith BW, et al. (2008) compared the effects of two mind-body interventions: mindfulness-based stress reduction (MBSR) and cognitive-behavioral stress reduction (CBSR). Fifty (50) subjects were recruited from the community and took part in MBSR (n = 36) and CBSR (n = 14) courses. CBSR was an 8-week course using cognitive and behavioral techniques to change thinking and reduce distress. Perceived stress, depression, psychological well-being, neuroticism, binge eating, energy, pain, and mindfulness were assessed before and after each course. Pre-post scores for each intervention were compared by using paired t tests. Pre-post scores across interventions were compared by using a general linear model with repeated measures. Weekly meetings for both courses were held in a large room on a university medical center campus. MBSR subjects improved on all eight outcomes, with all of the differences being significant. CBSR subjects improved on six of eight

outcomes, with significant improvements on well-being, perceived stress, and depression. Multivariate analyses showed that the MBSR subjects had better outcomes across all variables, when compared with the CBSR subjects. Univariate analyses showed that MBSR subjects had better outcomes with regard to mindfulness, energy, pain, and a trend for binge eating. While MBSR and CBSR may both be effective in reducing perceived stress and depression, MBSR may be more effective in increasing mindfulness and energy and reducing pain. Future studies should continue to examine the differential effects of cognitive behavioral and mindfulness-based interventions and attempt to explain the reasons for the differences.

Scime M, and Cook-Cottone C. (2008) investigated the impact of a primary prevention program for eating disorders aimed at fifth-grade females. The curriculum was based on empirically validated risk and protective factors and incorporated interactive discourse, yoga, and relaxation into 10 weekly sessions. Pre- and post-test data from five groups conducted over 2 years were combined for a total of 75 participants. Data were also collected from 69 control group participants. Results indicate completion of the group resulted in a significant decrease on scales from the Eating Disorder Inventory-2 measuring body dissatisfaction and bulimia, as well as an increase on the Social scale of the Multidimensional Self-Concept Scale. The results demonstrate mixed support for the Girls' Group prevention program. Implications for practice and future research are discussed.

Mitchell KS, et al. (2007) reported that eating-disordered behavior is prevalent among college women. Few interventions have successfully reduced risk factors for these behaviors, however. The most promising interventions are both selective and interactive. This study compared two newer types of interventions that meet these criteria: cognitive dissonance and yoga programs. This study advertised programs for women who were dissatisfied with their bodies. Participants (N = 93) were randomly assigned to dissonance, yoga, or control groups. Hierarchical regression analyses revealed that there were no significant post-intervention differences between the yoga and control groups. Dissonance group participants had significantly lower scores than the scores of both other groups on measures of disordered eating, drive for thinness, body dissatisfaction, alexithymia, and anxiety. These findings have important implications for interventions on college campuses. In particular, dissonance interventions appear to be an efficient and inexpensive approach to reducing eating disorder risk factors. Additional research regarding the value of yoga interventions is needed.

Panneerselvam (2014) studied the effect of Simplified Kundalini Yoga with and without Sattvic diet on selected physiological and psychological variables among stressed college girls. The results of the study proved that simplified Kundalini Yoga with Sattvic diet significantly altered selected physiological and psychological variables, namely, body mass index, mean arterial blood pressure, resting pulse rate, stress, emotional maturity and

achievement motive. It was also found that simplified Kundalini Yoga without Sattvic diet significantly altered selected variables, resting pulse rate, stress and emotional maturity. The results proved that simplified Kundalini yoga with Sattvic diet was significantly better than simplified Kundalini Yoga without Sattvic diet in altering variables, stress, emotional maturity and achievement motive of stressed college girls.

Kethara Eswaran (2014) studied the effect of Manavalakalai Yoga with and without Sattvic food on selected physiological and psychological variables among college boys. The results proved that Manavalakalai Yoga with and without Sattwik food significantly contributed for the improvement of physiological and psychological conditions of college boys as measured through body mass index, systolic blood pressure, anxiety, study skills and self confidence and failed to alter diastolic blood pressure.

#### **2.4 SUMMARY OF RELATED STUDIES**

In this chapter the researcher reviewed 20 related studies done on effect of yogic practices on physiological variables, 19 related studies done on effect of yogic practices on psychological variables and 11 related studies done on effect of yogic diet. It was found that there was further scope for research to find out the effect of consolidated yogic practices and yogic diet on selected physiological and psychological variables among engineering college obese women students. Hence, the researcher selected this topic.