

## CHAPTER - II

### REVIEW OF RELATED LITERATURE

The researcher has studied in depth the literature of previous researches through journals, magazines, books and research articles. Review of the literature for this study is to get familiar with what is already done and to know what is still unknown and untested and to understand in depth about the variables and present the information here. The survey of literature on the research topic also makes the researcher familiar and more knowledgeable with the existing studies, which helps to focus on a particular problem and lay the foundation for newer and greater knowledge. The Review of literature related to the topic is essential to gain the background knowledge. The present study is classified under the following headings.

Studies on physiological variables related to Yoga

Studies on bio-chemical variables related to Yoga

Studies on psychological variables related to Yoga

Studies on Varma Therapy

Summary of Related Literature

#### 2.1 STUDIES ON PHYSIOLOGICAL VARIABLES RELATED TO YOGA

**Bandi Hari Krishna et.al., (2014)** conducted the study on the effect of yoga therapy on heart rate, blood pressure and cardiac autonomic function in heart failure. It is well known indicator of heart failure is unfavourable changes in autonomic function. High Blood Pressure is a powerful predictor of congestive heart failure and other Cardiovascular Disease (CVD) outcomes. In this study, it is to examine the effects of a 12 week yoga therapy on blood pressure, heart rate, heart rate variability, and Rate Pressure Product (RPP). Out of 130 heart failure patients recruited for the study, 65 patients were randomly selected to receive 12 week yoga therapy along with standard medical therapy (yoga group). Other patients (n=65) received only standard medical

therapy (control group). Heart rate, blood pressure, cardiac autonomic function (by short-term heart-rate variability analysis) and myocardial oxygen consumption (by RPP) were assessed before and after 12 weeks. In the yoga group, 44 patients and in the control group, 48 patients completed the study. There was a considerable decrease in heart rate, blood pressure and RPP in yoga group compared to control group. Also, LFnu and LF-HF ratio diminished significantly and HFnu increased significantly in yoga group compared to control group. Twelve-week yoga therapy significantly enhance the parasympathetic activity and decreased the sympathetic activity in heart failure patients (NYHA I&II).

**Shepal Amod V and Shete Sanjay U (2013)** conducted a preliminary study on consequences of yoga on bio-markers linked with development of diabetes complications in type 2 diabetes patients. Diabetes mellitus constitute a metabolic disorder of multiple etiologies characterized by high level of glucose (hyperglycaemia) with disturbances in carbohydrate, fat and protein metabolism resulting from defects in either insulin secretion, or insulin action or both. Fourteen type 2 diabetic patients, aged 43-69 years with duration of diabetes ranged 1year- 10 years were randomly selected and intervened for three months of exclusive Yoga practices. Research design used was Quasi-experimental Single Group pre test and post test. The investigation show non-significant difference in mean HbA1c values, whereas plasma TNF- $\alpha$ , BMI, systolic, diastolic blood pressure and pulse rate were significantly reduced. The result of the study reveal that integration of thus integration of yoga practices in daily lifestyle of T2DM patients can be beneficial in restraining and suppressing the progression of the disease and its associated complications.

**Marshall Hagins et.al., (2014)** conducted the study on a randomized controlled trial comparing the effects of yoga with an active control on ambulatory blood pressure in individuals with pre-hypertension and stage 1 hypertension. The objective of this study was to differentiate the effects of yoga with an active control (non-aerobic exercise) in individuals with pre-hypertension and stage 1 hypertension. A randomized clinical trial was performed using two arms: (1) yoga and (2) active control. Primary outcomes were 24-hour day and night ambulatory systolic and diastolic blood pressures. Within-group and between-group examination were performed using paired

t tests and repeated-measures analysis of variance (time  $\times$  group), respectively. Eighty-four participants enrolled, with 68 participants completing the trial. Within-group analyses found 24-hour diastolic, night diastolic, and mean arterial pressure all considerably reduced in the yoga group (-3.93, -4.7, -4.23 mm Hg, respectively) but no significant within-group changes in the active control group. Direct comparisons of the yoga intervention with the control group found a single blood pressure variable (diastolic night) to be significantly different ( $p=.038$ ). This study has indicated that a yoga intervention can lower blood pressure in patients with mild hypertension. Even though, this study was not adequately powered indicate between-group differences, the size of the yoga-induced blood pressure reduction appears to justify performing a definitive trial of this intervention to test whether it can cater meaningful therapeutic value for the management of hypertension.

**Barnes, VA et.al., (2004)** studied the effect of meditation on resting and ambulatory blood pressure and heart rate in youth. Researches of the Medical College of GeorGIN, in Augusta, GA, investigated the effects of meditation on blood pressure and heart rate in youth for this purpose. 73 middle school students (age 12.3 $\pm$  0.6 years) were randomly assigned to either a mediation group (N=34) or health education control group (N=39) group. The mediation group mediated for 10 minutes at school and after school (at home) every day for 3 months. Blood pressure and heart rate were measures pre-test (pre-meditation training) and post-test (after the 3 months). Researches took both resting (seated) and ambulatory (walking around in everyday life) measured of blood pressure and heart rate. Resting blood pressure and heart rate were measured on three consecutive school days (to increase reliability of the measurements). Ambulatory measurements were recorded over 24-hour periods at pretest and posttest every 20 minutes during self-reported normal waking hours and every 30 minutes during self-reported normal sleep hours. Compared to the students in the control group, the Students in the meditation group showed a considerable decline in resting blood pressure, daytime ambulatory blood pressure after school, and daytime ambulatory heart rate after school. These findings establish the potential beneficial impact of mediation on blood pressure and heart rate in the natural environment in healthy normotensive youth.

**Mody BS (2011)** conducted the study on the acute effects of Surya Namaskar on the cardiovascular & metabolic System. With the recent rise in obesity awareness and the increased understanding of the importance of physical activity in promoting overall health, greater emphasis has been placed on improving physical fitness to enhance quality of life. Surya Namaskara, a component of Hatha Yoga, has been practiced by Asian Indians for hundreds of years and is often used in place of a typical fitness program. It constitutes of a series of postures (asanas) that are repeated 12 times per round. Only one published study has looked specifically at Surya Namaskar, measuring the energy cost of individual asanas.

**Sahay BK (2007)** conducted the study on role of Yoga in Diabetes. The science of yoga is an ancient one. The rich heritage of our culture is inherited from our ancestors. Several older books make a mention of the functionality of yoga in the treatment of certain diseases and protection of health in normal individuals. The influence of yogic practices on the management of diabetes has not been investigated appropriately. A study was conducted to study in normal individuals and those with diabetes to assess the role of yogic practices on glycaemic control, insulin kinetics, body composition exercise tolerance and various co-morbidities like hypertension and dyslipidemia. These studies were both short term and long-term. These studies have affirmed the useful role of yoga in the control of diabetes mellitus. Fasting and postprandial blood glucose levels came down significantly. Good glycaemic status can be maintained for long periods of time. There was a lowering of drug requirement and the incidence of acute complications like infection and ketosis was considerably reduced. There were significant changes in the insulin kinetics and those of counter-regulatory hormones like cortisol. There was a decline in free fatty acids. There was an increase in lean body mass and decrease in body fat percentage. The number of insulin receptors was also increased. There was an improvement in insulin sensitivity and decline in insulin resistance. All these suggest that yogic practices have a notable role even in the prevention of diabetes. There is a favourable effect on the co-morbid conditions like hypertension and dyslipidemia.

**John Ebnezar et.al., (2012)** conducted the study on the effect of integrated yoga therapy on pain, morning stiffness and anxiety in osteoarthritis of the knee joint:

A randomized control study, examine the effect of integrated yoga on pain, morning stiffness and anxiety in osteoarthritis of knees. For these purpose two hundred and fifty participants with OA knees (35-80 years) were randomly assigned to yoga or control group. Both groups had transcutaneous electrical stimulation and ultrasound treatment followed by intervention (40 min) for two weeks with follow up for three months. The integrated yoga comprised of yogic loosening and strengthening practices, asanas, relaxation, pranayama and meditation. The control group had physiotherapy exercises. Assessments were done on 15<sup>th</sup> (post 1) and 90<sup>th</sup> day (post 2). Resting pain (numerical rating scale) reduced better ( $p<0.001$ , Mann-Whitney U test) in yoga group (post 1=33.6% and post 2=71.8%) than control group (post 1=13.4% and post 2=37.5%). Morning stiffness decreased more ( $p<0.001$ ) in yoga (post 1=68.6% and post 2=98.1%) than control group (post 1=38.6% and post 2=71.6%). State anxiety (STAI-1) reduced ( $p<0.001$ ) by 35.5% (post 1) and 58.4% (post 2) in the yoga group and 15.6% (post 1) and 38.8% (post 2) in the control group; trait anxiety (STAI 2) reduced ( $p<0.001$ ) better (post 1=34.6% and post 2=57.10%) in yoga than control group (post 1=14.12% and post 2=34.73%). Systolic blood pressure reduced ( $p<0.001$ ) better in yoga group (post 1=-7.93% and post 2=-15.7%) than the control group (post 1=-1.8% and post 2=-3.8%). Diastolic blood pressure reduced ( $p<0.001$ ) better in yoga group (post 1=-7.6% and post 2=-16.4%) than the control group (post 1=-2.1% and post 2=-5.0%). Pulse rate reduced ( $p<0.001$ ) better in yoga group (post 1=-8.41% and post 2=-12.4%) than the control group (post 1=-5.1% and post2=-7.1%). The result of study proved that integrated approach of yoga therapy is more appropriate worthier than physiotherapy exercises as an adjunct to transcutaneous electrical stimulation and ultrasound treatment in decreasing pain, morning stiffness, state and trait anxiety, blood pressure and pulse rate in patients with OA knees.

**Bharshankar JR et.al., (2003)** conducted the study to influence the effect of yoga on cardiovascular function in subjects above 40 years of age. Totally 100 individuals were subjected to this study – 50 of them were control subjects (not doing any physical activity) and 50 subjected were taken who had been practicing Yoga. Pulse rate, systolic and diastolic blood pressure and valsalva ratio were studied on them. 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). Among Yoga practitioners the Valsalva ratio was also found to be significantly higher than in controls ( $P < 0.001$ ). Our results indicate that yoga reduces the age related deterioration in cardiovascular functions.

**Kyeongra Yang and Lisa M Bernar (2011)** conducted study on utilization of 3-month yoga program for adults at high risk for type 2 diabetes. Various modes of physical activity, combined with dieting, have been widely suggested to prevent or delay type 2 diabetes. Among these, yoga holds promise by reducing risk factors for type 2 diabetes by promoting weight loss, improving glucose levels and reducing blood pressure and lipid levels. The purpose of this pilot study is to assess the feasibility of implementing a 12-week yoga program among adults at high risk for type 2 diabetes. Twenty-three adults (19 Whites and 4 non-Whites) were randomly assigned to the yoga intervention group or the educational group. The yoga group participated in a 3-month yoga intervention with sessions twice per week and the educational group received general health educational materials every 2 weeks. All participants completed questionnaires and had blood tests at baseline and at the end of 3 months. Effect sizes were reported to summarize the efficacy of the intervention. All participants assigned to the yoga intervention completed the yoga program without complication and expressed high satisfaction with the program (99.2%). Their yoga session attendance ranged from 58.3 to 100%. Compared with the education group, the yoga group experienced improvements in weight, blood pressure, insulin, triglycerides and exercise self-efficacy indicated by small to large effect sizes. This preliminary study implies that a yoga program would be a possible risk reduction option for adults at high risk for type 2 diabetes. In addition, yoga holds promise as an approach to reducing cardio-metabolic risk factors and increasing exercise self-efficacy for this group.

**Johnson P and Anjaneyulu M (2014)** conducted the study on effects of practicing yogasanas and physical training on specified physiological variables. The study was intended to substantiate the relative effects of yogasana practices and physical training on selected physiological variables. For achieving the purpose sixty male students aged 15 through 18 years were selected as subjects from Govt. Junior College, Ponnalur, Prakasam District, Andhra Pradesh. The subjects selected were equated on the basis of their cardio-respiratory endurance and segregated them into two groups: Group I – yogasana practice group and Group II – physical training group of thirty subjects each. The yardstick variables confined to this study were systolic blood pressure, diastolic blood pressure and pulse rate. The experimental programme is five days a week for eight weeks in the morning session. The one-way analysis of variance was used to test the statistical significance. The results obtained from the study suggest that performing yogasanas is better as compared to isometric exercise training in improving the blood pressure and pulse rate.

**Savita Singh et.al., (2004)** conducted the study on the role of yoga in modifying certain cardiovascular functions in type 2 diabetic patients. To study the effect of forty days of Yogic exercises on cardiac functions in Type 2 Diabetics. 2. To study the effect of forty days of Yogic exercises on blood glucose level, glycosylated hemoglobin. The present study done in twenty-four Type 2 DM cases who practice regular yoga provides metabolic and clinical evidence of improvement in glycaemic control and autonomic functions. These middle-aged subjects were type II diabetics on antihyperglycaemic and dietary regimen. Their baseline fasting and postprandial blood glucose and glycosylated Hb were monitored along with autonomic function studies. Experts in the field of yoga gave these patients training in yoga asanas and they pursued those asanas 30-40 min/day for 40 days under guidance. These asanas comprised of 13 well known postures, done in a sequence. After 40 days of yoga asanas regimen, the parameters were repeated. The results specify that there was remarkable decrease in fasting blood glucose levels from basal 190.08 +/- 18.54 in mg/dl to 141.5 +/- 16.3 in mg/dl after yoga regimen. The post prandial blood glucose levels decreased from 276.54 +/- 20.62 in mg/dl to 201.75 +/- 21.24 in mg/dl, glycosylated hemoglobin showed a decrease from 9.03 +/- 0.29% to 7.83 +/- 0.53% after yoga regimen. The pulse rate, systolic and diastolic blood pressure decreased significantly (from 86.45 +/- 2.0 to 77.65 +/- 2.5

pulse/min, from 142.0 +/- 3.9 to 126.0 +/- 3.2 mm of Hg and from 86.7 +/- 2.5 mm of Hg to 75.5 +/- 2.1 mm of Hg after yoga regimen respectively). Corrected QT interval (QTc) decreased from 0.42 +/- 0.0 to 0.40 +/- 0.0. These findings specify that better glycaemic control and stable autonomic functions can be obtained in Type 2 DM patients who practice yoga asanas and pranayama. However, the exact mechanism as to how these postures and controlled breathing interact with somato-neuro-endocrine mechanism affecting metabolic and autonomic functions remains to be worked out.

**Gopal Krishna Pal et.al., (2012)** conducted the study on the Body mass index contribution to sympathovagal imbalance in pre-hypertensive. The present study was conducted to determine the nature of sympathovagal imbalance (SVI) in prehypertensives by short-term analysis of heart rate variability (HRV) to understand the alteration in autonomic modulation and the contribution of BMI to SVI in the genesis of prehypertension. Body mass index (BMI), basal heart rate (BHR), blood pressure (BP), rate pressure product (RPP) and HRV indices such as total power (TP), low-frequency power (LF), normalized LF (LFnu), high-frequency power (HF), normalized HF (HFnu), LF-HF ratio, mean heart rate (mean RR), square root of the mean squared differences of successive normal to normal intervals (RMSSD), standard deviation of normal to normal RR interval (SDNN), the number of interval differences of successive NN intervals greater than 50 ms (NN50) and the proportion derived by dividing NN50 by the total number of NN intervals (pNN50) were assessed in three groups of subjects: normotensives having normal BMI (Group 1), prehypertensives having normal BMI (Group 2) and prehypertensives having higher BMI (Group 3). SVI was assessed from LF-HF ratio and correlated with BMI, BHR, BP and RPP in all the groups by Pearson correlation. The contribution of BMI to SVI was appraised by multiple regression analysis. LF and LFnu were significantly increased and HF and HFnu were significantly decreased in prehypertensives subjects in comparison to normotensive subjects and the magnitude of these changes was more prominent in subjects with higher BMI compared to that of normal BMI. LF-HF ratio, the sensitive indicator of sympathovagal balance had significant correlation with BMI (P=0.000) and diastolic blood pressure (DBP) (P=0.002) in prehypertensives. BMI was found to be an independent contributing factor to SVI (P=0.001) in prehypertensives. It was concluded that autonomic imbalance in prehypertensives manifested in the form of increased

sympathetic activity and vagal inhibition. In prehypertensives with higher BMI, vagal withdrawal was predominant than sympathetic over activity. Magnitude of SVI (alteration in LF-HF ratio) was linked to changes in BMI and DBP. BMI had an independent influence on LF-HF ratio. It was advised that life-style modifications such as yoga and exercise would enable achieve the sympathovagal balance and blood pressure homeostasis in prehypertensives.

**Prithviraj Karaket.al., (2014)** conducted the study on holistic approach of yoga on blood pressure management. Yoga is an ancient Indian system of exercise and therapy is an art of righteous living or an integrated system for the benefit of the body, mind and inner spirit. Regular practice of yoga can help to diminish stress and anxiety. Forward bends such as the Paschimottana Asana assist to increase blood flow to the brain, reduce stress, have a calming effect on the nervous system, and greatly help in reducing hypertension. The objective of yoga is the attainment of the physical, mental and spiritual health and to control the blood pressure. The present study was conducted to determine the effect of yoga training on confirmed coronary artery disease (CAD+) and without coronary artery disease (CAD-) patients. We examined the effects of yoga on hemodynamic and laboratory parameters in a 1-year pilot study. All the subjects were made to attend course of yoga for 1.5 hours six days a week. Systolic and diastolic blood pressures, heart rate, body mass index (BMI) were all studied at before and after yoga practice. This prospective cohort study included 200 subjects (mean age  $52 \pm 2$  years), both with (50%) and without (50%) established coronary artery disease (CAD). Yoga training resulted in decrease in systolic blood pressure (SBP) (average 20%), mean arterial pressure (MAP) (11%), heart rate (HR) (average 12.5%) and BMI (8%). SBP, HR and BMI value shows statistically highly significant ( $p < 0.05$ ). These results imply that there is a significant reduction in blood pressure, heart rate, and BMI in the total cohort with yoga.

**Satyanarayana Pet.al., (2013)** conducted the study on effect of yoga on heart rate, blood pressure, body mass index. The aim of yoga is to maintain physical, mental and spiritual health and to control the blood pressure. Forward bending asanas such as the Paschimottana Asana help to increase blood flow to the brain, reduce stress, have a calming effect on the nervous system, and minimize hypertension to great extent. The

present study was conducted to determine the effect of yoga training on 50 male. The effects of yoga on hemodynamic and laboratory parameters in a 6-months pilot study were examined. All the subjects attended a yoga session of 1.5 hours six days in a week for twenty-four weeks. Systolic and diastolic blood pressures, heart rate, body mass index (BMI) were all studied, before and after 6-months of yoga practice. This prospective cohort study included 50 subjects (mean age  $52 \pm 2$  years) both with CAD (30%) and without established coronary artery disease (CAD) (70%). Yoga training causes decrease in systolic blood pressure (SBP) (average 20%), mean arterial pressure (MAP) (11%), heart rate (HR) (average 12.5%) and BMI (8%). SBP, HR and BMI value shows statistically highly significant ( $p < 0.05$ ). The outcome of the study suggests that there is a significant reduction in blood pressure, heart rate, and BMI in the total cohort with yoga.

**Telles S et.al., (2014)** conducted the study on Blood pressure and heart rate during yoga-based alternate nostril breathing practice and breath awareness. Previous research has shown a reduction in blood pressure (BP) immediately after the practice of Alternate Nostril Yoga Breathing (ANYB) in normal healthy male volunteers and in hypertensive patients of both sexes. The BP during ANYB has not been recorded. 26 male Participants (group mean age  $\pm$ SD,  $23.8 \pm 3.5$  years) were assessed (1) heart rate variability, (2) non-invasive arterial BP, and (3) respiration rate, during (a) ANYB and (b) breath awareness (BAW) sessions. Each session was 25 minutes. The assessments were performed at 3 time points. Pre (5 minutes), during (15 minutes; for ANYB or BAW) and Post (5 minutes). A naïve-to-yoga control group ( $n=15$  males, mean age  $\pm$ SD  $26.1 \pm 4.0$  years) were assessed while seated quietly for 25 minutes. During ANYB there was a significant decrease (repeated measures ANOVA) in systolic BP and respiration rate; During BAW respiration rate decreased. The results of the study reveal that vagal activity increased during and after ANYB, which could have contributed to the decrease in BP and changes in the HRV.

**Ramkumar Thiyagarajan et.al., (2014)** conducted the study on additional benefit of yoga to standard lifestyle modification on blood pressure in pre hypertensives subjects, a randomized controlled study. High blood pressure (BP) is a known risk factor for cardiovascular disease morbidity. Considering the growing evidence of

nonpharmacological interventions in the management of high BP, a randomized design, parallel active-controlled study on the effect of yoga and Standard Lifestyle Modification (LSM) on BP and heart rate in individuals with pre hypertension (systolic BP 120-139 mm Hg and/or diastolic BP 80-89 mm Hg). Volunteers (20-60 years) of both genders without any known cardiovascular disease were randomized into either LSM group (n = 92) or LSM+yoga group (n = 92). Before the intervention, age, waist circumference, physical activity, BP and fasting plasma glucose and lipids were compared between the groups. After 12 weeks of intervention, we noticed a significant reduction in the BP and heart rate in both the groups. Further, the reduction in systolic BP was significantly more in LSM+yoga group (6 mm Hg) when compared to LSM group (4 mm Hg). In addition, 13 prehypertensives became normotensives in LSM, yoga group and four in LSM group. The results declared the efficacy of non-pharmacological intervention and the additional benefit of yoga to standard LSM. Further research in this field may add to the level of evidence on the benefit of yoga, in the reduction of BP in high BP subjects, in the scientific literature.

**Anand Balayogi Bhavanani et.al., (2014)** conducted the study on the Comparative immediate effect of different yoga asanas on heart rate and blood pressure in healthy young volunteers. This study aimed at comparing immediate cardiovascular effects of different yoga asanas in healthy young volunteers. Heart rate (HR), systolic pressure (SP), and diastolic pressure (DP), blood pressure (BP), were recorded using the non-invasive blood pressure (NIBP) apparatus on 22 healthy young subjects, before and after the performance of Dhanurasana (DA), Vakrasana (VA) (both sides), Janusirasasana (JSA) (both sides), Matsyasana and Shavasana for 30 s. HR and BP were further recorded during supine recovery at 2, 4, 6, 8, and 10 min. A repeated measure of ANOVA was used for statistical analysis. There were not able changes in HR and BP both immediately after the Asanas as well as during the recovery period. Overall comparisons of changes immediately after the performance of the Asanas revealed significant differences with regard to HR that increased remarkably significantly after DA. During the recovery phase, there were significant intergroup differences from 2 min onward in both SP and DP. The decrease of SP after VA (right side) (VA-R) was significantly greater than Shavasana (4<sup>th</sup>, 6<sup>th</sup>, and 8<sup>th</sup> min) and JSA (left side) (JSA-L) at 6<sup>th</sup> and 8<sup>th</sup> min. DP decreased significantly after performing JSA-L compared to VA-

R at the 6<sup>th</sup> and 8<sup>th</sup> min. The cardiovascular changes immediately after the Asanas and during the recovery phase reveal inherent differences between the selected postures. The rise of HR in DA may be attributed to increased sympathetic response due to the relative difficulty of the posture as well as abdominal compression occurring in it. The effect of supine relaxation is more pronounced after the performance of the Asanas when compared to mere relaxation in Shavasana. This may be attributed to a normalization and resultant homeostatic effect occurring due to a greater, healthier deactivation of the autonomic nervous system occurring owing to the presence of prior activation. There were also subtle differences between the right sided and left sided performance of VA and JSA that may be prevailing due to the different internal structures being either compressed or relaxed on either side. Our study confers initial evidence of differential cardiovascular effects of Asanas and subtle differences between right and left sided performance. Further, cardiovascular recovery is greater after the practicing of the Asanas as compared to shavasana; thus, implying a better response when effort precedes relaxation.

**Madanmohan et.al., (2005)** conducted a research of effect of slow and fast pranayama on reaction time and cardiorespiratory variables. It was planned to undertake a comparative study of the effect of short term (three weeks) training in savitri (slow breathing) and bhastrika (fast breathing) pranayam on respiratory pressure 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 taught in savitripranayam 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. Savitripranayam produced a significant increase in respiratory pressures and respiratory endurance. In both the groups, there was a substantial but statistically insignificant shortening of reaction time. Heart rate, rate-pressure product and double product decreased in savitripranayam group but rose significantly in bhastrika group. It is concluded that different types of pranayam produce different physiological responses in normal young volunteers.

**McDermott KA et.al., (2014)** conducted a study on a yoga intervention for type 2 diabetes risk reduction: a randomized controlled trial. Type 2 diabetes is a major health problem in many countries including India. Yoga may be effective type 2 diabetes prevention strategies in India, particularly given its cultural familiarity. This was a parallel, randomized pilot study to collect feasibility and preliminary efficacy data on yoga for diabetes risk factors among people at high risk of diabetes. Primary outcomes included: changes in BMI, waist circumference, fasting blood glucose, postprandial blood glucose, insulin, insulin resistance, blood pressure, and cholesterol. The measures of psychological well-being including changes in depression, anxiety, positive and negative affect and perceived stress were also checked. Forty-one participants with elevated fasting blood glucose in Bangalore, India were randomized to either yoga (n=21) or a walking control (n=20). Participants were supposed to either attend yoga classes or complete monitored walking 3-6 days per week for eight weeks. Randomization and allocation was executed using computer-generated random numbers and group assignments distributed in sealed, opaque envelopes generated by off-site study staff. Data were analyzed based on intention to treat. This study was feasible in terms of recruitment, retention and adherence. In addition, yoga participants had significantly greater reductions in weight, waist circumference and BMI versus control (weight  $-0.8 \pm 2.1$  vs.  $1.4 \pm 3.6$ ,  $p=0.02$ ; waist circumference  $-4.2 \pm 4.8$  vs.  $0.7 \pm 4.2$ ,  $p<0.01$ ; BMI  $-0.2 \pm 0.8$  vs.  $0.6 \pm 1.6$ ,  $p=0.05$ ). There were no differences between groups in fasting blood glucose, postprandial blood glucose, insulin resistance or any other factors related to diabetes risk or psychological well-being. There were significant decrease in systolic and diastolic blood pressure, total cholesterol, anxiety, depression, negative affect and perceived stress in both the yoga intervention and walking control over the course of the study. Among Indians with high fasting blood glucose, we found that participation in an 8-week yoga intervention was feasible and resulted in greater weight loss and reduction in waist circumference when compared to a walking control. Hence, it is concluded that yoga. Yoga provides a promising lifestyle intervention for decreasing weight-related type 2 diabetes risk factors and thereby potentially increasing psychological well-being.

**Ramesh Chand Yadav (2016)** conducted study on effects of Twelve Weeks Selected Pranayama Practices on Primary High Blood Pressure Patients. The study was conducted to determine the effects of selected pranayama practices on primary high blood pressure patients. For the purpose of the study thirty (n = 30) randomly selected male people aged between 30 - 50 years, volunteered to participate in the study. Pre-test and Post-test randomized group design was employed in the study. The total subjects, were divided into two groups, one experimental group and the other control group, each group comprising of fifteen subjects. At the end of twelve weeks of practice, the Post-test was conducted for both groups. The Experimental Group (Pranayama group) performed selected Pranayama in different combinations. Anulom Viloma Pranayama, Sitkari Pranayama, Sitali Pranayama, Ujjayi Pranayama, Bhastrika Pranayama, was taught to the subjects during the practice sessions. The practice session was conducted for a period of 45 minutes in the morning i.e. 6:00 am to 6:45 am on alternate days. Blood pressure was measured with the help of Sphygmomanometer. The Analysis of Co-variance (ANCOVA) was applied to see the effect of selected Pranayama practices on Primary High Blood Pressure patients was used with the 0.05 level of significance. The results showed that the both systolic and diastolic blood pressure was significantly lowered with a regular programme of Pranayama practice. It was concluded that twelve weeks of pranayama practice can decrease, resting systolic and diastolic blood pressure for primary high blood pressure patients.

## **2.2 STUDIES ON BIO-CHEMICAL VARIABLES RELATED TO YOGA**

**Beena RK and Sreekumaran E (2013)** conducted the study on the yogic practice and diabetes mellitus in geriatric patients. Stress has negative impact on health and type 2 diabetes patients may be at an increased risk. Abnormally high levels of free radicals and the simultaneous decline of antioxidant defense mechanisms can increase lipid peroxidation and insulin resistance. The purpose of the present study was to demonstrate the efficacy of yogic practice in geriatric patients with type 2 diabetes mellitus and also to compare the efficacy with the state of glycaemic control. Seventy three (73) healthy elderly patients of type 2 diabetes mellitus in the age group of 60 to 70 years with a history of diabetes for 5 to 10 years and with poor glycaemic control (HbA1c >8 %) residing in Kozhikode district were recruited for the study. The subjects

were divided into three groups according to their glycaemic control. Group I with HbA1c) 8.6-9.7 %, group II with HbA1c 9.8-10.7 % and group III with HbA1c 10.8-12.7 %.

Participants did yogic practice under the supervision of experienced trainer, daily 90 minutes and for three months. Bio-chemical estimation of HbA1c), glucose, lipid profile, cortisol, ferritin, malondialdehyde (MDA) and catalase activity were carried out on 0 day and 90<sup>th</sup> day. Seventy patients participated in a comparable control session. The participants in the test group showed statistically significant ( $p < 0.001$ ) decline in glucose, HbA1c, lipids, cortisol, ferritin, MDA and significant increase in catalase activity after yogic practice. Yoga shows positive implication in risk profiles induced by stress in geriatric patients with type 2 diabetes and may have promise for the prevention or delay in diabetes complications and at all stages of the disease a remarkable improvement can be achieved by yogic practice in geriatric diabetes.

**Pandey RK et.al., (2017)** conducted a study on effects of 6 months yoga program on renal functions and quality of life in patients suffering from chronic kidney disease (CKD). A group of 54 CKD Patients were divided into two groups, namely: yoga groups and control groups. The Yoga therapy with other conventional treatment was given for the yoga group for 5 days in a week for 40-60 minutes a day for a period of 6 months. The control group was not given any treatment. Blood pressure, renal function, requirement of a number of dialysis, and quality of life (QOL) indicators were periodically monitored. Fifty patients (yoga – 25; control-25) completed 6 months follow-up. After a period of 6 months the yoga group showed a significant reduction of systolic and diastolic blood pressure, significant reduction in blood urea and serum creatinine levels besides significant improvement in physical and psychological domain. In control group, rise of blood pressure, deterioration of renal function, and QOL were observed. Post study comparison between the two groups showed a statistically significant reduction of blood pressure, non significant reduction in blood urea and serum creatinine, and significant improvement in physical and psychological domain of QOL in yoga group as compared to control group. Except for inability of some patients to perform certain yogic asanas no adverse effect was found in the study.

**Himashree G et.al., (2016)** conducted a study on Yoga Practice Improves Physiological and Bio-chemical Status at High Altitudes (HA). The study was intended to explore the effects of comprehensive yogic practices on the health and performance of Indian soldiers deployed at HA. The research team designed a prospective, randomized, case-control study. The study was done at Karu, Leh, India, at an altitude of 3445 metre among 200 acclimatized soldiers in the Indian army. The soldiers were divided into 2 groups of equal size. The first group, the control group, carried out the routine activities for physical training in the Indian army. The second group, the intervention group practiced a comprehensive yoga package, including physical asanas, pranayama, and meditation, without any of their regular physical training. Both groups were monitored during their activities. The outcome measures a wide and comprehensive range of anthropometrical, physiological, bio-chemical, and psychological parameters which includes (1) height and weight; (2) body fat percentage (BFP); (3) heart rate (HR); (4) respiratory rate (RR); (5) systolic and diastolic blood pressure (DPB); (6) peripheral saturation of oxygen; (7) end tidal CO<sub>2</sub> (EtCO<sub>2</sub>); (8) chest expansion; (9) pulmonary function; (10) physical work capacity (VO<sub>2</sub> Max); (11) hematological variables; (12) lipid profile; (13) serum urea; (14) creatinine; (15) liver enzymes; (16) blood glucose; and (17) anxiety scores. Measurements were made at baseline and post intervention. Significant improvement was observed among the yoga group in health indices as compared with control group. They had lower weights, BFPs, RRs, DBPs, and anxiety scores. They also had a significantly higher EtCO<sub>2</sub>, forced vital capacity, forced expiratory volume in the first second (FEV1), and VO<sub>2</sub> Max. Also, the yoga group showed a significant reduction in serum cholesterol, low-density lipoprotein, triglycerides, and blood urea as compared with their pre yoga levels and with the exercise group. It was concluded that Practice of yoga facilitates improvements in health and performance at HAs and is superior to routine training with physical exercises. Comprehensive yogic practices are an effective modality for improving health and performance at HAs.

**Singh S et.al., (2001)** conducted the study, a preliminary report on the role of yoga asanas on oxidative stress in non-insulin dependent diabetes mellitus. Nineteen subjects of non-insulin dependent diabetes mellitus (NIDDM) between the age group of 30-60 yrs were studied to see the effect of specific yoga asanas on fasting and

postprandial blood glucose (FBG, PPG), serum malondialdehyde (MDA) and glycosylated hemoglobin (HbA1c) in addition to drug treatment and diet control. The duration of diabetes ranged from 1-10 years. Patients with renal, cardiac and proliferative retinal diseases were excluded in the study. The same patients served as their own control. Subjects were gathered in the morning to the cardio-respiratory laboratory and were given training by a yoga expert. Yoga asanas included Suryanamskar, Tadasan, Trikonasan, Padmasan, Pranayam, Paschimottanasan, Ardhamatsyendrasan, Pavanmukthasan, Sarpasan and Shavasan. The subjects performed these asanas every day practiced every day for 40 days for 30-40 min. FBG, PPG, serum MDA and HbA1c were estimated before and after 40 days of yoga asanas regimen. Significant reduction was seen in FBG from 220 mg/dl to 162 mg/dl, PPG from 311 mg/dl to 255 mg/dl, MDA from 6 nmol/l to 3 nmol/l and HbA1c, from 8.8% to 6.4%. Subjects felt better and were relieved of their stresses and gained an improvement in their day to day performance. The decrease was statistically significant ( $p < 0.0001$  for FBG and PPG,  $p < 0.001$  for MDA and for HbA1c).

**Kanaya AM et.al., (2014)** conducted the study on restorative Yoga, Fat Distribution and Metabolic Risk Factors Practicing Restorative Yoga vs. Stretching for the Metabolic Syndrome (PRYSMS) Intensive lifestyle interventions have prevented or delayed type 2 diabetes studies reveal that aerobic exercise is beneficial. In overall and regional fat weight loss, but might not be feasible for obese, sedentary adults. The effects of gentle physical activity, such as restorative yoga and active stretching, on fat distribution and improving metabolic factors have not been assessed. A 48-week randomized trial comparing restorative yoga vs. active stretching in overweight adults (ages 21-65 years) with the metabolic syndrome (IDF criteria) was conducted. Participants were underactive (<150 minutes/wk of exercise) and not taking anti-diabetes medications, niacin, fibrates, and hormones. Lifestyle counseling and a tapering series of 90-min group classes in the 24-week intervention period and 24-week maintenance period was given. Weight, visceral and subcutaneous fat (by computed tomography, fasting and 2-h glucose, HbA1c, triglycerides, HDL-cholesterol, insulin, and systolic blood pressure were measured by computed tomography at baseline, 6- and 12-months. 180 participants were randomized and 135 (75%) completed the trial. Mean age was 55 years and mean BMI was  $34 \text{ kg/m}^2$ . Waist,

weight and subcutaneous fat, decreased significantly after 6 and 12 months (by 2.1 cm, 1.7 kg, 34 cm<sup>2</sup>) in the yoga group, whereas waist decreased by 1.1 cm at 12 months, and weight decreased only at 6 months (by 0.7 kg) in the stretching group. Subcutaneous fat decreased significantly in the yoga vs. stretching group after 6 and 12 months, but visceral fat did not change in either group. At 12 months, fasting glucose decreased more in the yoga group than in the stretching group (-0.35 mmol/L vs. -0.03 mmol/L; p=0.002); there were no other considerable differences between groups. At 6 months favorable changes within the yoga group included reductions in fasting glucose, insulin, and HbA1c and an increase in HDL-cholesterol that were not sustained at 1 year except changes in fasting glucose. The stretching group had a significant decline in triglycerides at 6 months which was not sustained at 1 year. Restorative yoga was efficient in reducing and sustaining reduction in waist, weight, and subcutaneous fat, and was marginally better than active stretching for improving fasting glucose.

**Singh S et.al., (2008)** conducted the study on influence of pranayamas and yoga-asanas on serum insulin, blood glucose and lipid profile in type 2 diabetes. A distinguishable feature of type 2 diabetes besides hyperglycemia and deranged lipid profile is an impaired insulin secretion, peripheral insulin resistance and obesity which have become a major health concern worldwide. India with an estimated 31million diabetics in 2000 and 79millions by the yr 2030 has the highest number of type 2 diabetics in the world. The purpose of this study is to determine whether yoga, asanas and pranayamas have any influence in modifying certain bio-chemical parameters. Sixty patients of uncomplicated type 2 diabetes (age 35-60 yrs of 1-10 yrs duration) were divided into two groups: Group 1 (n=30): performed yoga along with the conventional hypoglycemic medicines and group 2 (n=30), patients who only received conventional medicines. Study was conducted on duration of 45 days. Basal recordings of blood glucose (fasting and post-prandial), lipid profile and serum insulin were taken at the time of recruitment and the second reading after forty five days. Results showed a significant improvement in all the bio-chemical parameters in group 1 while group 2 showed notable improvement in only few parameters, thus proposing beneficial effect of yoga regimen on these parameters in diabetic patients.

**Nagarathna SR et.al., (2012)** conducted the randomized control study on efficacy of yoga based life style modification program on medication score and lipid profile in type 2 diabetes. Several studies have documented the beneficial short term effects of yoga in type 2 diabetics. In this potential two-armed interventional randomized control study, 277 type 2 diabetics of both genders aged above 28 years who fulfilled the study criteria were recruited from 5 zones in and around Bengaluru, India. They were subjected to a yoga-based life style modification program or exercise-based life style modification program. Integrated yoga special technique for diabetes included yogasanas, pranayama, meditation and lectures on yogic life style. Control intervention included physical exercises and life style education. Medication score, blood glucose, HbA1c and lipid profile were assessed at baseline and after 9 months. Intention to treat analysis showed better reduction ( $p < 0.05$ , Mann-Whitney test) in the dose of oral hypoglycemic medication required (Yoga-12.8 %) (Yoga-12.3 %) and increase in HDL (Yoga-7 %) in Yoga as compared to the control group; FBG reduced (7.2 %,  $P = 0.016$ ) only in the Yoga group. There was significant decline within groups ( $P < 0.01$ ) in PPBG (Yoga-14.6 %, Control-9 %), HbA1c (Yoga-14.1 %, Control-0.5 %), Triglycerides (Yoga-15.4 %, Control-16.3 %), VLDL (Yoga-21.5 %, Control-5.2 %) and total cholesterol (Yoga-11.3 %, Control-8.6 %). Thus, the study proved that yoga based life style modification program is correspondent to exercise-based life style modification in reducing blood glucose, HbA1c, triglycerides, total cholesterol and VLDL. Yoga is better than exercise in decreasing oral hypoglycemic medication requirement and LDL; and increasing HDL in type 2 diabetics.

**Netam R et.al., (2015)** conducted the study on interleukin-6, vitamin D & diabetes risk-factors modified by a short-term yoga-based lifestyle intervention in overweight/obese individuals. Short term yoga-based lifestyle intervention programs have shown efficiency in weight loss and decline in incidence of diabetes. The investigations conducted include investigation if interleukin (IL)-6, vitamin D, neopterin, vaspin, and diabetes risk factors can be modified by a short-term yoga-based lifestyle intervention in overweight/obese subjects. In this pilot study, 34 overweight/obese [body mass index (BMI)  $\geq 23$  to  $< 35$  kg/m<sup>2</sup>] per Asian cut-off values] individuals were enrolled, and received directly supervised intervention for

10 days. Thereafter, they were directed to follow this yoga-based lifestyle at home for one month, and were reassessed for study variables at day 30. There was a reduction from baseline to day 10 in weight ( $p < 0.001$ ), BMI ( $p < 0.001$ ), waist/hip-ratio ( $p < 0.05$ ), blood glucose ( $p < 0.01$ ), and a significant improvement in lipid profile. There was a reduction in median fasting insulin ( $p < 0.05$ ), homeostatic model assessment-insulin resistance ( $p < 0.01$ ), and IL-6 ( $p < 0.05$ ). A non-significant increase in 25-OH-vitamin D and a decrease in neopterin and vaspin were observed. Twenty subjects returned for follow up assessments. At day 30, weight loss was sustained while systolic blood pressure also showed reduction ( $p < 0.05$ ). Changes in vitamin D levels were significantly and negatively correlated with changes in weight, BMI and fasting blood glucose, and positively with change in high density lipoprotein. Changes in body weight and BMI significantly and positively correlated with insulin. Changes in IL-6 levels positively and significantly correlated with change in neopterin levels. The findings displayed that IL-6, vitamin D, and diabetes risk factors were favorably changed by a short-term yoga-based lifestyle intervention in obesity. This study also emphasized the challenges in compliance associated with the follow up of subjects following an aggressive supervised intervention of 10 days.

**Balaji PA et.al., (2011)** conducted the study on influence of yoga - pranayama practices on metabolic parameters and anthropometry in type 2 diabetes. India being the diabetic capital of the world, there is a rise in the incidence of type 2 diabetes with the increase in age, physical inactivity and sedentary lifestyle. So, the present study was undertaken to assess the strength of association of these factors and the effects of yoga-pranayama in type 2 diabetes. 44 uncomplicated type 2 diabetic patients in the age group of 40-55 years were selected, with diabetes duration of 1-10 years. They were divided into test group and control groups with 22 patients in each group. The test group (T1 and T2) were taught yoga and pranayama for 3 continuous months, 1 hour every day in the morning by a yoga expert. The results showed significant decrease in metabolic parameters, with  $p < 0.001$  in FBS of both the T1 and T2 sub groups [T1-182.87 + 45.55 to 135.77 + 38.88, T 2 – 160.64 + 41.22 to 130.82 + 36.11], PPBS with  $p < 0.001$  [ T1-270.64 + 76.6 to 196.90 + 64.67, T 2 – 230.62 + 71.32 to 183.46 + 52.20], Hb A 1c with  $p < 0.001$  in both the T1 and T2 sub groups, [T1- 9.77 + 0.5 % to 7.68 + 0.4% and T 2 – 8.46 + 0.3% to 7.23 + 0.3%]. There was significant decrease

with  $p < 0.001$  in triglycerides of both the T1 and T2 sub groups, [T1-  $170 + 70.55$  to  $132.2 + 60.6$ , T 2 –  $164 + 80.66$  to  $1143.1 + 28.89$ ]. There was significant decrease with  $p < 0.001$  in LDL of both the T1 and T2 sub groups [T1-  $108 + 36.24$  to  $98 + 33.2$ , T 2 –  $101.28 + 32.34$  to  $86.21 + 27.2$ ]. However, no significant change in HDL levels in test groups (T1 and T2). It also showed significant decrease in weight, BMI and waist-hip ratio in test group. Addition to above benefits there was significant decrease in the requirement of insulin per day in the T2, from  $36.42 + 4.2$  units to  $31.48 + 3.2$  units. There were no major changes in the control group. Thereby concluding that, there are noteworthy benefits of yoga pranayama practices on metabolic parameters and anthropometric measurements in uncomplicated type 2 diabetes.

**Gordon LA et.al., (2008)** investigated the study on effect of exercise therapy on lipid profile and oxidative stress indicators in patients with type 2 diabetes. Yoga has been proved to be a simple and economical therapeutic modality that may be considered as a favourable adjuvant for type 2 diabetes mellitus. This study investigated the impact of Hatha yoga and conventional physical training (PT) exercise regimens on bio-chemical, oxidative stress indicators and oxidant status in patients with type 2 diabetes. This prospective randomized study consisted of 77 type 2 diabetic patients in the Hatha yoga exercise group that were matched with a similar number of type 2 diabetic patients in the conventional PT exercise and control groups. Bio-chemical parameters such as fasting blood glucose (FBG), serum total cholesterol (TC), triglycerides, low-density lipoprotein (LDL), very low-density lipoproteins (VLDL) and high-density lipoprotein (HDL) were determined at baseline and at two consecutive three monthly intervals. The oxidative stress indicators (malondialdehyde - MDA, protein oxidation - POX, phospholipase A2 - PLA2 activity) and oxidative status [superoxide dismutase (SOD) and catalase activities] were measured. The concentrations of FBG in the Hatha yoga and conventional PT exercise groups after six months decreased by 29.48% and 27.43% respectively ( $p < 0.0001$ ) and there was a significant reduction in serum TC in both groups ( $p < 0.0001$ ). The concentrations of VLDL in the managed groups after six months differed significantly from baseline values ( $p = 0.036$ ). Lipid peroxidation as indicated by MDA significantly decreased by 19.9% and 18.1% in the Hatha yoga and conventional PT exercise groups respectively ( $p < 0.0001$ ); whilst the activity of SOD significantly increased by 24.08% and 20.18%

respectively ( $p = 0.031$ ). There was no prominent difference in the baseline and 6 months activities of PLA2 and catalase after six months although the latter increased by 13.68% and 13.19% in the Hatha yoga and conventional PT exercise groups respectively ( $p = 0.144$ ). The study determine the efficacy of Hatha yoga exercise on fasting blood glucose, lipid profile, oxidative stress markers and antioxidant status in patients with type 2 diabetes and recommend that Hatha yoga exercise and conventional PT exercise may have therapeutic preventative and protective effects on diabetes mellitus by decreasing oxidative stress and developing antioxidant status.

**Malhotra V et.al., (2005)** conducted the study on the how Yoga is beneficial to diabetic patients. Twenty NIDDM subjects (mild to moderate diabetics) in the age group of 30-60 years were selected from the outpatient clinic of G. T. B. hospital. They were on a 40 days yoga asana regime under the supervision of a yoga expert. 13 specific Yoga asanas < or = done by Type 2 Diabetes Patients included. Surya Namaskar, Trikonasana, Tadasana, Sukhasana, Padmasana, Bhastrika Pranayama, Pashimottanasana, Ardhmatsyendrasana, Pawanmuktasana, Bhujangasana, Vajrasana, Dhanurasana and Shavasana are beneficial for diabetes mellitus. Serum insulin, plasma fasting and one hour postprandial blood glucose levels and anthropometric parameters were measured before and after yoga asanas. The outcome of the study that there was significant decrease in fasting glucose levels from basal 208.3 +/- 20.0 to 171.7 +/- 19.5 mg/dl and one hour postprandial blood glucose levels decreased from 295.3 +/- 22.0 to 269.7 +/- 19.9 mg/dl. The exact mechanism as to how these postures and controlled breathing interact with somatoendocrine mechanism affecting insulin kinetics was worked out. A significant decrease in waist-hip ratio and changes in insulin levels were also observed, advocating a positive effect of yoga asanas on glucose utilisation and fat redistribution in NIDDM. Yoga asanas may be used as an adjunct with diet and drugs in the management of Type 2 diabetes.

**Chimkode SM et.al., (2015)** conducted the study on effect of yoga on blood glucose levels in patients with type 2 diabetes mellitus. 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). To examine the beneficial

influence of yoga on blood glucose levels in normal and T2DM volunteers. 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 learn yoga training at yoga centre were included in the control group. All the participants were imparted training yoga experts and subjected to regular practice under supervision for six months. In all the participants Fasting Blood Sugar (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. 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. There was a decline 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 trivial ( $p < 0.05$ ) in control group. The results of the present study demonstrated that the yoga is effective in reducing the blood glucose levels in patients with T2DM.

**Manjunatha S et.al., (2005)** conducted the study on an investigation into the acute and long-term effects of selected yogic postures on fasting and postprandial glycemia and insulinemia in healthy young subjects. The study was conducted to examine the hypothesis that yogasanas help in the treatment of diabetes mellitus by releasing insulin from the pancreas. The subjects of the study were twenty healthy and young volunteers out of which 17 were male and 3 were female age group (19-31 Years). Each volunteer performed four sets of asanas in random order for 5 consecutive days each with a 2-day gap between consecutive sets of asanas. The four sets of asanas were: (I) dhanurasana + matsyendrasana, (II) halasana + vajrasana, (III) naukasana + bhujangasana, and (IV) setubandhasana + pavanamuktasana. Blood samples were

collected on days 4 and 5 of each set of asanas for measurement of glucose and insulin levels before the asanas, within 10 min after performing the asanas, and 30 min after ingestion of 75 g glucose, which in turn was ingested immediately after the second blood sample. A standard 75 g Oral Glucose Tolerance Test (OGTT) was also done before and after the study. On the days of the pre-study or post-study OGTT, no asanas were done. The serum insulin levels after the asanas were lower ( $p < 0.05$ ) than those before the asanas. Anyhow, the serum insulin level 0.5 h after the post-asana oral 75 g-glucose challenge was higher ( $p < 0.05$ ) in Set IV than the 0.5 h postprandial insulin level in the pre-study OGTT; the same trend was observed in other sets as well although statistically not significant. The observations suggest that the performance of asanas led to increased sensitivity of the B cells of pancreas to the glucose signal. The increased sensitivity seems to be a sustained change resulting from a progressive long-term effect of asanas. The study is noteworthy in that it has for the first time attempted to probe the mechanism by which yogasanas help diabetes mellitus.

**Maninder Bindra et.al., (2013)** conducted the study on influence of pranayamas and yoga asanas on blood glucose, lipid profile and HbA1c in type 2 diabetes. Characteristic features of type II diabetes besides hyperlipidemia a hyperglycemia is impaired insulin secretion and obesity and is a major health hazard. The purpose of the study aimed to see whether pranayama and yoga asanas have any influence on certain parameters. 100 patients of type-II D. M. without complications (aged 35 to 65 years) were divided in to two groups. Group-I patients received conventional medicines alone while group II patients performed yoga along with conventional medicine. Duration of study was 90 days. Basal recordings of blood glucose, lipid profile and HbA1C were taken at the time of recruitment and second reading after 90 days of study. Results displayed a notable improvement of all biochemical parameters except TG in group II patients while group I patients showed insignificant improvement thus broadcasting the favourable effect of yoga regimen on these parameters in diabetic patients.

**Rajesh P et.al., (2013)** conducted the study on the effect of yoga therapy on anthropometry, metabolic parameters and cardiac autonomic function tests in type 2 diabetes mellitus patients. 120 diabetic patients in the age group of 30- 60 years were

selected. The total population was divided into two groups based on age, group I (GI) consisting of 30-45 years and group II (GII) consisting of 46-60 years. The yoga therapy consisting of asana, Pranayamas, bandhas and mudras was practiced by the patients enrolled in the study daily for one hour for 100 days. Fifty one subjects in group I and forty seven subjects in group II participated till the end of the study. Bio-chemical tests and cardiac autonomic function tests were conducted before and after 100 days of therapy. The mean values of various parameters before and after the 100 days of therapy were as follows, fasting blood glucose changed from  $155.6 \pm 16.5$  to  $130.4 \pm 14$  in GI,  $205.4 \pm 48.9$  to  $174.6 \pm 40$  in GII, cardiac autonomic function score changed from  $6.9 \pm 1.37$  to  $4.8 \pm 1.13$  in GI,  $7.06 \pm 1.29$  to  $5.21 \pm 1.71$  in GII. From the study it is concluded that yoga therapy plays a prominent in reduction of blood glucose and better cardiac autonomic functioning in patients with Type-2 diabetes mellitus in conjunction with medical therapy and the benefit is more pronounced when yoga therapy is started at an earlier age.

**Rast SD et.al., (2013)** conducted the study on the effect of yoga training on lipid profile and blood glucose in type II diabetic females. This work has been conducted to examine the impact of 8 weeks of yoga training on blood glucose and lipid profile in patients with type II diabetes. In this quasi-experimental study, 30 women with type II diabetes and between 45 to 60 years old were randomly selected and divided into two (n= 15) groups of experimental and control. Regular yoga training for 8 weeks (3 sessions per week, 60 minutes per session) was given to Experimental Group whereas the Control Group did not get any regular exercise. The dependent variables were Total Cholesterol (TC), triglycerides (TG), Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), and blood glucose and were examined before and after exercise training in both groups. Results indicated a significant difference in the changed levels of total cholesterol, triglycerides, LDL, HDL, and blood glucose between the control and experimental groups ( $p \leq 0.05$ ). Based on our results, it can be said that, yoga is a non-drug, non-invasive and cost-effective method to improve the quality of life. In addition, the effects of yoga on the connection of mind and body and reducing stress hormones have been proved since long times. Therefore, it seems that, patients with type II diabetes, along with fully compliance with their diet, can benefit these exercises in order to control some risk factors linked with diabetes.

**Aswathy S et.al., (2013)** conducted the study on effective management of type 2 DM in India: Looking at low-cost adjunctive therapy. A randomized study done in India found a significant improvement in fasting blood sugar, HbA1c, and total cholesterol with yoga therapy. Notable improvements in scores of psychological assessment (satisfaction, impact, and worry) were also seen. Clinically significant reduction in the doses of hypoglycemic agents and insulin were observed after yoga lifestyle intervention. Another study (a more rigorous, inpatient yoga treatment accompanied by visceral cleansing procedures, in addition to Asanas and Pranayama) was undergone on 149 patients for 40 days. This study showed that, for type 2 diabetes of less than 10yrs duration and fasting glucose <140 mg/dl, hyperglycemia can be controlled by yoga alone. However, patients with very severe hyperglycemia/glucose intolerance would need a combination of yoga and hypoglycemic drugs Bijlani et al., within a short period of study for 10 days was able to show a significant reduction in fasting glucose, total cholesterol, LDL, VLDL, total cholesterol/HDL ratio with yoga therapy; these were more marked in those with hypercholesterolemia and hyperglycemia. In addition to reporting, a fall in fasting glucose and post-meal blood glucose. Thus, it is recommend that yoga be considered as a candidate for community-based management programs in tackling the burden of type 2 diabetes. Yoga is a potential intervention that is not resource-intensive. If studies prove the effectiveness of yoga, the future may see the emergence of a “Yoga movement by the people with diabetes” to generate positive health. And finally, yoga, an transformation created in India, could find its way back to pre-eminence in this country, given its potential in the ever-increasing epidemic of diabetes and cardiovascular disease.

**Malhotra V et.al., (2002)** conducted the study on the yoga asanas in assessment of pulmonary function in NIDDM patients. Certain specified Yoga asanas if practiced regularly are known to have beneficial effects on human body. These yoga practices might be interacting with various, somato-neuro-endocrine mechanisms to have therapeutic effects. The present study done in twenty four NIDDM patients of 30 to 60 year old provides metabolic and clinical evidence of improvement in glycaemic control and pulmonary functions. These middle-aged subjects were type II diabetics on antihyperglycaemic and dietary regimen. Their baseline fasting and postprandial blood glucose and glycosylated Hb were monitored along with pulmonary function studies.

The expert impart these patients training in yoga asanas and was pursued 30-40 min/day for 40 days under guidance. These asanas consisted of 13 well known postures, done in a sequence. After 40 days of yoga asanas regimen, the parameters were repeated. The results proved that there was significant decrease in fasting blood glucose levels (basal 190.08 +/- 90.8 in mg/dl to 141.5 +/- 79.8 in mg/dl). The postprandial blood glucose levels also decreased (276.54 +/- 101.0 in mg/dl to 201.75 +/- 104.1 in mg/dl), glycosylated hemoglobin showed a decrease (9.03 +/- 1.4% to 7.83 +/- 2.6%). The FEV1, FVC, PEF, MVV increased significantly (1.81 +/- 0.4 lt to 2.08 +/- 0.4 lt, 2.20 +/- 0.6 lt to 2.37 +/- 0.5 lt, 3.30 +/- 1.0 lt/s to 4.43 +/- 1.4 lt/s and 64.59 +/- 25.7 lt min to 76.28 +/- 28.1 lt/min respectively). FEV1/FVC% improved (85 +/- 0.2% to 89 +/- 0.1%). These findings show that better glycaemic control and pulmonary functions can be obtained in NIDDM cases with yoga asanas and pranayama. The exact mechanism as to how these postures and controlled breathing interact with somato-neuro-endocrine mechanism affecting metabolic and pulmonary functions remains to be worked out.

**Innes KE et.al., (2011)** conducted the study on association of fructosamine to indices of dyslipidemia in older adults with type 2 diabetes. To evaluate the association of serum fructosamine values to lipid profiles and to other indices of glycemia both at baseline and over time in adults with type 2 diabetes (T2DM). Forty adults aged 45 or older with T2DM, not taking insulin, and an HbA1c of 6-10% were subjected to a randomized controlled trial regarding the effects of an 8-week yoga program on glycemia and related cardiovascular disease risk indices in adults with T2DM. Fasting blood was drawn to determine glycemia (HbA1c, glucose, and fructosamine) and dyslipidemia (LDL, HDL, total cholesterol, cholesterol:HDL ratio, LDL:HDL ratio, and triglycerides) pre and post-intervention. Since the relation of fructosamine to other indices of glycemia and to lipid profiles did not differ between treatment groups either at baseline or over time, groups were pooled for analysis. Baseline fructosamine values were significantly correlated with HbA1c ( $r=0.77$ ,  $p<0.0001$ ), glucose ( $r=0.72$ ,  $p<0.0001$ ), LDL:HDL ratio ( $r=0.46$ ,  $p=0.01$ ), cholesterol:HDL ratio ( $r=0.55$ ,  $p=0.002$ ), and triglycerides ( $r=0.39$ ,  $P=0.032$ ), but not to other lipid indices at baseline. Change in fructosamine over 8 weeks was significantly correlated with change in HbA1c ( $r=0.63$ ,  $P=0.0001$ ), glucose ( $r=0.39$ ,  $p=0.029$ ), cholesterol ( $r=0.65$ ,  $p<0.0001$ ), LDL ( $r=0.55$ ,  $P=0.001$ ), LDL:HDL ratio ( $r=0.53$ ,  $P=0.003$ ), and cholesterol:HDL ratio

( $r=0.52$ ,  $P=0.002$ ), and was more strongly related to change in lipid values than were other indices of lycemia. Fructosamine was significantly correlated with measures of dyslipidemia and glycemia both at baseline and over time, and may represent a relatively sensitive and low cost index of short to medium term change in both glycemia and certain lipid profiles. Although, findings from this study should be interpreted with caution, and warrants replication in larger prospective studies.

**Madanmohan et.al., (2012)** conducted the study on the effect of yoga therapy on reaction time, bio-chemical parameters and wellness score of pre and post-menopausal diabetic patients. Yogic practices may assist in the prevention and management of Diabetes Mellitus (DM) and reduce cardiovascular complications in the population. The present study has been undertaken ascertain the effect of yoga therapy on reaction time, bio-chemical parameters and wellness score of peri and post-menopausal diabetic patients.<sup>15</sup> Pre and post-menopausal patients receiving standard medical treatment for type 2 DM were recruited and reaction time and bio-chemical investigations were done before and after a comprehensive yoga therapy program comprising of three times a week sessions for six weeks. A post-intervention, retrospective wellness questionnaire compiled by ACYTER was used to evaluate the comparative feelings of the patients after the therapy program. Yoga training reduced Auditory Reaction Time (ART) from right as well as left hand, the decrease being statistically significant ( $p<0.05$ ) for ART from the right hand. There was a significant ( $p<0.01$ ) decrease in fasting and postprandial blood glucose levels as well as low density lipoprotein. The decrease in total cholesterol, triglycerides, and very low density lipoprotein and increase in high density lipoprotein was also statistically significant ( $p<0.05$ ). All the lipid ratios showed considerable improvement with a decrease ( $p<0.01$ ) of TC/HDL and LDL/HDL ratios and increase ( $p<0.05$ ) in the HDL/LDL ratio. Shortening of RT implies an improvement in the information processing and reflexes and is the first such report in diabetic patients. This has clinical significance and is worth further exploration with wider, well controlled, randomized studies in the diabetic population. Changes in blood glucose levels may be due to improved insulin sensitivity, decline in insulin resistance and increased sensitivity of the pancreatic b cells to glucose signals. Yoga raised the 'heart friendly' status of lipid profile in our subjects and as our participants was pre and post-menopausal, the

decrease in cardiovascular risk profile is of greater significance. A comprehensive yoga therapy program has the potential to augment the beneficial effects of standard medical management of diabetes mellitus and can be used as an effectual complementary or integrative therapy program.

**Shantakumari N et.al., (2013)** conducted the study on the effects of a yoga intervention on lipid profiles of diabetes patients with dyslipidemia. The present study was conducted to analyse the effectiveness of yoga in the management of dyslipidemia in patients of type 2 diabetes mellitus. This randomized parallel study was carried out in Medical College Trivandrum, Kerala, India. Hundred type 2 diabetics with dyslipidemia were randomized into control and yoga groups. Oral hypoglycemic drugs were prescribed to the Control Group. The yoga group practiced yoga daily for 1 hour duration along with oral hypoglycemic drugs for 3 months. The lipid profiles of both the groups were compared at the start and at the end of 3 months. After intervention with yoga for a period of 3 months the study group indicated a decrease in total cholesterol, triglycerides and LDL, with an improvement in HDL. Yoga, being a lifestyle incorporating exercise and stress management training, targets the raised lipid levels in patients with diabetes through integrated approaches.

**Bijlani RL et.al., (2005)** conducted the study on comprehensive lifestyle education program based on yoga reduces risk factors for cardiovascular disease and diabetes mellitus. The purpose of the study was to determine the short-term impact of a brief lifestyle intervention based on yoga on some of the bio-chemical indicators of risk for cardiovascular disease and diabetes mellitus. The variables of interest were measured at the beginning (day 1) and end (day 10) of the intervention using a pre-post design. The study is the result of operational research carried out in our Integral Health Clinic (IHC). The IHC is an outpatient facility which conducts 8-day lifestyle modification programs based on yoga for prevention and management of chronic disease. A new course begins every alternate week of the year. The study is based on data collected on 98 subjects (67 male, 31 female), ages 20-74 years, who attended one of our programs. The subjects were a heterogeneous group of patients with hypertension, coronary artery disease, diabetes mellitus, and a variety of other illnesses. The intervention consisted of asanas (postures), pranayama (breathing exercises),

relaxation techniques, group support, individualized advice, lectures and films on the philosophy of yoga and the place of yoga in daily life, meditation, stress management, nutrition, and knowledge about the illness. The outcome measures were fasting plasma glucose and serum lipoprotein profile. These variables were determined in fasting blood samples, taken on the first and last day of the course. Fasting plasma glucose, serum total cholesterol, low-density lipoprotein (LDL) cholesterol, very-LDL cholesterol, the ratio of total cholesterol to high density lipoprotein (HDL) cholesterol, and total triglycerides were significantly lower, and HDL cholesterol significantly higher, on the last day of the course compared to the first day of the course. The changes were prominent in subjects with hyperglycemia or hypercholesterolemia. The observations recommend that a short lifestyle modification and stress management education program leads to favorable metabolic effects within a period of 9 days.

**Chaya MS et.al., (2008)** conducted the study on the insulin sensitivity and cardiac autonomic function in young male practitioners of yoga. While yoga is believed to reduce the risk of chronic non-communicable diseases such as diabetes, there are no studies on insulin sensitivity in long term practitioners of yoga. The insulin sensitivity and cardiac autonomic function is in long term practitioners of yoga. Fifteen healthy, young, male practitioners of yoga were compared with 15 young, healthy males who did not practice yoga matched for body-mass index was assessed. Fasting insulin sensitivity was measured in the fasting state by the hyperinsulinaemic-euglycaemic clamp. There were no prominent differences between the groups in their anthropometry or body composition. On the other hand, the fasting plasma insulin was significantly lower in the yoga group. The yoga group was also more insulin sensitive (yoga 7.82 [2.29] v. control 4.86 [11.97] (mg/[kg. min])/(microU/ml),  $p < 0.001$ ). While the body weight and waist circumference were negatively correlated with glucose disposal rate in the controls, there were no similar correlations in the yoga group. The yoga group had remarkably higher low-frequency power and lower normalized high-frequency power. Long term yoga practice (for 1 year or more) is associated with increased insulin sensitivity and attenuates the negative relationship between body weight or waist circumference and insulin sensitivity.

**Hemant H Mahapureet.al., (2008)** conducted the study on effect of yogic exercise on super oxide dismutase levels in diabetics. Reactive oxygen species are known to aggravate disease progression. To counteract their harmful effects, the body produces various antioxidant enzymes, viz, superoxide dismutase, glutathione reductase etc. Literature reviews revealed that exercises help to boost antioxidant enzyme systems; hence, yogic exercises may be useful to combat various diseases. This study aims to record the potency of yoga on superoxide dismutase, glycosylated hemoglobin (Hb) and fasting blood glucose levels in diabetics. Forty diabetics aged 40-55 years were assigned to experimental (30) and control (10) groups. The experimental subjects underwent a Yoga program comprising of various Asanas (isometric type exercises) and Pranayamas (breathing exercises) along with regular anti-diabetic therapy whereas the control group was given anti-diabetic therapy only. Heparinized blood samples were used to determine erythrocyte superoxide dismutase (SOD) activity and glycosylated Hb levels and fasting blood specimens collected in fluoride Vacutainers were used for assessing blood glucose. Data were analyzed by using  $2 \times 2 \times 3$  Factorial ANOVA followed by Scheffe's posthoc test. The results revealed that Yogic exercise enhanced the levels of Superoxide dismutase and reduced glycosylated Hb and glucose levels in the experimental group as compared to the control group. The findings conclude that Yogic exercises have enhanced the antioxidant defense mechanism in diabetics by reducing oxidative stress.

**Pasyar N et.al., (2015)** conducted the study aimed to evaluate the effectiveness of Benson's relaxation technique in improving the hemodialysis patients' dietary and fluid adherence and biomedical markers. This randomized controlled trial with a pre-post test design was conducted on 86 hemodialysis patients randomly divided into an intervention (receiving Benson's relaxation technique) and a control group (usual care). The setting of the study was two hemodialysis units affiliated to Shiraz University of Medical Sciences, Shiraz, Iran. The patients listened to the audiotape of Benson's relaxation technique twice a day each time for 20 min for 8 weeks. Dietary and fluid adherence and some biomedical markers were measured in both the intervention and the control group at baseline and at the 8th week after the intervention. The results displayed remarkable differences between the two groups regarding blood urea nitrogen and phosphate as dietary adherence and inter dialytic weight gain as fluid adherence in

the 8th week of the intervention ( $p < 0.05$ ). Also, a considerable difference was found between the two groups concerning blood glucose level after the intervention ( $p < 0.05$ ). This study highlighted the significance of Benson's relaxation technique in improvement of adherence and some biomedical markers in hemodialysis patients. Thus, Benson's relaxation therapy be used as a part of the nursing care practice for hemodialysis patients and those having from chronic diseases.

**Bhavanani AB et.al., (2013)** conducted the study to analyse the effects of the training on the participants' health and Quality of Life (QoL) Materials and Methods: 60 healthy nursing students (12 M, 48 F) aged  $18.60 \pm 0.67$  (SD) y were recruited, and 60 min of yoga training was given twice weekly, for 6 months. Selected bio-chemical and hematological parameters were recorded along with Ferrans and Powers QoL index before and after the training period. QoL was also tested at mid term. The results show that Post intervention statistical analysis (repeated measures of ANOVA) revealed highly significant and beneficial changes in most hematological and bio-chemical parameters. Major findings are enhanced bone marrow function, reduced allergic tendency, alkalization of urine, metabolic reconditioning (with special emphasis on liver function) and improvement in all QoL indices. These changes correlated positively with the subjects' frequency of attendance, as evidenced by Pearson's linear correlation testing. There were also significant development in QoL index and its subscales, both at mid training and post training. These improvements also correlated positively with attendance. The present study shows evidence of the beneficial psychological and physical effects of yoga training amongst graduate nursing course students. It is suggest that yoga be made an integral part of medical and paramedical collegiate education.

**Gordon L et.al., (2013)** conducted a study on effect of Yoga exercise therapy on Oxidative stress indicators with end-stage renal disease on hemodialysis. The incidence and prevalence of Chronic Kidney Disease (CKD) are increasing worldwide. All the participants were from Hemodialysis unit at University Hospital of the West Indies. The patients were end stage renal disease, between 20-70 years, good psychological condition, and non-smoker, non-alcoholic. The yoga exercise consisted of pranayama (breath-control exercise), asanas (Yogic postures), and supine (relaxation in savasana - corpse pose) and the participants in control group continued their regular

lifestyle practice without any intervention. A total 66 participants (33 cases in the Yoga group and 33 comparison control group) were taken for a 4 months study. The Hatha Yoga had an effect on the bio-chemical parameters of pre and post-hemodialysis patients. They were applied with Fisher exact test and 0.05 was taken to the cut-off for acceptability of significance levels. The efficacy of Hatha Yoga exercise was on the oxidative stress markers and antioxidants status in patients with ESRD. It was concluded that it has a therapeutic, preventative and protective effects in ESR by decreasing the oxidative stress.

**Cui J et.al., (2017)** conducted a study on the effects of Yoga in Adults with type 2 diabetes mellitus, a meta-analysis. This meta-analysis study was carried out to evaluate the efficacy of yoga in adults with type 2 diabetes mellitus. The Pubmed, Embase and Cochrane databases were searched to obtain eligible randomized controlled trials. The primary outcome was fasting blood glucose, and the secondary outcomes included glycosylated hemoglobinA1c, total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol, triglyceride and postprandial blood glucose. Weighted mean differences and 95% Confidence Intervals (CIs) were calculated. The statistic represented heterogeneity. A total of 12 randomized controlled trials with a total of 864 patients met the inclusion criteria. The pooled weighted mean differences were -23.72 mg/dL (95% CI -37.78 to -9.65;  $p = 0.001$ ;  $I^2 = 82\%$ ) for fasting blood glucose and -0.47% (95% CI -0.87 to -0.07;  $p = 0.02$ ;  $I^2 = 82\%$ ) for hemoglobin A1c. The weighted mean differences were -17.38 mg/dL (95% CI -27.88 to -6.89;  $P = 0.001$ ;  $I^2 = 0\%$ ) for postprandial blood glucose, -18.50 mg/dL (95% CI -29.88 to -7.11;  $p = 0.001$ ;  $I^2 = 75\%$ ) for total cholesterol, 4.30 mg/dL (95% CI 3.25 to 5.36;  $p < 0.00001$ ;  $I^2 = 10\%$ ) for high-density lipoprotein cholesterol, -12.95 mg/dL (95% CI -18.84 to -7.06;  $p < 0.0001$ ;  $I^2 = 37\%$ ) for low-density lipoprotein cholesterol and -12.57 mg/dL (95% CI -29.91 to 4.76;  $p = 0.16$ ;  $I^2 = 48\%$ ) for triglycerides. It was concluded that the yoga benefits adult patients with type 2 diabetes mellitus. However, considering the limited methodology and the potential heterogeneity, further studies are necessary to support the findings and investigate the long-term effects of yoga in type 2 diabetes mellitus patients.

**Purnima Datey and Alex Hankey (2017)** conducted a study on lowering Creatinine levels by Herbal Treatment and Yoga, A Pilot Controlled Trial to measure the kidney dysfunction, with its low life expectancy problems. The only commonly used recognized means to lower creatinine levels is dialysis. The study present the results of a pilot controlled trial that creatinine levels can be lowered of newly diagnosed diabetic patients by treating with herbal juices with yoga or only Yoga. A total of 112 incarcerated males aged  $40.8 \pm 11.1$  yrs with newly diagnosed elevated fasting blood sugar levels were selected and a three month controlled trial was conducted on them.. The Intervention group was given fresh herbal juices and yoga, another group was given yoga without herbal juice and the control group without anything. Assessments of creatinine levels were made on days zero and 90, pre/post the intervention. The results showed significant reductions (all  $p < 0.001$ ) of creatinine levels in the herbal juices and yoga group ( $0.15 \pm 0.06$ ), and yoga alone group ( $0.09 \pm 0.06$ ) and Control group levels increased by  $0.12 \pm 0.07$ . Between group differences were also significant. Results suggest that a combination of daily intake of herbal juices and regular Yoga practice improves kidney function more than regular Yoga practice alone. The study was privately funded by Bhopal Central Jail and the first author. It was concluded that the decrease in Group 1 creatinine values was consistent with the research hypothesis, based on previous results obtained from patients attending the Rasahara (Herbal Juice) Clinics in the city of Bhopal. Out of ten recent kidney patients who attended the clinics and were on dialysis at the start of treatment, two have been able to return to normal kidney function, while clinically significant improvements have been seen in most of the others (about 40). The decrease in Group 2 patients, though less, was also statistically significant  $p < 0.0001$ . It is consistent with reports from a private kidney hospital in the city of Thrissur in the state of Kerala in South-West India, which treats kidney patients on a strict Yoga and life-style regime, and has unpublished records of many successful cases of bringing kidney patients off dialysis. It was suggested that these results require follow-up studies with larger numbers of patients to confirm trends seen in pre-diabetic participants in this study. Since the present Indian government is committed to encouraging practice of integrative medicine at its leading nationally funded AIIMS group of hospitals, further

studies should be carried out under leading nephrologists, and, if successful, similar treatments can be widely implemented.

### 2.3 STUDIES ON PSYCHOLOGICAL VARIABLES RELATED TO YOGA

**Kosuri M and Sridhar GR (2009)** conducted the study on Yoga Practices in diabetes improves physical and psychological outcomes. The objective of this study was to examine the effect of yoga practice on clinical and psychological outcomes in subjects with type 2 diabetes mellitus (T2DM). In a 40-day yoga camp at the Institute of Yoga and Consciousness, ambulatory subjects with T2DM not having significant complications ( $n = 35$ ) participated in a 40-day yoga camp, where yogic practices were administered by trained yoga teachers. Clinical, bio-chemical, and psychological well-being were studied at baseline and at the end of the camp. At the end of the study, there was a reduction of body mass index (BMI) ( $26.514 \pm 3.355$  to  $25.771 \pm 3.40$ ;  $P < 0.001$ ) and anxiety ( $6.20 \pm 3.72$  to  $4.29 \pm 4.46$ ;  $P < 0.05$ ) and an improvement in total general well-being ( $48.6 \pm 11.13$  to  $52.66 \pm 12.87$ ;  $p < 0.05$ ). Participation of subjects with T2DM in yoga practice for 40 days resulted in reduced BMI, improved well-being, and reduced anxiety.

**Benavides S and Caballero J (2009)** conducted the study on the ashtanga yoga for children and adolescents for weight management and psychological well-being an uncontrolled open study. The goal of this 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. A 12-week prospective Ashtanga yoga program enrolled twenty children and adolescents. 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. Anxiety symptoms decreased in the study. The result implied that Ashtanga yoga was found to be beneficial as a weight loss strategy in a predominately Hispanic population.

**Paulius Skruibis et.al., (2016)** studied about Internet-based modular program BADI for adjustment disorder: protocol of a randomized controlled trial. Adjustment disorder is one of the most common mental health diagnoses. This study is a two-armed Randomized Controlled Trial (RCT) to examine the effectiveness of a web-based intervention Brief Adjustment Disorder Intervention (BADI) for adjustment disorder symptoms. Study will provide new perception of modular internet-based interventions efficacy for adjustment disorders. The study will also provide information about the role of motivation and expectancies on engagement in modular internet-based interventions of BADI, it could be used very widely. It could become a cost-effective and accessible intervention for adjustment disorder.

**Paula MC Mommersteeg et.al., (2012)** conducted the study on higher levels of psychological distress is associated with a higher risk of incident diabetes during 18 year follow-up: results from the British household panel survey. Reviews have shown that depression is a risk factor for the development of type 2 diabetes. However, there is limited evidence for general psychological distress to be associated with incident diabetes. The intention of the present study was to test whether persons who report higher levels of psychological distress are at increased risk to develop type 2 diabetes during 18 years follow up, adjusted for confounders. A prospective analysis using data from 9,514 participants (41 years, SD=14; 44% men) of the British Household Panel Survey. The General Health Questionnaire 12 item version was used to assess general psychological distress, diabetes was measured by means of self-report. Cox proportional hazards regression models were used to calculate the multivariate-adjusted hazard ratio (HR) of incident diabetes during 18 years follow up, comparing participants with low versus high psychological distress at baseline (1991). A total of 472 participants developed diabetes 18 year follow up. Those with a high level of psychological distress had a 33% higher hazard of developing diabetes (HR=1.33, 95% CI 1.10-1.61), relative to those with a low level of psychological distress, adjusted for age, sex, education level and household income. After further adjustment for differences in level of energy, health status, health problems and activity level, higher psychological distress was no longer associated with incident diabetes (HR=1.10, 95% CI 0.91-1.34). Higher levels of psychological distress are a risk factor for the

development of diabetes during an 18 year follow up period. This association may be probably mediated by low energy level and impaired health status.

**Vizcaino M (2013)** conducted the study on the Hatha yoga practice for type 2 diabetes mellitus patients. This study was conducted to analyse the impact of Hatha yoga on glycemic control, psychological and physiological stress, and self-care for individuals with type 2 diabetes mellitus (T2DM). Ten sedentary individuals with T2DM who were non-insulin dependent, free of diabetes-related complications, and had no previous yoga experience completed therapeutic yoga classes for 6 weeks, 3 times per week. Glycemic control measures included fasting blood glucose, glycated hemoglobin, and fasting insulin. The State-Trait Anxiety Inventory, Perceived Stress Scale, and salivary cortisol were used to assess levels of stress, and the Summary of Diabetes Self-care Activities questionnaire was used to assess regimen adherence. There was no significant changes in glucose control or physiological stress were found; however, significant changes in perceived stress, state anxiety, and self-care behaviors were detected. Initial findings support further investigation of the benefits of Hatha yoga as a complementary therapy for those with T2DM.

**Gupta N et.al., (2006)** conducted the study on the effect of yoga based lifestyle intervention on state and trait anxiety. Considerable evidence exists for the place of mind body medicine in the treatment of anxiety disorders. Excessive anxiety is maladaptive. It is often supposed to be the major element of unhealthy lifestyle that contributes significantly to the pathogenesis of not only psychiatric but also many other systemic disorders. Among the approaches to reduce the level of anxiety has been the search for healthy lifestyles. The aim of the study was to observe the short-term impact of a comprehensive but brief lifestyle intervention, based on yoga, on anxiety levels in normal and diseased subjects. The study was the result of operational research accomplished in the Integral Health Clinic (IHC) at the Department of Physiology of All India Institute of Medical Sciences. The subjects had history of hypertension, coronary artery disease, diabetes mellitus, obesity, psychiatric disorders (depression, anxiety, and 'stress'), gastrointestinal problems (non-ulcer dyspepsia, duodenal ulcers, irritable bowel disease, Crohn's disease, chronic constipation) and thyroid disorders (hyperthyroidism and hypothyroidism). The intervention consisted of asanas,

pranayama, relaxation techniques, group support, individualized advice, and lectures and films on philosophy of yoga, the place of yoga in daily life, meditation, stress management, nutrition, and knowledge about the illness. The outcome measures were anxiety scores, taken on the first and last day of the course. Anxiety scores, both state and trait anxiety were considerably reduced. Among the diseased subjects substantial improvement was seen in the anxiety levels of patients of hypertension, coronary artery disease, obesity, cervical spondylitis and those with psychiatric disorders. The observations propose that a short educational programme for lifestyle modification and stress management leads to remarkable reduction in the anxiety scores within a period of 10 days.

**Kanojia S et.al., (2013)** conducted the study on the impact of yoga on autonomic functions and psychological status during both phases of menstrual cycle in young healthy females. Premenstrual stress affects 75% of women of childbearing age and yoga has been found to be beneficial in many psycho-somatic disorders. To investigate the effect of integrated yoga on autonomic parameters and psychological well-being is during both pre and post phases of menstrual cycle in healthy young female subjects. Present study is a randomized control trial and was conducted in the Department of Physiology, Lady Hardinge Medical College, New Delhi, India. Fifty apparently healthy females in the age group of 18-20 years were randomized into two groups: Group I (n=25) consisted of subjects who practiced yoga 35-40 minutes per day, six times per week for the duration of three menstrual cycles. Training was given to them by qualified yoga instructor. Group II (n=25) subjects acted as controls. Following parameters were recorded at the beginning and after completion of three menstrual cycles in all the subjects: Height, weight (BW), Resting Heart Rate (HR), Resting Systolic (SBP) and Diastolic Blood Pressure (DBP), parasympathetic reactivity tests including Expiration-Inspiration Ratio (E: I ratio) and 30:15 ratio, sympathetic reactivity tests including BP changes due to Isometric Hand Grip (IHG) exercise, and Cold Pressor Test (CPT). Assessment of psychological status was done by administering Defense Institute of Physiology and Allied Sciences (DIPAS) inventories of Anger self-report scale, Trait Anxiety, Sense of well-being and Depression scale. Intra-group comparison of physiological parameters was done by using paired 't' test, whereas intra-group comparison of non-parameteric data such as scores of anxiety,

depression, anger and sense of well-being was done by Wilcoxon signed-rank test. Inter-group comparison of parameters was done by Students 't' test for parametric tests and Mann-Whitney 'U' test for non-parametric tests. There was remarkably higher BW, resting SBP, DBP, sympathetic activity and blunting of parasympathetic reactivity and also, significantly higher scores of anger, depression, anxiety and decreased score of well-being in premenstrual phase as compared to postmenstrual phase in both the groups in initial cycle. The study ascertained significantly higher percentage decrease in BW, HR, SBP and DBP in yoga group as compared to control group in both the phases from initial to second and onwards between second and third menstrual cycle. Also, there was a phenomenal decrease in anger, depression and anxiety and increase in well-being score was significant in yoga group as compared to control group from initial to second and third cycle in premenstrual phase while the change was significant only in depression score in postmenstrual phase. The study proves that there was significant alteration of autonomic functions and psychological status in pre-menstrual phase when compared with post-menstrual phase in young healthy females. Also, regular practice of yoga has favourable effects on both phases of menstrual cycle by bringing parasympatho dominance and psychological well-being probably by balancing neuro-endocrinal axis.

**Sudhir PM et.al., (2012)** conducted the study on Quality of life in anxiety disorders. Its relation to work and social functioning and dysfunctional cognitions: An exploratory study from India. The study was conducted to examine the quality of life, functioning, disability, work and social adjustment, depression, anxiety and dysfunctional cognitions in patients with anxiety disorders. The subjects taken for the study were one hundred patients with anxiety disorders and 98 non-clinical participants. A cross sectional design was adopted. The participants were assessed on the WHO QoL-BREF, Global Assessment of Functioning (GAF), Sheehan Disability Scale (SDS), the Work and Social Adjustment Scale (WSAS) and Dysfunctional Attitudes Scale (DAS). Data was analyzed using descriptive statistics, Mann-Whitney test, Spearman's Rho and regression analysis. Patients with anxiety disorders reported significantly lower quality of life than the community sample ( $df = 98, p < .001$ ). A shorter duration of illness was associated with lower quality of life. QoL was significantly correlated with severity of anxiety, depression and stress as well as with

measures of disability and adjustment. Partial correlations indicated that depression did not significantly impact the relationship between work and social adjustment and QoL. Work and social adjustment, depression and dysfunctional cognitions emerged as significant predictors of QoL. The results of the study are discussed in the light of existing research and the implications for future interventions are highlighted.

**Sreevani Ret.al., (2013)** conducted a study on effectiveness of integrated body-mind-spirit group intervention on the well-being of Indian patients with depression. Depression is a leading cause of disability worldwide. There is a need to develop effective strategies to treat depression and prevent recurrence. Treatments that combine pharmacological and psychotherapeutic approaches are preferred for treating severe forms of depression. The study assesses the efficacy of an integrated body-mind-spirit group intervention in patients with depression. This study was a pretest-posttest design study. Thirty adult patients diagnosed with depression attending the psychiatric outpatient department at a district hospital were randomly assigned to either the intervention group or comparison group. Each group consisted of 15 patients. The intervention group received both the intervention and routine hospital treatment and underwent four group integrated body-mind-spirit group intervention therapy sessions. These sessions were conducted once per week on either Saturday or Sunday, with each session lasting more than 3 hours. The comparison group underwent only routine hospital treatment. Outcome measures, including level of depression, well-being, work and social adjustment, were measured using the Beck Depression Inventory-II, body-mind-spirit well-being scale, and work and social adjustment scale. Both groups were evaluated at baseline, 1 month, 2 months, and 3 months. Results showed that both groups had significant reductions in the level of depression, improvements in well-being, and work and social adjustment at 3-month follow-up compared with baseline. In addition, the intervention group showed notable mean differences in levels of depression, well-being, and work and social adjustment compared with the comparison group. The integrated body-mind-spirit group intervention model appears to decline depressive symptoms and improve well-being in patients with depression.

**Allison Aet.al., (2014)** conducted the study on consequence of Bikram yoga on psychological well-being. Bikram yoga is sometimes referred to as hot yoga and a typical class is 90-minutes in duration, consists of 26 Hatha yoga postures and 2 breathing exercises, and is performed in a room heated to 41°C (105° F) with 40% humidity. This study examined the effects of Bikram yoga on two aspects of psychological well-being: Core Self-Evaluation (CSE) and life satisfaction. Core self-evaluation is sometimes referred to as positive self-concept and is comprised of aspects of self-esteem, self-efficacy, locus of control, and emotional stability. Life satisfaction is a holistic appraisal of one's life in which a comparison is made of one's current circumstances to what is thought to be an appropriate internally determined personal standard. Twenty-two subjects completed a 60-day Bikram yoga challenge. Self-report survey responses were collected before and immediately after the challenge. A within-subjects one group pretest-posttest experimental design was used. Bonferroni-adjusted t-tests for change over time in CSE and life satisfaction were both statistically significant. Cohen's d statistic as a measure of effect size was .53 for core-self-evaluation and .40 for life satisfaction. Life satisfaction and CSE each improved over the course of the intervention. It is likely that the well-known effects of involving in intense physical exercise also contributed to advancement in psychological well-being.

**Sharma Ret.al., (2008)** conducted the study on effect on yoga based lifestyle intervention on subject well-being. Yoga is gaining importance in improving mental health and quality of life in the treatment of a number of psychiatric and psychosomatic disorders. The present study was a prospective controlled study to explore the short-term impact of a comprehensive but brief lifestyle intervention, based on yoga, on subjective well-being levels in normal and diseased subjects. Normal healthy individuals and subjects having hypertension, coronary artery disease, diabetes mellitus or a variety of other illnesses were included in the study. The outcome measures were 'Subjective Well-Being Inventory' (SUBI) scores, taken on the first and last day of the course. The inventory is made up of questions related to one's feelings and attitude about various areas of life, such as happiness, achievement and interpersonal relationship. There was remarkable development in the subjective well-being scores of the 77 subjects within a period of 10 days as compared to controls. These observations advocate that a short lifestyle modification and stress management educational program

leads to remarkable improvement in the subjective well being scores of the subjects and can therefore make an appreciable contribution to primary prevention as well as management of lifestyle diseases.

**Vallath N (2013)** conducted the study on the interpretation on yoga inputs in the management of chronic pain. Chronic pain is multi-dimensional. At the physical level itself, beyond the non receptive pathway, there is hyper arousal state of the components of the nervous system, which negatively influences tension component of the muscles, patterns of breathing, energy levels and mindset, all of which exacerbate the distress and affect the quality of life of the individual and family. Beginning with the physical body, Yoga eventually influences all aspects of the person: vital, mental, emotional, intellectual and spiritual. It offers various levels and approaches to relax, energize, remodel and strengthen body and psyche. The asanas and pranayama harmonize the physiological system and initiate a relaxation response in the neuro endocrinal system. This consists of decreased metabolism, quieter breathing, stable blood pressure, reduced muscle tension, lower heart rate and slow brain wave pattern. As the neural discharge pattern gets modulated, hyper arousal of the nervous system and the static load on postural muscle decline. The function of viscera improves with the sense of relaxation and sleep gets deeper and sustained, fatigue diminishes. Several subtle level notional corrections can happen in case the subject meditates and that changes the context of the disease, pain and the meaning of life. Meditation and pranayama, along with relaxing asanas, can assist individuals deal with the emotional aspects of chronic pain, reduce anxiety and depression effectively and improve the quality of life perceived.

**Telles S et.al., (2010)** conducted the study on the post-traumatic stress symptoms and heart rate variability in Bihar flood survivors following yoga: a randomized controlled study. An earlier study showed that a week of yoga practice was useful in stress management after a natural calamity. Due to heavy rain and a rift on the banks of the Kosiriver, in the state of Bihar in north India, there were floods with loss of life and property. One month after the incidence of flood yoga practice was given to the survivors and the effect was examined. Twenty-two volunteers (group average age +/- S. D, 31.5 +/- 7.5 years; all of them were males) were randomly assigned to two

groups, yoga and a non-yoga wait-list control group. The yoga group practiced yoga for an hour daily while the control group continued with their routine activities. Both groups' heart rate variability, breath rate, and four symptoms of emotional distress using visual analog scales, were assessed on the first and eighth day of the program. The result of the study showed a notable decrease in anxiety level in the yoga group ( $p < 0.05$ , paired t-test, post data compared to pre) and an increase in anxiety in the control group ( $p < 0.05$ , paired t-test, post data compared to pre). A week of yoga can reduce post-traumatic stress symptoms.

**Ray US et.al., (2001)** conducted the study on the effect of yogic exercises on physical and mental health of young fellowship course trainees. A study was conducted 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 10<sup>th</sup> 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 registered. Various parameters were taken into consideration 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 moderately 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 advancement in various psychological parameters like reduction in anxiety and depression and a better mental function after yogic practices.

**Hoge EA et.al., (2013)** carried out a study on the randomized controlled trial of mindfulness meditation for generalized anxiety disorder: effects on anxiety and stress reactivity. Mindfulness meditation has broomed increasing interest as a therapeutic strategy for anxiety disorders, but prior studies have been limited by methodological concerns, including a lack of an active comparison group. This is the first randomized, controlled trial comparing the minimalized Mindfulness-Based Stress Reduction (MBSR) program with an active control for Generalized Anxiety Disorder (GAD), a disorder characterized by chronic worry and physiologic hyperarousal symptoms. For this purpose, Ninety-three individuals with DSM-IV-diagnosed GAD were randomly assigned to an 8-week group intervention with MBSR or to an attention control, Stress Management Education (SME), between 2009 and 2011. Anxiety symptoms were measured with the Hamilton Anxiety Rating Scale (HAMA; primary outcome measure), the Clinical Global Impressions-Severity of Illness and -Improvement scales (CGI-S and CGI-I), and the Beck Anxiety Inventory (BAI). Stress reactivity was assessed by comparing anxiety and distress during pretreatment and post treatment administration of the Trier Social Stress Test (TSST). A modified intent-to-treat analysis including participants who completed at least 1 session of MBSR (n= 48) or SME (n = 41) showed that both interventions led to significant ( $p < .0001$ ) reductions in HAMA scores at endpoint, but did not significantly differ. MBSR, however, was incorporated with a significantly greater reduction in anxiety as measured by the CGI-S, the CGI-I, and the BAI (all P values  $< .05$ ). MBSR was also associated with greater reductions than SME in anxiety and distress ratings in response to the TSST stress challenge ( $p < .05$ ) and a greater increase in positive self-statements ( $p = .004$ ). These results propose that MBSR may have a beneficial effect on anxiety symptoms in GAD and may also improve stress reactivity and coping as measured in a laboratory stress challenge.

**Shapiro D et.al., (2007)** conducted the study on yoga as a complementary treatment of depression: effects of traits and moods on treatment outcome. Preliminary findings support the potential of yoga as a complementary treatment of depressed patients who are taking anti-depressant medications but who are only in partial remission. The purpose of this article is to present further data on the intervention, focusing on individual differences in psychological, emotional and biological processes

affecting treatment outcome. Twenty-seven women and 10 men were enrolled in the study, out of which 17 completed the intervention and pre- and post-intervention assessment data. The intervention comprised of 20 classes led by senior Iyengar yoga teachers, in three courses of 20 yoga classes each. All participants were diagnosed with unipolar major depression in partial remission. Psychological and biological characteristics were assessed pre- and post-intervention, and participants rated their mood states before and after each class. Significant reductions were shown for depression, anger, anxiety, neurotic symptoms and low frequency heart rate variability in the 17 completers. Eleven out of these completers achieved remission levels post-intervention. Participants who remitted differed from the non-remitters at intake on several traits and on physiological measures indicative of a greater capacity for emotional regulation. There was a development in mood enhancement after the yoga sessions. Yoga appears to be a promising intervention for depression. More over it is cost-effective and easy to implement. It produces many beneficial emotional, psychological and biological effects, as supported by observations in this study. The physiological methods are primarily useful as they provide objective markers of the processes and effectiveness of treatment. These observations may help guide further clinical application of yoga in depression and other mental health disorders, and future research on the processes and mechanisms.

**Tamilselvi B et.al., (2013)** conducted the study on effects of Yoga on Adjustment Problems of School Teachers. Teaching is a very demanding job requiring a teacher to stand for many hours daily alone before a group of some alienated pupils. Moreover, the teacher has to play multiple roles such as supporting parent, disciplinary taskmaster, stimulating actor and informative resource person. Researchers have identified various causes of job related stress of teachers such as work load, insecurity of service, low status in the society, low physical health, lack of recreation and many more. This causes unnecessary stress and strain among teachers. Prolonged unhealthy stress can cause the following cognitive, emotional and behavioral effects. They inclined to lack of concentration, and ability to think rationally, reduced memory, easily distracted, increased errors, increased tension, and change in personality, depression, loneliness, reduced self-esteem, less enthusiasm, lower energy levels, speech problems and sleeplessness. Their organization and planning ability gets degenerated. They

become aggressive and irritable. Apart from these, stress will lead to the other psychological disorders like anxiety, stress and adjustment disorders. The professional efficiency of school teachers is adversely affected by the adjustment disorder caused by adjustment problem. Moreover, the adjustment of a school teacher plays a major factor in determining the mental health of the students. So there arises a need to find out a solution for reducing the adjustment problems of school teachers. The long search for a natural healing remedy for all ailments finally lead to a scientifically proven technology called Yoga. The Inner Science makes wonders in the person's body mind and soul. So an attempt has been made in this study to use this Yogic Science, on school teachers to reduce their adjustment problems. A small experimental research has been conducted to find the effects of Yoga on Adjustment problems of school teachers by giving a regular practice of Yoga. It was concluded that adjustment problem among school teachers reduced due to the effects of Yoga practice.

**Narke et.al., (2015)** conducted the study on Yoga practices for adolescents' adjustment in relation to their gender and inhabitation difference. As children grow gradually from year to year, they develop greater complexity in their behavior. The values, belief and social skills required by an individual in their adolescence period plays a major role in determining the level of adjustment. The objective of the study was to investigate the effect of yoga practices, gender and inhabitation on students' adjustment. The initial sample comprised of 80 students from various sr. schools through random sampling technique. The whole sample was equally divided into two groups namely with yoga practices (n=40) and without yoga practices (n=40). These both groups constituted with equal number of students belong to urban (n=20) and rural (n=20) settings. All four subgroups were made with equal number of male (n=10) and female (n=20) students. To obtain the data Adjustment Inventory for School Students (AISS) by K. P. Sinha was administered on selected sample. As per requirement the present investigation deals with  $2 \times 2 \times 2$  factorial design and data was analyzed using 3 Way ANOVA. The obtained result concluded that yoga practices, inhabitation and gender individually as well as interaction with each other to determine level of adjustment among students.

**Cohen Let.al., (2004)** conducted the study on the psychological adjustment and sleep quality in a randomized trial of the effects of a Tibetan yoga intervention in patients with lymphoma. Research suggests that stress-reduction programs tailored to the cancer setting help patients cope with the effects of treatment and improve their quality of life. Yoga, an ancient Eastern science, incorporates stress-reduction techniques that include regulated breathing, visual imagery, and meditation as well as various postures. The authors analysed the effects of the Tibetan yoga (TY) practices of Tsa lung and Trulkhor, which incorporate controlled breathing and visualization, mindfulness techniques, and low-impact postures in patients with lymphoma. Thirty-nine patients with lymphoma who were undergoing treatment or who had concluded treatment within the past 12 months were assigned to a TY group or to a wait-list control group. Patients in the TY group participated in 7 weekly yoga sessions, and patients in the wait-list control group were free to participate in the TY program after the 3-month follow-up assessment. Eighty nine percent of TY participants completed at least 2–3 three yoga sessions, and 58% completed at least 5 sessions. Patients in the TY group reported significantly lower sleep disturbance scores during follow-up compared with patients in the wait-list control group (5.8 vs. 8.1;  $p < 0.004$ ). This included better subjective sleep quality ( $p < 0.02$ ), faster sleep latency ( $p < 0.01$ ), longer sleep duration ( $p < 0.03$ ), and less use of sleep medications ( $p < 0.02$ ). There were no predominant differences between groups in terms of intrusion or avoidance, state anxiety, depression, or fatigue. The participation rates suggested that a TY program is feasible for patients with cancer and that such a program significantly improves sleep-related outcomes.

**Khalsa MKet.al., (2014)** conducted the study on yoga-enhanced cognitive behavioural therapy (Y-CBT) for Anxiety Management: A Pilot Study. Cognitive behavioral therapy (CBT) is an effective treatment for generalized anxiety disorder, but there is still room for improvement. The present study examining the potential aimed at benefit the potential benefit of enriching CBT with kundalini yoga (Y-CBT). Subjects 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. Preliminary study

recommended that Y-CBT may have potential as a promising treatment for those suffering from generalized anxiety disorder. Yoga-enhanced cognitive behavioral therapy (Y-CBT) may be a promising new treatment for those suffering from generalized anxiety disorder. Y-CBT may also lower depression in those persons severely suffering from generalized depression and anxiety. Y-CBT may reduce depression and anxiety in a clinic population where clients suffer from multiple diagnoses including generalized anxiety disorder.

**Lakkireddy Det.al., (2013)** conducted the study on consequence of yoga on arrhythmia burden, anxiety, depression, and quality of life in paroxysmal atrial fibrillation, the Yoga my heart study. The objective of this study was to examine the impact of yoga on a trial fibrillation (AF) burden, quality of life (QoL), depression, and anxiety scores. Yoga is known to have significant benefit on cardiovascular health. The effect of yoga in reducing AF burden is unknown. This single-center, pre-post study enrolled patients with symptomatic paroxysmal AF with an initial 3-month non interventional observation period followed by twice-weekly 60-min yoga training for next 3 months. AF episodes during the control and study periods as well as SF-36, Zung self-rated anxiety, and Zung self-rated depression scores at baseline, before, and after the study phase were assessed. Yoga training reduced symptomatic AF episodes ( $3.8 \pm 3$  vs.  $2.1 \pm 2.6$ ,  $p < 0.001$ ), symptomatic non-AF episodes ( $2.9 \pm 3.4$  vs.  $1.4 \pm 2.0$ ;  $p < 0.001$ ), asymptomatic AF episodes ( $0.12 \pm 0.44$  vs.  $0.04 \pm 0.20$ ;  $p < 0.001$ ), and depression and anxiety ( $p < 0.001$ ), and improved the QoL parameters of physical functioning, general health, vitality, social functioning, and mental health domains on SF-36 ( $p = 0.017$ ,  $p < 0.001$ ,  $p < 0.001$ ,  $p = 0.019$ , and  $p < 0.001$ , respectively). There was significant reduction in heart rate, and systolic and diastolic blood pressure before and after yoga ( $p < 0.001$ ). In patients with paroxysmal AF, yoga improves symptoms, arrhythmia burden, heart rate, blood pressure, anxiety and depression scores, and several domains of QoL.

**Yeung Aet.al., (2014)** conducted the study Randomized controlled trial of a 12 week yoga intervention on negative affective states, cardiovascular and cognitive function in post-cardiac rehabilitation patients. Negative affective states such as anxiety, depression and stress are noteworthy risk factors for cardiovascular disease,

particularly in cardiac and post-cardiac rehabilitation populations. Yoga is a balanced practice of physical exercise, breathing control and meditation that can diminish psychosocial symptoms as well as enhance cardiovascular and cognitive function. It has the potential to positively affect multiple disease pathways and may prove to be a practical adjunct to cardiac rehabilitation in further reducing cardiac risk factors as well as improving self-efficacy and post-cardiac rehabilitation adherence to healthy lifestyle behaviors. This is a parallel arm, multi-centre, randomized controlled trial that will assess the outcomes of post-phase 2 cardiac rehabilitation patients assigned to a yoga intervention in comparison to a no-treatment wait-list control group. Subject randomized to the Yoga group participated in a 12 week yoga program, comprising of two group based sessions and one self-administered home session each week. Group based sessions was led by an experienced yoga instructor. This will comprise teaching beginner students a hatha yoga sequence that incorporates asana (poses and postures), pranayama (breathing control) and meditation. The primary outcomes of this study are negative affective states of anxiety, depression and stress assessed using the Depression Anxiety Stress Scale. Secondary outcomes include measures of quality of life, and cardiovascular and cognitive function. The cardiovascular outcomes include blood pressure, heart rate, heart rate variability, pulse wave velocity, carotid intima media thickness measurements, lipid/glucose profiles and C-reactive protein assays. Assessments will be conducted prior to (week 0), mid-way through (week 6) and following the intervention period (week 12) as well as at a four week follow-up (week 16). This study examined the effect of yoga practice on negative affective states, cardiovascular and cognitive function in post-phase 2 cardiac rehabilitation patients. The findings confirmed to incorporate yoga into standardized cardiac rehabilitation programs as a practical adjunct to improve the management of psychosocial symptoms associated with cardiovascular events in addition to improving patients' cognitive and cardiovascular functions.

## 2.4 STUDIES ON VARMA THERAPY

**Ponnappan P (2013)** conducted a study on the effect of varma therapy and yoga therapy on selected physiological, bio chemical and psychological variables among diabetic men. 90 male diabetic patients were chosen randomly ranging from 40 to 55 years from Chennai city. Independent variables were varma therapy and yoga therapy. Two experimental groups (I and II) were engaged and a control group kept at rest was given no training for 12 weeks with 30 subjects in each group. Dependent variables were pulse rate, systolic and diastolic blood pressure, total cholesterol and blood sugar and stress and self confidence. ANCOVA and scheffe's post hoc tests were used as statistical techniques to find the results. It was found that significant decline in were pulse rate, systolic and diastolic blood pressure, total cholesterol and blood sugar and reduced stress and improved self confidence due to varma therapy and yoga therapy. Hence the hypothesis was accepted at 0.05 Level of confidence. It was concluded that yoga therapy was more effective than varma therapy on selected variables among diabetic men.

**Thirumurugadhakshnamurthy (2015)** studied on the effect of yogic practices with and without varma practices on selected physiological clinical and psychological variables among back pain men. 45 male back pain sufferers were selected randomly at age ranged from 35 to 45 years from Chennai city. Independent variables were yogic practices with varma and yogic practices without varma. Two experimental groups (I and II) were engaged and a control group kept at active rest was given no training for 12 weeks with 15 subjects in each group. Dependent variables were resting pulse rate, blood pressure range of motion, pain, stress and anxiety. ANCOVA and scheffe's post hoc tests were used as statistical techniques to find out the results. It was found that notable decline in resting heart rate and blood pressure, pain and increase in range of motion reduced stress and anxiety due to yogic practices with and without varma. Hence the hypothesis was accepted at 0.05 Level of confidence. It was concluded that yogic practices along with varma more effective than yogic practices without varma on selected variables among back pain men.

**Maanickha Chelvi K S (2016)** conducted Effectiveness of Varma Therapy and Conventional Exercises on Osteoarthritis of Knee – A Pilot Study, a common type of arthritis which is most common in people over 65 years. Varma therapy is one of the treatment modalities used in Siddha system of Medicine which is originated in southern part of India. It is also one of the traditional systems approved by World Health Organization (WHO). Stimulation of particular points in human body in appropriate pressure gives relief from the pain. A total of 30 subjects who fulfilled section criteria were allotted into two groups by random sampling method and out of them 15 were allotted in Group A and 15 in Group B. The group consists of Age group between 40 – 60 years, both sexes and patients with radiological evidence of osteoarthritis of knee, Fracture around the knee joint, neurological disorders and Osteoporosis. The varma points include, Mootu Varma, Pathaippu Varma, Kuthirai Nakku Adi Varma, Kavuli Varma, and Santhi Varma. Group A was given Varma therapy with conventional exercises and Group B were given only Conventional exercises for 2 weeks. It was concluded that there is a considerable improvement on reduction in course of disease following varma therapy with conventional exercise program than conventional exercise. It was also declared that there is no conflict of interest.

**Muley SK et.al., (2011)** conducted a study of Vaiklyakara Varma with special reference to Kurpara Varma in relation to its Vaikalyakara effects when injured. Various ayurvedic texts have taken the reference of Kurpara Varma with the help of description of Varma in Ayurveda. For the purpose of study, a total 80 patients having trauma to elbow joints due to various causes such as fall, road traffic accident, direct trauma on elbow joint, history of trauma a year back, and injury due to burn were taken up. The observations period for these patients were 3 months to observe any changes in symptoms. In Sushruta Samhita, it was stated that an injury to the Kurpara Varma ends in Kuni (dangling of the hand), swelling, loss of power, restricted movements, and muscle wasting and associated symptoms like tingling sensation, heaviness, syncope, sweating, dizziness, and vomiting. After 3 months of observation, the data was taken for analysis, i.e., after analyzing the percentage of all symptoms on admission as well as after 3 months; it was found that all 80 patients, i.e., 100% had swelling and loss of muscle power. A total of 72 patients, i.e. 90% had dangling of hand

on admission. After 3 months, 40 patients (50%) still remained with the dangling of hand. Seventy-two patients had restriction in flexion and extension deformity which still remained in 50% of patients. Hence, it was proved that Kurpara (elbow joint) is definitely a Vaikalyakara Varma which cured the disabilities like restriction of movements, swelling, and atrophy were remains of an injured elbow joint inspite of best surgical treatment.

**Fox M et.al., (2006)** conducted a study on Varma therapy for stroke rehabilitation, a Pilot Study, to examine the feasibility and acceptability issues and to gather preliminary outcome data to ascertain the numbers needed for a trial of Varma massage therapy for stroke rehabilitation. A nested qualitative study was conducted among adult patients who had an infraction or haemorrhage at any brain location with a Bartel Index score of 75/100 or less. Feasibility was assessed in terms of recruitment and response rates and loss to follow-up, and acceptability was assessed by patient interviews (n=13) and the main outcome measure was the Barthel Index. The recruitment rate was 0.53 patients per week in a stroke unit with an admission rate of 15.1 per week the response rate was 91% and the loss to follow-up 30%. Most patients believed that the massage was beneficial, and although some patients reported pain when discussed and they have decided to choose it again. The effectiveness data showed no significant differences in changed scores. However, the secondary measure follow-up score differences of the Motricity Index at 6 and 12 weeks and the trunk control test at 6 weeks suggest a possible greater improvement in the intervention group ( $p<0.05$ ,  $p<0.01$ ). It was concluded that a future trial of Varma therapy (n=172), will be undertaken which would be feasible and acceptable to patients.

**Natarajan S et.al., (2012)** conducted a study on the role of Varma Therapy in CakanaVatam correlates with cervical Spondylosis. Geriatric patients were grouped into drug therapy as Group A and drugless therapy as Group B. Group A was prescribed with Anti Vata Drugs and Group B with external medications such as massage, fomentation, yogic exercise, diet restriction. Among them drugless therapy is considered to be supremo and Varma therapy comes under this category. As the geriatric patients suffer with a complex of diseases, no new drug has been discovered so far, for the total geriatric health care. This makes the patients to take specific drugs

for each disease which lead them to frustrate over its adverse effects. So they prefer to have a drugless therapy as Varma therapy. In case of cakanavatam, some of the Varma points are triggered during the course of massage. Varma Points are stimulated as and when during the course of massage. Massage was given for both head and neck to get a better relief for a period of 5 – 7 days. It was concluded, there was a good relief if Varma therapy is given to the geriatric patients. Since a holistic approach over geriatric patients fulfils the treatment and instills confidence of being a healthy person.

**Sivaranjani K (2016)** conducted a clinical study on Varma Therapy for Musculoskeletal Disorders and it was found that before using herbals, metals, minerals and animal products as medicine, by using his own fingers to cure the disease which is called as Kai Maruthuvam, now popularly known as Varma therapy. It involves stimulation of certain specialized point in our body called as varma points. With proper varma point stimulation the flow of pranic energy can be controlled and thereby physiological and metabolic functions can be restored. Over 150 diseases and syndromes usually associated with pains which are broadly classified as Joint diseases, spinal disorders and conditions resulting from trauma. As per World Health Organization (WHO), 9.6% of men and 18.0% of women aged over 60 years have symptomatic osteoarthritis. 80% of those with osteoarthritis have movement limitations and 25% cannot perform major daily activities of life. When the Protective cartilage on the ends of the bones wears down, osteoarthritis occurs and the symptoms include pain and stiffness, particularly in morning or after resting or clicking or cracking sounds when joint bends. The Varma Points include Kannady Kalam, Mootu Varma, Veera Adangal, Kudhiraimuga Varma, Chippi Munai Varma, Adappa Kaalam, Vilangu Kalam, Komberi Kalam, Viruthi Kalam. Also the Frozen Shoulder is a condition characterised by stiffness and pain in shoulder joint. This is known as Adhesive Capsulities because of adhesion of subacromial bursa and it is related to tendinitis of rotator cuff tendon. Pain will be worsened with attempted motion or if bumped. Varma Points for Peri arthritis shoulder will be Mudichu Varma, Chavu Varma, Kavuli Varma, and Manibandham Varma, The study concluded that Varma an ancient medicinal therapy is a unique advantage coupled with rich traditional knowledge of long history use. It alleviates musculoskeletal disorders and studies have shown manipulation of this varma can release Endorphin and boosts level

of Serotonic and Dopamine. The hormones will make one feel good, calm nerves and promotes healing and relieves pain. It improves the overall well-being.

**Sugunthan S et.al., (2017)** conducted a comparative Clinical Study on on Villaiver Kudineer and Varma Therapy in the Treatment of Cervical Spondylosis. It is mainly because of postural changes, poor dietary habits and factors contributing to degeneration of the bone. Anti-inflammatory and analgesic drugs, often pose to hepato toxicity, nephrotoxicity and adverse drug reactions and hence the study was to have a combined therapy with a total 60 patients comprising 20 members in three groups. The age wise distribution: 20-30 = 28.3%, 31-40 = 26.7%, 41-50 = 23.3% and 51-60 = 21.7% shows there is no difference in distribution among age. Group I was given polyherbal formulation villaiver kudineer for 6 weeks and Group 2 varma therapy twice a week for 6 weeks and Group 3 received both Villaiver Kudineer and Varma Therapy for 6 weeks to Outpatients of Postgraduate Department of Varma, Puramuthuvam and Sirappu Maruthuvam, Government of Siddha Medical College attached with Aringnar Anna Hospital for Indian Medicine and Homeopathy, Arumbakkam, Chennai. Among the groups, Group 3 showed significant improvement in reducing all symptoms. It was noteworthy improvement in assuaging the symptoms of Cervical Spondylosis. It was observed that in patients who carries heavy loads on their heads, shoulders, dancers, gymnasts and in patients with spasmodic torticollis. In males it is present almost 100% in all by age of 70 years and in females it is 96% above age of 70. Confusingly, the life can be shown a new path with Siddha drug Villaiver Kudineer and Varma Therapy for Group 3 showed good improvement which in turn indicates that drug and varma to get rid of Cervical Spondylosis. Further combination of both Villaiver kudineer and varma therapy has shown noteworthy improvement in assuaging the symptoms of CS.

**Pratheep Get.al., (2017)** conducted a study on validation of Siddha Medicine and Varma Therapy on Azhalkeel Vayu [Osteoarthritis] – Case Series. Siddha medicine dealing with this disease is known as Azhal Keel Vayu (AKV). China and India were ranked the top two countries in the absolute number of people aged 65 and over. For the purpose of the study, 10 patients with AKV were selected out of which, 6 had the knee injury. The objective of the study is to validate, varma therapy on AKV. Patients with age group of 40 – 60 were treated with AKV for 30 days at RVS Siddha

Medical College and Hospital. The results show that after the 30 days varma therapy treatment, 4 patients got relieved upto 81% and 3 patients got relieved between 61 to 80% and the balance 3 got 65% relief. Based on this result, the study concludes that Varma Therapy is effective in Azhal Keel Vayu (AKV) or Osteoarthritis (OA).

**Gandhi S and Anbalagan P (2016)** conducted the study on effect of yogic practices combined with varma on the selected physical variables among the middle aged men. To achieve the purpose of the study, thirty subjects between the age group of 35 to 45 were selected from Coimbatore. The selected criterion variables were muscular strength, endurance and flexibility. The subjects were divided into two equal groups. The study was formulated as a true random group design, consisting of a pre-test and post-test. The subjects (n=30) were randomly assigned to two equal groups of fifteen subjects each. The groups were assigned as a Experimental group I Asana, Pranayama, Meditation combined with varma Training group (APMVTG) and group II Control Group (CG) in an equivalent manner. All the subjects were tested immediately prior and after the experimental programme. 't' ratio was applied to analyze the significant difference and 0.05 level of confidence was fixed as the level of significance. Based on the result of the study it was concluded that Asana, Pranayama, Meditation combined with Varma (APMVTG) produced as significant development on the selected physical variables among the middle aged men. For this study Yogic Practices combined with Varma points were used for stimulating some of the Varma Points. The points (sites / centers / stations) was controlled the life- energy flow and absorb the energy from one or more organs or varma points and pump it to other one or more organs or varma points systematically. So the job of the varma point was to enhance the force that regulates the flow of the life-energy through the channels. Measurements were made during the weeks prior to the 12 week of training programme. All the procedures were demonstrated prior to the testing of Muscular Strength Endurance and it was measured by the Sit Ups and the Flexibility was measured by sit and reach test. The sit-and-reach apparatus had the 25cm mark equivalent to the point where the feet touched the box. The subjects, were asked to sit barefoot with the legs fully extended with the soles of the feet laced flat against the horizontal cross board of the apparatus, inner edge of the sole have placed 2cm from the scale, keeping the knee have fully extended, arms evenly stretched and the palms down. The position of

maximum flexion must be held for approximately two seconds. The test is repeated twice and the maximum distance reached was recorded to the nearest 0.5cm. This study shows that the twelve weeks of yogic practices combined with the Varma points was showed significant benefits in improving the physical variables after the training. Our results indicates that the Asana, Pranayama, Meditation and Varma (APMVTG) yoga practice with Varma points increased significantly on the muscular strength endurance, flexibility, the increased range of motion can most likely be attributed to the proper training of the Yogic practices with Varma. Hence it was concluded that the Asana, Pranayama, Meditation combined with Varma (APMVTG) is significantly improving the physical variables in muscular strength endurance, flexibility in middle aged men.

**Janani L and Manickavasagam R (2015)** conducted a study to find out the effectiveness of Varma Therapy for the management Of Osteoarthritis. Varma is one among such therapies used to treat multiple ailments, especially ailments of musculoskeletal and neurological deficits. Osteoarthritis (OA) is the second most common rheumatologic problem and is most frequent joint disease with prevalence of 22% to 39% in India. For the purpose of study, 30 clinically diagnosed patients of osteoarthritis (knee joint). In Siddha system of medicine, Osteoarthritis is also known as Azhal keel vaayu. In Siddha system, varma is a specialized field pertaining to cure neurological weakness, neuromuscular problems, migraine headaches, convulsions, arthritis, spinal problems, muscle wasting and to wail intense pain. The time required for the therapy is less and gives a long lasting result. Hence an attempt has been done to prove the efficacy of Varma therapy for the management of osteoarthritis. The study was conducted on 30 clinically diagnosed patients aged between 30-60 years from both sexes who were suffering from Primary Osteoarthritis of Knee joint and were willing to undergo varma treatment for 48 days. The treatment methodology adopted was, stimulation of the following varma points for 48 days. Chippi Varma, Uppukuttri Varma, Kuthikaal Varma, Viruthi Kaalam, Komberi Kaalam, Naai thalai Varma, Kaal moottu Varma and Veeradangal. After 48 days of treatment of Varma therapy the results showed clinical improvement which is evident from the assessment parameters ( $p = 1$ ). The results regarding pain, stiffness, swelling and range

of movements were really encouraging. It has been concluded that the Varma treatment regime is very effective for the Osteoarthritis treatment.

**Maanickha Chelvi KS et.al., (2016)** conducted a study on effectiveness of Varma Therapy in Kumbavatham (Periarthritis shoulder) with special reference to restriction of movement. 17 patients with age group of 35 – 65 years were triggered for Varma points for 5 sittings in 2 weeks. Varma Points such as Mozhipiralga, Kavulikaalam, Chavvu Varma, Enthikaalam, Piratharai, Kakkatai Kaalam and Kaikettivarma were used to activate the affected areas for the patients. The study concluded that Varma therapy for Kumbavatham patients (periarthritis shoulder) is very effective in managing their disease. This varma therapy has changed their quality of life remarkably in two week. Hence it may be concluded that Varma therapy plays a positive role in the kumbavatham management.

**Bay R and Bay F (2011)** conducted a study on combined therapy using acupressure therapy, hypnotherapy, and transcendental meditation versus placebo in type 2 diabetes. The purpose of this research was to evaluate the effect of combined therapy using acupressure therapy, hypnotherapy, and Transcendental Meditation (TM) on the Blood Sugar (BS) level in comparison with placebo in type 2 diabetic patients. “Convenience sampling” method was used for selection of patients with type 2 diabetes. 20 patients were selected for collection of data, Therapy sessions each lasting 60-90 min were carried out on 10 successive days. 2 capsules (containing 3g of wheat flour each) for each member of the placebo group (one for evening and one for morning) were prescribed. Pre-tests, post-tests, and follow-up tests were conducted in a medical laboratory recognized by the Ministry of Health and Medical Education of Iran. Mean BS level in the post-tests and follow-up tests for the experimental group was reduced significantly in comparison with the pre-tests whereas in the placebo group no changes were observed. Combined therapy including acupressure therapy, hypnotherapy, and TM reduced BS of type 2 diabetic patients and was more effective than placebo therapy on this parameter.

**Fitrullah and Rousdy A (2017)** conducted a study in Indonesia on effectiveness of Acupressure at the Suzanli (ST-36) Acupoint as a comfortable Treatment for Diabetes Mellitus Indonesia had 10 million diabetic and 17.9 million pre diabetic citizens. Unfortunately, less than half of these diabetic individuals are aware of their conditions and less than 1% of those receiving medical treatment achieve their healing targets. Because acupressure is believed to be an effective treatment without the use of drugs, in this study we investigated acupressure as a comfortable and effective way of treating patients with diabetes mellitus. For the purpose of this pilot study 30 participants were selected and were split into two groups of, 15 each in the experimental and the control groups. The experimental group was administered acupressure treatment at the Zusanli (ST-36) acupoint for 30 minutes per visit for 11 weeks and the control group continued their regular treatment. Participants of both groups had their blood glucose randomly checked weekly. To analyze the Data the Generalized Estimating Equation model was used. The result proved that the two groups were remarkably different ( $p=0.331 > \alpha=0.05$ ; mean difference=99.14; Bonferroni sig.  $p=0.000 < \alpha=0.05$ ) and that acupressure at ST-36 was effective in reducing blood sugar. This research concluded that acupressure was an effective method for reducing blood glucose and was helpful for reducing complications due to diabetes.

**Yang MH et.al., (2015)** conducted a study on comparison of the efficacy of aroma-acupressure and aromatherapy for the treatment of dementia-associated agitation. The most common symptoms observed in patients with dementia are agitation, and several non-pharmacological treatments have been used to control this symptom. The objective of the study was to compare aroma-acupressure and aromatherapy with respect to their effects on agitation in patients with dementia. In this experimental study, the total no of 186 participants were randomly grouped into three groups: 56 patients for the aroma-acupressure group, 73 patients in the aromatherapy group, and 57 patients in the control group received daily routine as usual without intervention. The Cohen-Mansfield Agitation Inventory (CMAI) scale and the Heart Rate Variability (HRV) index were used to assess differences in agitation. The CMAI was used in the pre-test, post-test and post-three-week test, and the HRV was used in the pre-test, the post-test and the post-three-week test as well as every week during the

four-week interventions. The CMAI scores were significantly lower in the aroma-acupressure and aromatherapy groups compared with the control group in the post-test and post-three-week assessments. The study concluded that Aroma-acupressure had a greater effect than aromatherapy on agitation in patients with dementia. However, agitation was improved in both of the groups, which allowed the patients with dementia to become more relaxed.

**Bastani F (2015)** conducted a Randomized clinical trial on the effect of Acupressure on Maternal Anxiety in Women with Gestational Diabetes Mellitus. The aim of the study was to evaluate the effect of acupressure on relieving anxiety of women with Gestational Diabetes Mellitus (GDM). For the purpose of the study, 60 women with GDM were given randomized clinical trial at a university hospital. 30 participants were allocated to experimental group and 30 to the placebo group. The experimental group was given acupressure at the true point, and the placebo group received pressure touch at a false point. Anxiety was measured by a questionnaire and the Visual Analogue Scale, immediately in both the groups prior to and after a 2-day intervention. The data was analyzed using descriptive and inferential statistics. Results showed that the anxiety has significantly lower in the acupressure group than the placebo group ( $p \leq .0001$ ). It was concluded that acupressure treatment appeared to be effective in reducing anxiety in diabetic pregnant women.

**Liu CF et.al., (2008)** conducted a study on effect of auricular pellet acupressure on anti oxidative systems in high-risk diabetes mellitus. Free radicals and lipid peroxides, are easily formed in the diabetic state, and play an important role in the development of diabetic complications. Antioxidative therapy may help in prevention of diabetic complications caused by lipoperoxidation and free-radical formation in Diabetes Mellitus (DM). A number of findings suggest that oxidative stress exists in persons with high-risk DM. Auricular pellet acupressure has reportedly been an effective treatment method for a variety of medical conditions, including anxiety, juvenile myopia, essential hypertension, and senile vascular dementia. The impact of auricular pellet acupressure on antioxidative status in persons with high-risk DM was evaluated. The study involved 69 persons with high-risk DM, who were allocated either to undergo acupressure as active treatment for the experimental group or to a control

group. The experimental group in the study received auricular pellet acupressure three times daily for 5 consecutive days. After a 2-day rest period, the procedure was performed on the contralateral ear. Acupressure was performed twice on each ear, with each application followed by its application to the contralateral ear, over a total treatment period of 20 days. The control groups did not undergo auricular pellet acupressure. At the end of the 20-day period of treatment of the experimental group, blood was collected from all of the study participants for assay of serum superoxide dismutase (SOD) and catalase concentrations, and the same was also done for the control group. Serum concentrations of SOD ( $p < 0.05$ ) and catalase ( $p < 0.0001$ ) were significantly higher in the experimental group than in the control group. The findings suggested that auricular pellet acupressure can increase the concentration of antioxidative enzymes in persons with high-risk DM.

**Revathi R (2014)** conducted a study on the effect of simplified kundalini yoga with and without varma therapy on selected Haematological, bio chemical and psychological variables among women suffering with menstrual disorders. 45 women suffering with menstrual disorder from Chennai city independent variables were simplified kundalini yoga without varma. Two experimental groups (I and II) were engaged and a control group kept at active rest was given no training for 12 weeks with 15 subjects in each group. Dependent variables were HDL, LDL and TC, Hemoglobin and THS, Shelf confidence and Stress. ANCOVA and scheffe's post hoc tests were used as statistical techniques to find the results. It was observed that there was a notable decline in LDL, TC, TSH and increase in HDL and improved self confidence due to simplified kundalini yoga with and without varma therapy. Hence the hypothesis was accepted at 0.05 Level of confidence. It was established that simplified kundalini yoga with varma was more effective than simplified kundalini yoga without varma on selected variables among women sufferers with menstrual disorders.

**Vijay Prabha V (2016)** conducted a study on effect of simplified kundalini yoga with and without varma application on selected psychological variable of self-confidence among college girls suffering with menstrual problem. 45 college Girls in the age group of 18-23 years, suffering from menstrual problems were selected randomly for the study. The girls were divided in to 3 groups of 15 members each. The

Group I was administered with Simplified Kundalini Yoga (SKY) and Varma Therapy, whereas the Group II was administered with only SKY practice and Group III was kept under rest as control group. The collected data at various intervals were statistically analysed with 0.05 level of confidence to determine the significant difference among the groups. The selected variables Self-Confidence was measured through a questionnaire, Agnihotry Rekha manifest self-confidence inventory. The difference among pre- post-test scores and adjusted mean scores of the subjects were statistically treated using analysis of co-variance and F values obtained were 0.04, 34.93 and 38.28, respectively. It was found that obtained F value on pre-test score was not significant at 0.05 level of confidence as the obtained value was lesser than the required table value and post-test scores was significant at 0.05 level of confidence as the value was greater than the required table F value of 3.22. The post-hoc analysis through Scheffe's confidence test proved that due to 12 weeks treatment the SKY group and Varma applications group there was a significant decrease in self-confidence levels than the control group and the differences were significant at 0.05 level. The post-hoc analysis between the experimental Groups I and II proved that there was a significant difference. The results of the study show that the Group I which was given the SKY with Varma Practice had significant positive impact on the self confidence of the subjects. Within the limitation and delimitations set for this study and considering the results obtained, the following conclusion was drawn. For the purpose of this study, it was hypothesized that the SKY with Varma applications (experimental Group I), SKY without Varma applications (experimental Group II) would improve the selected psychological variables as compared to control group (Group III). It was concluded that the psychological variable self-confidence was significantly improvement due to 12 weeks of SKY with Varma applications (experimental Group I), SKY without Varma applications (experimental Group II) among college girls suffering with menstrual problem comparing to the control group.

## **2.5 SUMMARY OF RELATED LITERATURE**

The investigator scrutinized related literature on studies pertaining to Yoga Practices, Varma Therapy, Physiological Bio-chemical, Psychological Variables, Diabetes Mellitus and Type II Diabetic Men from various sources like books, journals, guidance from experts and material available on the internet provided sufficient knowledge to the investigator to have a comparative analysis for the present study. The reviews are presented as studies on physiological variable, on yoga (n=20), studies on bio-chemical variables on yoga (n=29) and studies on psychological variables, on yoga (n=22) and allied reviews. Studies on Varma Therapy (n=29) Total no of studies are 90. All the research studies that are presented in this section proves that yoga and varma therapy practices contribute significantly for better improvement in all the criterion variables. The critical reviews are 81 and allied reviews are 9 in total. The review of literature taught the researcher from the methodological point of view too. It was learnt that most of the research studies cited in this chapter on Analysis and experimental design as the appropriate methods for finding out the foundation and main ingredient for future research and investigate in training methods to guide and complete the study.