

## **Chapter II**

### **REVIEW OF RELATED LITERATURE**

The phrase “Review of Literature” consists of two words “Review” and “Literature”. In research methodology the term literature refers to the knowledge of a particular area of any discipline, which includes theoretical, practical and its research studies. The related literature reviewed for better understanding of the problem and to interpret the results systematically, they are presented in this chapter. The researcher in a quest to explore the reference materials confined to the libraries of Tamilnadu Physical Education and Sports University Chennai, Annamalai University Chidambaram, Alagappa University Karaikudi, Karpagam University Coimbatore, Sivanthi Adithanar College of Physical Education, Tiruchendure. Some literatures were also obtained from Internet.

The researcher finds out some of the review of literature which could be very supportive and strengthen this study. An extensive overview of literature was done by the investigator to elicit factual information about in diabetes patient. The related literature is organizes and present under the following.

Sh. Dide Rast et, al,(2014) 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. Experimental group were subjected to regular yoga training for 8 weeks (3 sessions per week, 60 minutes per session), while the control group did not have any regular activity. The dependent variables were blood glucose, Insulin and resting heart rate and were examined before and after exercise training in both groups. Results indicated a significant difference in

the changed levels of blood glucose, Insulin and Resting heart rate between the control and experimental groups ( $P \leq 0.05$ ). According to the findings, it can be concluded that regular practices of yoga with appropriate intensity can improve the effects of the illness and decrease the use of diabetes drugs and also the drugs for controlling the risk factors of coronary diseases in patients, along with having a diet, can use this type of sport to control the dangerous factors related to diabetes.

Sharma MP, et.al. (2013) studied about Mindfulness-based stress reduction program in coronary heart disease at Tiaho Mai, Adult Acute Inpatient Mental Health Unit, Middle more Hospital, Private Bag 93311, Otahuhu, Auckland, New Zealand. Thirty male patients, age range (30-65 years) with CHD were randomly allocated to either group. The therapeutic program comprised of eight weekly sessions of structured MBSR intervention for the MBSR group and one health education session for the TAU group. Regular medical intervention and monthly consultations with the cardiologist were consistent for both groups. As result the MBSR program is effective in reducing symptoms of anxiety and depression, perceived stress, BP and BMI in patients with CHD.

Sobana R, et.al. (2013) studied about the effect of yoga therapy on selected psychological variables among male patients with insomnia at Assistant Professor, Department of Physiology, Mahatma Gandhi Medical College and Research Institute, Pondicherry, Southern India. Forty males with insomnia were divided randomly into 2 groups (the experimental and the control groups). The experimental group received eight weeks of yoga therapy, while the control group did not receive any therapy. The pre and post treatment stress and the self confidence scores were taken as results, that yoga is an effective treatment option for the patients with insomnia.

Cramer H, et.al, (2012) conducted the study on Mindfulness-based stress reduction for low back pain at University of Duisburg-Essen, Essen, Germany. MEDLINE, the Cochrane Library, EMBASE, CAMBASE, and PsycInfo were screened through November 2011. The search strategy combined keywords for MBSR with keywords for low back pain. Randomized controlled trials (RCTs) comparing MBSR to control conditions in patients with low back pain were included. Two authors independently assessed risk of bias using the Cochrane risk of bias tool. Clinical importance of group differences was assessed for the main outcome measures pain intensity and back-specific disability. Three Randomized controlled trials (RCTs) with a total of 117 chronic low back pain patients were included. One RCT on failed back surgery syndrome reported significant and clinically important short-term improvements in pain intensity and disability for MBSR compared to no treatment. Two RCTs on older adults (age $\geq$ 65 years) with chronic specific or non-specific low back pain reported no short-term or long-term improvements in pain or disability for MBSR compared to no treatment or health education. Two RCTs reported larger short-term improvements of pain acceptance for MBSR compared to no treatment. It was concluded that this review found inconclusive evidence of effectiveness of MBSR in improving pain intensity or disability in chronic low back pain patients. However, there is limited evidence that MBSR can improve pain acceptance. Further RCTs with larger sample sizes, adequate control interventions, and longer follow-ups are needed before firm conclusions can be drawn.

Clarke G, et.al. (2012) conducted the study on Yoga for reducing perceived stress and back pain at work at Centre for Health Economics and Medicines Evaluation, Bangor University, Bangor, UK. Recent research indicates that yoga can be effective for reducing perceived stress, alleviating back pain, and improving psychological well-being. Participants were recruited from a British local government authority and randomized into a yoga group

who received one 50min Dru Yoga session each week for 8 weeks and a 20min DVD for home practice and a control group who received no intervention. Baseline and end-programme measurements of self-reported stress, back pain and psychological well-being were assessed with the Perceived Stress Scale, Roland Morris Disability Questionnaire and the Positive and Negative Affect Scale. The results indicate that a workplace yoga intervention can reduce perceived stress and back pain and improve psychological well-being. Larger randomized controlled trials are needed to determine the broader efficacy of yoga for improving workplace productivity and reducing sickness absence.

Singh RB, (Dec 2011) A study was conducted in North India to find out the social class and all-cause mortality in an urban population. Death records from 2222 (1385 men and 837 women) victims, aged 25-64 years, out of 3034 death records during 1999-2001 at the Municipal Corporation, Moradabad were randomly selected. Results revealed that 2.2% of deaths occurred directly due to diabetes mellitus (n = 49) while complications of diabetes such as infectious diseases (41.1%, n = 915) and circulatory diseases (29.1%, n = 646) top the list. Heart attacks, strokes, hypertension, diabetes and obesity were statistically significantly more common among higher social classes. This study indicates that circulatory diseases, injury and malignant diseases have become the major causes of death in India, after infections.

Agarwal AK, et.al.(Dec2011) A study was conducted in New Delhi, India to estimate the prevalence of non-alcoholic fatty liver disease (NAFLD) by ultrasonography, and to correlate NAFLD with coronary artery disease (CAD) and coronary risk factors in a group of Indian type 2 diabetics. The study group was divided into a NAFLD group (n=71) and a non-NAFLD group (n=53). The results revealed that the prevalence of NAFLD was 57.2%. CAD was more prevalent in the NAFLD subgroup (60.5%) compared to the non-

NAFLD subgroup (45.2%). The NAFLD subgroup had higher prevalence of hypertension, smoking, obesity (measured by BMI), central obesity (measured by waist circumference and waist hip ratio), higher HbA1c, higher triglyceride levels and lower HDL levels. It was found that hypertension ( $p=0.013$ ), LDL cholesterol ( $p=0.049$ ), microalbuminuria ( $p=0.034$ ) and NAFLD ( $p=0.016$ ) were significantly correlated with CAD.

Agarwal N, et.,al.(Dec2011) A study was conducted in Jhansi, India study the incidence of nephropathy in newly diagnosed type 2 diabetics and to study the relationship of development of nephropathy with various risk factors associated with DM, like age, sex, blood pressure, blood sugar, body mass index (BMI). A total number 300 newly diagnosed type 2 diabetics (diagnosed within 6 months), between Jan 2008 to August 2009. Presence of urinary microalbuminuria in two samples in a period of six months was taken as criteria for detecting nephropathy. Results revealed that incidence of 17.34% (52/300) nephropathy in newly diagnosed type 2 diabetics. It increased significantly with increase in age and was 30% in age group >60 years. This study concludes Incidence of nephropathy in newly diagnosed type 2 diabetics is as high as 17.34%. Hypertension is the most important associated factor contributing to development of nephropathy in these patients. Poor glycemic control (high HbA1C), high BMI, dyslipidemia, age, male sex also play significant role. Family history of DM seems to have little effect.

Viswanathan V, Dec 2011) A study was conducted in India to assess the pattern and causes of amputations in diabetic patients across various parts of India. A total of 1985 (M:F 1249:736) type 2 diabetic subjects were selected from 31 centers across India. A total of 1295 (850:445) patients had undergone amputations among study participants. Results revealed that the major cause for the occurrence of amputations among the patients was infection (90%). Among the subjects who underwent major amputations, more than 50% accounts for

below knee amputations and 11.9% above knee amputations. Prevalence of neuropathy (82%) was high and 35% had peripheral vascular disease. In conclusion, infection was found to be the major cause of amputation in India. Below knee, toes and rays amputations were the most common type of amputations. Diabetic patients should be educated on foot care and importance of proper foot wear.

Shiekh GA,et.,al. (Dec 2011) A study was conducted in Srinagar, India to investigate the nitrate level, which is very essential for the healthy functioning of blood vessels, in patients having diabetes and hypertension and to determine the relationship of nitrate turn over with the disease. The first group consisted of 74 hypertensive patients, the second group consisted of 72 diabetic patients and the third group consisted of 60 healthy controls. Nitrate synthesis activity was evaluated by automated Nitric Oxide detector. Results revealed that the plasma concentration of nitrate was found to be significantly lower in both essential hypertensive patients and diabetic patients without complications as compared to the healthy controls ( $P < 0.05$ ). This data concludes that different factors like hyperglycemia and blood pressure are seen to have immense influence on NO production.

Amita S, Prabhakar S, (Nov 2011)A study was conducted in Madhya Pradesh, India to evaluate the effect of Yoga-Nidra on blood glucose level in diabetic patients. This study was conducted on 41, middle aged, type-2 diabetic patients, who were on oral hypoglycemic. These patients were divided in to two groups: 20 patients on oral hypoglycemic with yoga-nidra and 21 were on oral hypoglycemic alone. Yoga-nidra practiced for 30 minutes daily up to 90 days, parameters were recorded every 30th day. Results of this study showed that most of the symptoms were subsided ( $P < 0.004$ , significant), and fall of mean blood glucose level was significant after 3-month of Yoga-nidra. This fall was 21.3 mg/dl,  $P < 0.0007$ , (from 159 +/- 12.27 to 137.7 +/- 23.15,) in fasting and 17.95 mg/dl,  $P = 0.02$ , (from 255.45 +/- 16.85 to

237.5 +/- 30.54) in post prandial glucose level. This study suggest that subjects on Yoga-nidra with drug regimen had better control in their fluctuating blood glucose and symptoms associated with diabetes, compared to those were on oral hypoglycaemics alone.

Malhotra V. et.,al.,(Nov 2011) A study was conducted in Delhi, India to see the effect of 40 days of Yoga asanas on the nerve conduction velocity. Yoga asanas included Suryanamskar. Tadasan, Konasan, Padmasan Pranayam, Paschimottansan Ardhamatsyendrasan, Shavasan, Pavanmukthasan, Sarpasan and Shavasan. Study showed that yoga asanas have a beneficial effect on glycaemic control and improve nerve function in mild to moderate Type 2 diabetes with sub-clinical neuropathy while control group nerve function parameters deteriorated over the period of study.

Sugumar (August, 2011) study was framed find out the effect of yogic practices on body composition among the college men students. Thirty healthy, untrained male subjects were selected from various Departments of Gandhigram Rural Institute, Deemed University, Gandhigram, Dindigul and their age ranged from 18 to 25 years. The subjects were equally divided into two groups namely the control and the experimental group. The experimental group underwent selected asanas and pranayama for five days per week for six weeks. Control group did not undergo any training programme rather than their routine work. Body composition was measured by using BIA method in the three sites. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. Finding of body composition shows significant improvement due to the six weeks yogic practice when compared to the control group.

Boffetta P, et.,al.(Jun 2011) A pooled cross-sectional analysis was conducted in different parts of Asia to evaluate the association between baseline body mass index (BMI, measured as weight in kg divided by the square of height in m) and self-reported diabetes

status in over 900,000 individuals recruited in 18 cohorts. The sample has been obtained from Bangladesh, China, India, Japan, Korea, Singapore and Taiwan. The sex- and age-adjusted prevalence of diabetes was 4.3% in the overall population, ranging from 0.5% to 8.2% across participating cohorts. The results revealed that positive association between BMI and diabetes prevalence was present in all cohorts and in all subgroups of the study population, although the association was stronger in individuals below age 50 at baseline (p-value of interaction <0.001), in cohorts from India and Bangladesh (p<0.001), in individuals with low education (p-value 0.02), and in smokers (p-value 0.03). This study concludes the shape and the strength of the association between BMI and prevalence of diabetes in Asian populations and identified patterns of the association by age, country, and other risk factors for diabetes.

Tekur P, et.al, (2010) conducted the study on Effect of yoga on quality of life of CLBP patients at Division of Yoga and Life Sciences, Swami Vivekananda Yoga Research Foundation (SVYASA), Bangalore, India. About 80 patients with CLBP (females 37) registered for a week long treatment at SVYASA Holistic Health Centre in Bengaluru, India. They were randomized into two groups (40 each). The yoga group practiced a specific module for CLBP comprising of asanas (physical postures), pranayama (breathing practices), meditation and lectures on yoga philosophy. The control group practiced physical therapy exercises for back pain. Perceived stress scale (PSS) was used to measure baseline stress levels. Outcome measures were WHOQOL Brief for quality of life and straight leg raising test (SLR) using a Goniometer. There were significant negative correlations (Pearson's,  $P < 0.005$ ,  $r > 0.30$ ) between baseline PSS with all four domains and the total score of WHOQOLBref. All the four domains' WHOQOLBref improved in the yoga group (repeated measures ANOVA  $P = 0.001$ ) with significant group\*time interaction ( $P < 0.05$ ) and differences between groups ( $P < 0.01$ ). SLR increased in both groups ( $P = 0.001$ ) with higher increase in yoga (31.1 % right, 28.4 % left) than control (18.7% right, 21.5 % left) group with significant



group\*time interaction (SLR right leg  $P=0.044$ ). It was concluded that CLBP, a negative correlation exists between stress and quality of life. Yoga increases quality of life and spinal flexibility better than physical therapy exercises.

Aljasir B,et.,al.(Dec2010) A study was conducted in Ontario, Canada to analyze the effect of practicing yoga for the management of type II Diabetes. Total sample of 363 participants were included in this study. The results show improvement in outcomes among patients with diabetes type II. These improvements were mainly among short term or immediate diabetes outcomes and not all were statistically significant. No adverse effects were reported in any of the included studies. Short-term benefits for patients with diabetes may be achieved from practicing yoga. Further research is needed in this area. Factors like quality of the trials and other methodological issues should be improved by large randomized control trials with allocation concealment to assess the effectiveness of yoga on diabetes type II. A definitive recommendation for physicians to encourage their patients to practice yoga cannot be reached at present.

Gram B, Christenses R,( Sep 2010) A study conducted to evaluate the efficacy of the 2 interventions Nordic walking and exercise on prescription compared with standard information on physical activity. Single-blinded, randomized, controlled intervention study. Sixty-eight patients (37 men and 31 women) were randomized into 3 groups: Nordic walking (NW;  $n = 22$ ), Exercise on Prescription (EP;  $n = 24$ ), and control (CG;  $n = 22$ ). Patients were recruited from a diabetes outpatient clinic and via newspaper advertisement. Consisted of a 4-month intervention period followed by an 8-month follow-up, during which the participants were recommended to train on their own. There was no difference in HbA1c when comparing the intervention groups relative to the control group: However, fat mass assessed by dual

energy X-ray absorptiometry (DXA) decreased significantly in the NW group after 4 months and after 12 months in both NW and EP groups. No significant changes in other variables.

Kyizom T, et.,al.,(May 2010) A study was conducted in New Delhi, India to see the role of pranayama and yoga-asana on P300 latency and amplitude in type 2 diabetic patients. A sample of 60 patients of type 2 diabetes were recruited from diabetic clinic and divided into two groups - control group on only conventional medical therapy and yoga-group on conventional medical therapy along with pranayama and yoga-asana. Basal recordings of P300 and blood glucose were taken at the time of recruitment and second recordings repeated after forty five days for both the groups. Study showed a statistically significant improvement in the latency and the amplitude of N200, P300 in the yoga group as compared to the control group. Investigators suggested that yoga can be incorporated along with the conventional medical therapy for improving cognitive brain functions in diabetes.

Shenbagavalli1, A. and Poomayil(2010), M. The study was designed to investigate the effects of yoga practices and naturopathy treatments on selected blood sugar & blood pressure variables of diabetic patients. For this 45 diabetic patients were selected randomly from Annai Sakunthala Nature Cure Hospital & Yoga Centre, Karaikudi. Their age ranged from 35 to 55 years. They were divided into three equal groups namely experimental group 1, experimental group 2 and control group. The treatment was given during the working days (except Saturdays and Sundays). The experimental group 1 underwent naturopathy treatment, experimental group 2 underwent yogic practices and control group was not given any specific training. The following criterion variables were chosen namely, blood sugar, blood pressure and were assessed before and after the training period of 12 weeks. The analysis of covariance and Scheffe's Post\_Hoc test were used to test the adjusted posttest mean difference among the experimental groups. the analyzed data on diabetic-fasting. The pre test, post test

and adjusted post test means of the diabetic-fasting were (161.133,161.533,161.667), (160.933,135.400,145.867) and (161.247,135.310,145.642) for the experimental group I, II and the control groups respectively. The obtained „f $\square$  ratio for pre test 0.02, post test 20.06 and adjusted post test 47.12. The obtained „f $\square$  ratio of post and adjusted post test were 20.06 and 47.12. The table value is 3.22 at 5% level of significance for the degree of freedom (2 and 41). Therefore it is proved that experimental group I & II has been better than control group. The study revealed that the selected blood sugar and blood pressure were significantly reduced due to the influence of yogic practices and naturopathy treatments in diabetic patients.

Amitha (2009) Diabetes is a metabolic disorder, which has become a major health challenge worldwide. South East Asian countries have a highest burden of diabetes. In India the prevalence of diabetes is rising rapidly especially in the urban population because of increasing obesity and reduced physical activity. An objective of this study is to evaluate the effect of Yoga Nidra on blood glucose level in diabetic patients. This study was conducted on 41, middle aged, tupe-II diabetic patients, who were on oral hypoglycaemic alone. These patients were divided into two groups: (a) 20 patients on oral hypoglycaemic with yoga – nidra and (B) 21 were on oral hypoglycaemic alone. Yoga-nidra practiced for 30 minutes daily up to 90 days, parameters were recorded every, 30th day. Results of this study showed that most of the symptoms were subsided ( $p < 0.004$ , significant), and fall of mean blood glucose level was significant after 3-month of Yoga-nidra. This fall was 21.3mg/dl,  $P < 0.007$ , (from  $159 \pm 12.27$  to  $137.7 \pm 23.15$ ,) in fasting and 17.95 mg/dl,  $P = 0.02$ , (from  $255.45 \pm 16.85$  to  $237.5 \pm 30.54$  ) in post prandial glucose level. Results of this study suggest that subjects on Yoganidra with drug regimen had better control in their fluctuating blood glucose and symptoms associated with diabetes, compared to those were on oral hypoglycaemics alone.

Rashmi Vyas (2008) This study was designed to assess the effect of raja yoga meditation of Brahmakumaris which is very simple to practice, on serum lipids in normal Indian women. 49 normal female volunteers were the subjects. They were divided into pre – menopausal (n = 23 ) and post – menopausal (n=26) groups. They were further divided into non- meditators (who had never done any kind of meditation), short – term meditators (meditation for more than 5 years). Lipid profile was assessed using their respective reagent sets. Serum cholesterol, triglyceride and low-density lipoprotein – cholesterol in non – meditators were significantly more in post – menopausal women as compared to pre-menopausal women. Serum cholesterol and low density lipoprotein cholesterol were significantly lowered in both short and long term meditators as compared to non – meditators in post – menopausal women. No significant difference was observed in lipid profile in pre – menopausal women. Raja yoga meditation lowered serum cholesterol and low – density lipoprotein – cholesterol in post – menopausal women thus reducing the risk of coronary artery disease in them.

Badr Aljasir (May 2008) The effect of practicing yoga for the management of type II Diabetes was assessed in this systematic review through searching related electronic databases and the grey literature to the end of May 2007 using Ovid. All randomized controlled clinical trials (RCTs) comparing yoga practice with other type of intervention or with regular practice or both, were included regardless of language or type of publication. Each study was assessed for quality by two independent reviewers. Mean difference was used for summarizing the effect of each study outcomes with 95% confidence intervals. Pooling of the studies did not take place due to the wide clinical variation between the studies. Publication bias was assessed by statistical methods. Five trials with 363 participants met the inclusion criteria with medium to high risk of bias and different intervention characteristics. The studies' results show improvement in outcomes among patients with diabetes type II.

These improvements were mainly among short term or immediate diabetes outcomes and not all were statistically significant. The results were inconclusive and not significant for the long-term outcomes. No adverse effects were reported in any of the included studies. Short-term benefits for patients with diabetes may be achieved from practicing yoga. Further research is needed in this area. Factors like quality of the trials and other methodological issues should be improved by large randomized control trials with allocation concealment to assess the effectiveness of yoga on diabetes type II. A definitive recommendation for physicians to encourage their patients to practice yoga cannot be reached at present.

Chen, et. al.,<sup>13</sup> (October 2008) the study is determine the promoting physical fitness of young-older adults is essential in reducing healthcare expenditures which would occur in the future for those with chronic health problems. The silver yoga exercise programme was developed to accommodate the reduced body flexibility experienced by many older adults and was critically reviewed by experts and pilot-tested with communitydwelling older adults. This study aimed to test older adults' physical fitness after a 24-week silver yoga exercise programme and to examine whether the programme could be further shortened to fit senior activity centres' programme designs. DESIGN: A quasi-experimental, pre-post tests design was used: baseline, at 12-week and at 24-week periods. METHODS: Convenience samples of 204 subjects were recruited from eight senior activity centres and 176 subjects completed the study. Subjects were randomly assigned into three groups based on the centres: (1) Experiment I: complete silver yoga with stretching and meditation, (2) Experiment II: shortened silver yoga without the guided-imagery meditation and (3) Waitlist control. The interventions were conducted three times per week for 24 weeks. Physical fitness indicators included body compositions, cardiovascular-respiratory functions, physical functions and the range of motion. RESULTS: At the end of the 24-week period, the physical fitness of subjects in Experiments I and II had significantly improved

whether or not guided-imagery meditation was used and all had better physical fitness than subjects in the control group (all  $p < 0.05$ ). **CONCLUSIONS:** The physical fitness of older adults in both the 70-minute complete silver yoga group and the 55-minute shortened silver yoga group had significantly improved after the interventions. It was recommended that the silver yoga programme be shortened by eliminating the guided-imagery meditation. **RELEVANCE TO CLINICAL PRACTICE:** The shortened silver yoga exercise programme is recommended to be incorporated as an activity programme in community settings to promote the physical fitness of older adults.

Margie H. Devanport, (April 2008) A study conducted to assess effect of a one year intensified diet, exercise education on regimen on habitual physical activity and aerobic capacity in middle aged obese patients with newly diagnosed diabetes mellitus .after a 3 months basic education programme, 78 patients were randomly placed in a intervention or conventionally treated group .the intervention group received intensified diet education and continuous encouragement to increase physical activity which was monitored using exercise and questionnaires .aerobic capacity was assessed by measuring oxygen uptake at an aerobic threshold and at peak exercise .the proportion of patients with regular recreational exercise increased from 24% to 38% in the interventional men ,increased from 53% to 70% in the intervention women and from 31% to 50% in conventionally treated women .No measurable improvement were found in oxygen uptake in any of the group.

Gordon LA, et.,al., (May 2008) A prospective randomized study was conducted in Kingston, Jamaica to investigate the impact of Hatha yoga and conventional physical training (PT) exercise regimens on biochemical, oxidative stress indicators and oxidant status in patients with type 2 diabetes. It considered 77 type 2 diabetic patients to investigate the impact of Hatha yoga and conventional physical training (PT) exercise regimens on

biochemical, oxidative stress indicators and oxidant status in patients with type 2 diabetes. Results revealed that 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 ( $P = 0.036$ ). This study concludes that 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 suggest that Hatha yoga exercise and conventional PT exercise may have therapeutic preventative and protective effects on diabetes mellitus by decreasing oxidative stress and improving antioxidant status.

Innes KE, et.,al.,(Dec2007) A comprehensive literature search done in Charlottesville, USA. Identified 25 eligible studies, including 15 uncontrolled trials, 6 non-randomized controlled trials and 4 randomized controlled trials (RCTs). Overall, these studies suggest beneficial changes in several risk indices, including glucose tolerance and insulin sensitivity, lipid profiles, anthropometric characteristics, blood pressure, oxidative stress, coagulation profiles, sympathetic activation and pulmonary function, as well as improvement in specific clinical outcomes. Yoga may improve risk profiles in adults with DM 2, and may have promise for the prevention and management of cardiovascular complications in this population. However, the limitations characterizing most studies preclude drawing firm conclusions. Additional high-quality RCTs are needed to confirm and further elucidate the effects of standardized yoga programs in populations with DM 2.

Sahay (February 2007) The science of yoga is an ancient one. It is a rich heritage of our culture. Several older books make a mention of the usefulness of yoga in the treatment of certain diseases and preservation of health in normal individuals. The effect of yogic

practices on the management of diabetes has not been investigated well. We carried out well designed studies 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 confirmed 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 significantly reduced. There were significant changes in the insulin kinetics and those of counter regulatory hormones like cortisol. There was a decrease 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 role even in the prevention of diabetes. There is a beneficial effect on the co-morbid conditions like hypertension and dyslipidemia.

Stevenson CR, et., al. (Sep2007) A study was conducted in India to assess the potential impact of diabetes as a risk factor for incident pulmonary tuberculosis. An epidemiological model was used to collect data on tuberculosis incidence, diabetes prevalence, population structure, and relative risk of tuberculosis associated with diabetes and the contribution made by diabetes to both tuberculosis incidence, and to the difference between tuberculosis incidence in urban and rural areas was evaluated. Results revealed that diabetes accounts for 14.8% of pulmonary tuberculosis and 20.2% of smear-positive (i.e. infectious) tuberculosis. It is estimated that the increased diabetes prevalence in urban areas is associated with a 15.2% greater smear-positive tuberculosis incidence in urban than rural areas - over a fifth of the estimated total difference. This study concludes that Diabetes makes



a substantial contribution to the burden of incident tuberculosis in India, and the association is particularly strong for the infectious form of tuberculosis.

Oak et al., (2006) evaluated a 30-day yoga programme, followed by monthly follow-ups for the subsequent six months on obese Indian. Residential Yoga Group (RYG) showing a consistently, though statistically not- significant, decreasing trend in all the four factors of anxiety, enunciated in IPAT's A.S.Q Test. Non-residential Yoga Group (NRYG), Aerobic Group (AG) and Control Group (CG) have shown consistently high scores denoting the trait of apprehension. All the four groups have shown a normal-range score in factor C (emotional instability), L (suspiciousness) and Q3 (low self control) hinting at absence of neurotic tendencies in Indian obese. The study is indicative of an ample scope for long term interventions of yoga in rehabilitation programmes for the obese, in general & for the Indian obese, in particular.

Kim (December 2006) There is growing evidence that yoga may offer a safe and cost-effective intervention for Type 2 Diabetes mellitus (DM 2). However, systematic reviews are lacking. This article critically reviews the published literature regarding the effects of yoga-based programs on physiologic and anthropometric risk profiles and related clinical outcomes in adults with DM 2. We performed a comprehensive literature search using four computerized English and Indian scientific databases. The search was restricted to original studies (1970–2006) that evaluated the metabolic and clinical effects of yoga in adults with DM 2. Studies targeting clinical populations with cardiovascular disorders that included adults with comorbid DM were also evaluated. Data were extracted regarding study design, setting, target population, intervention, comparison group or condition, outcome assessment, data analysis and presentation, follow-up, and key results, and the quality of each study was evaluated according to specific predetermined criteria. We identified 25 eligible

studies, including 15 uncontrolled trials, 6 non-randomized controlled trials and 4 randomized controlled trials (RCTs). Overall, these studies suggest beneficial changes in several risk indices, including glucose tolerance and insulin sensitivity, lipid profiles, anthropometric characteristics, blood pressure, oxidative stress, coagulation profiles, sympathetic activation and pulmonary function, as well as improvement in specific clinical outcomes. Yoga may improve risk profiles in adults with diabetes mellitus II, and may have promise for the prevention and management of cardiovascular complications in this population. However, the limitations characterizing most studies preclude drawing firm conclusions. Additional high-quality RCTs are needed to confirm and further elucidate the effects of standardized yoga programs in populations with diabetes mellitus II.

P.S Singh (April 2005) The present study was conducted in 20 patients of type II Diabetes Mellitus. It provides metabolic and clinical evidence on improvement in glycaemic control and autonomic function. Patient's age ranged from 35 to 55 years and all were of antihyperglycaemic and dietary regimen. Their baseline fasting and postprandial blood glucose as well as glycosylated Hb were monitored along with autonomic function studies. These patients were given training in Pranayam for 35 minutes / day for 90 days under guidance. Pranayam consisted of Ujjai, Bhastrika, Omkar and Sudarshan kriya. After 3 mnths of Pranayam the parameters were repeated. The results indicate that there was significant decrease in fasting blood glucose levels from basal  $190 \pm 18$  to  $140 \pm 16$  mg% and postprandial level decreased from  $280 \pm 20$  to  $200 \pm 18$  mg%. Glycosylated Hb showed a decrease from  $10 \pm 0.30$  to  $7.80 \pm 0.5$  after Prranayam. Pulse rate, systolic and diastolic BP decrease significantly after Pranayam. Findings suggest better glycaemic control and stable autonomic function in type II Diabetes Mellitus with regular Pranayam. However exact mechanism as to how Pranayam interact with somato-neuroendocrine mechanism affecting metabolic and autonomic function remains to be worked out.

Malhotra (December 2005) has done research on diabetic patients. Twenty NIDDM subjects (mild to moderate diabetics) in the age group of 30-60 years were selected from the out patient 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, Ardhamatsyendrasana, 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 results indicate 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 somato endocrine mechanism affecting insulin kinetics was worked out. A significant decrease in waist-hip ratio and changes in insulin levels were also observed, suggesting a positive effect of yoga asanas on glucose utilization and fat redistribution in NIDDM. Yogasanas may be used as an adjunct with diet and drugs in the management of Type II diabetes.

Boden G. Sargrad K, (mar 2005) A study was conducted to assess the effectiveness of weight loss more quickly with low carbohydrate diets compared with usual dieting obese patients with type 2 diabetes 10 volunteers with type 2 diabetes who where the very obese were taken for a study purpose. For a first 7 days patients ate their usual diet for next 14 days. They followed a low carbohydrate diet, the study results showed that patient lost 1.65 kg after 14 days and low carbohydrate diet. Blood sugar and cholesterol level improved during the low carbohydrate diet. The researchers suggest that reduced caloric intake seems account for weight loss associated during the first 2 wks at low carbohydrate level.

Manjunatha (July-September 2005) has conducted a study to examine the hypothesis that yogasanas help in the treatment of diabetes mellitus by releasing insulin from the pancreas. Twenty healthy young volunteers (17 male, three female; age 19-31 years) participated in the study. Each volunteer performed four sets of asanas in random order for five consecutive days each with a two days 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 four and five of each set of asanas for measurement of glucose and insulin levels before the asanas, within 10 minutes after performing the asanas, and 30 minutes after ingestion of 75 grams. glucose, which in turn was ingested immediately after the second blood sample. A standard 75 gms. 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. However, the serum insulin level 0.5 h after the post-asana oral 75 grams. 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 significant in that it has for the first time attempted to probe the mechanism by which yogasanas help diabetes mellitus.

Malhotra V,A., et.,al,(2005) study was conducted in New Delhi, India to evaluate the effect of different yogasanas on 20 mild to moderate type II diabetic patients. Total of 20, NIDDM subjects (mild to moderate diabetics) in the age group of 30-60 years were selected from the out patient 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, Ardhamatsyendrasana, Pawanmuktasana, Bhujangasana, Vajrasana, Dhanurasana and Shavasana are beneficial for diabetes mellitus. The results indicate 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, suggesting a positive effect of yoga asanas on glucose utilization and fat redistribution in NIDDM. Yoga asanas may be used as an adjunct with diet and drugs in the management of Type 2 diabetes.

Bijlani RL, et., al.,(Apr 2005)A study was conducted in New Delhi, India to analyze the short-term impact of a brief lifestyle intervention based on yoga on some of the biochemical indicators of risk for cardiovascular disease and diabetes mellitus. 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. Results showed that 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, after the prescribed intervention. The changes were more marked in subjects with hyperglycemia or hypercholesterolemia. This study concludes that a short lifestyle modification and stress management education program leads to favorable metabolic effects within a period of 9 days.

Singh (March 2004) has done research on type II diabetes and the effect of yogic exercises. OBJECTIVES: 1. To study the effect of forty days of Yogic exercises on cardiac functions in Type II Diabetics. 2. To study the effect of forty days of Yogic exercises on blood glucose level, glycosylated hemoglobin. METHODS: The present study done in twenty-four Type II DM cases 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. The expert gave these patients training in yoga asanas and they pursued those 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. RESULTS: The results indicate that there was significant 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. CONCLUSION: These findings suggest that better glycaemic control and stable autonomic functions can be obtained in Type 2 DM 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 autonomic functions remains to be worked out.

Venkatareddy.et.al. (April, 2003) studied the effect of yoga on weight and fat fold thickness among obese women. 30 obese woman of age 19-53, categorized into two

groups, as per body mass index (BMI), were exposed to one-hour practice of asanas and pranayama in the morning for the period of 90 days. A significant reduction in BMI was seen in both groups. In group I (BMI greater than 35) the reduction was greater as compared to group II (BMI 25- 35). Lean body mass (LBM), however, did not show significant change in both the groups.

Kulkarni, Gore, Bhogal, Oak and Bera (2002)<sup>7</sup> derived lipid profile and cardiovascular risk ratio on the subjects of both sexes (Age range 15 to 70 years) followed by the intervention of yoga training to residential (male: 9, female: 28), nonresidential (M=9,FM=19), groups as well as aerobic exercise group (male: 37, female: 44). The intervention of an hour a day, total of 30 days with six months follow-up. The overall trend of results in both groups of yoga showed nonsignificant change in lipid profile. However non-residential group was better in magnitude of change. In aerobic group, lipid profile fluctuation with occasional significant change in both the directions was noticed, particularly in HDL and other lipoproteins. The cardiovascular risk ratio in males of both yoga groups remained moderate in pre, post, I and III follow-up tests. The aerobic group showed normal risk ratio in pre and in all follow-up tests. However a high-risk ratio was seen in posttest. The female residential group had a moderate risk in pre, post, I and II follow-up tests, and remained normal throughout all the follow-up tests. The nonresidential group had moderate risk ratio in pre test and remained normal in post and in all follow-up tests. The reverse was seen in aerobic group, having normal risk ratio in pre and follow-up tests and a high-risk ratio in the posttest. The study concludes that the cumulative effect of yoga practice along with physical activity is more effective in lowering the lipid profile as compared to residential yoga and aerobic exercise groups, apart from the role of diet control towards balanced energy expenditure. This implies that underlying biochemical mechanism of yoga practice is

instrumental in lipid profile reduction as against usual fat burning mechanism in exercise mode of intervention.

Takahashi M, Arati A(Sep2002). The study was concluded to compare the effect of simple dietary education on food intake, nutritional components and glycemic control with conventional dietary education. A randomly allocated 30 new elderly diabetic outpatients and 38 outpatient who had been visiting the clinic. For a long time to the simple education group and the conventional educating group. Before and 2 or 3 months after a simple or conventional education they assessed. Food intake nutritional education similarly reduced HbA1C levels as well as intakes of total energy, sweets and fruits after the education. However patient who had been visiting for a long time had no significant difference in total energy intake and HbA1C level between before and after education in both the simple and conventional groups the results suggest that simple dietary education is useful and effective diabetic patient on their first visit.

Dalal (2002) reveals emotion is a motive power, which helps in evolution. In yogic terminology, emotion is a Rajas guna of Prakriti, which exists in everyone. Excitement or upsurge of emotion is responsible for many types of disease. Psychophysiologically, emotions act upon our body through hypothalamus, which controls ANS and the endocrine systems. Negative emotions like anger, fear, greed, jealousy give rise to somatic illness where on the other hand positive emotions like love, compassion, friendship, affection etc. give the strength to combat the stress. Illness due to negative emotions includes hyper acidity, hypertension, insomnia, menstrual disturbances, loss of appetite etc. Daily yoga sadhana of eight-fold path with a proper balanced diet helps one to act against stressful threshold situations by increasing the threshold of tolerance. The beauty of yoga therapy is that it treats the individual as a whole. An observation was made on 287 sadhakas (male=133 and



female=154). Their financial condition, family background and environment were noted. Different symptoms of the subjects were tabulated and studied for every 2 months with the help of physical check-up and psychological testing with different questionnaires related to anxiety, depression, positive and negative outlook towards life. All the findings were again tabulated in details. The variables stated above were tested before and after the programmes viz., Pratipakshabhavana, Anityabhavana and Sakshibhavana respectively. These practices were done daily for a period of 2 months. The favourable results suggest that Yoga leads to Samadhi, kaivalya, eternal bliss, which aim to maintain physical fitness, mental stability, emotional quietness and spiritual elevation.

Malhotra (July 2002) Certain 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 middleaged 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 gave these patients training in yoga asanas and were 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 indicate 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 /s+1-1.0 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 suggest 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.

Vanninen E, Vusitupa M (1992 April) A pilot project was developed to document the effectiveness of a structured low-intensity walking protocol on capillary glucose control in GDM women. Ten GDM women followed conventional management of diet and insulin therapy, plus a low-intensity walking program (W) from diagnosis to delivery. Capillary glucose concentrations, insulin requirements, and pregnancy outcomes were compared with a matched cohort by body mass index (BMI), age, and insulin usage (20 GDM women who followed conventional management alone (C)). Baseline capillary glucose concentrations were not significantly different between the W and C groups. The W group had an average acute drop in capillary glucose concentration from pre- to post-exercise of 2.0 mmol•L<sup>-1</sup>. In addition, the W group had significantly lower mean glucose concentrations in the fasted state and 1 h after meals than the C group in the week prior to delivery. These lower glucose concentrations were achieved while requiring fewer units of insulin per day injected less frequently. These results suggest an effective role in glucose regulation for this structured walking program.

Gore (1987-88) investigated the beneficial effect of yoga training was observed on six out of nine diabetics in respect of fasting and postprandial blood sugar level, sugar in urine, glucose tolerance and medication. Avoidance of exertion and emphasis on relaxation and tranquilization were the main objectives of yoga training and practice.

Sahay (1988) has done research on blood sugar levels of diabetic patients. He found that fasting and post lunch blood sugar levels of diabetics came down significantly. The patients developed a sense of well being within 10 days, with lowering of the dosage of drugs and diminished incidence of acute complications like infections and ketosis. There were significant changes in the 'Insulin kinetics' and those of counter regulatory hormones like cortisol. The follow-up study was conducted for two to seven years revealed normalization of the periodic blood sugar values and hypoglycemia.

. Kabat-Zinn J, (1982) studied about an outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation, theoretical considerations and preliminary results. The practice of mindfulness meditation was used in a 10-week Stress Reduction and Relaxation Program to train chronic pain patients in self-regulation. The meditation facilitates an attention stance towards proprioception known as detached observation. This appears to cause an "uncoupling" of the sensory dimension of the pain experience from the affective/evaluative alarm reaction and reduce the experience of suffering via cognitive reappraisal. Data are presented on 51 chronic pain patients who had not improved with traditional medical care. The dominant pain categories were low back, neck and shoulder, and headache. Facial pain, angina pectoris, noncoronary chest pain, and GI pain were also represented. At 10 weeks, 65% of the patients showed a reduction of greater than or equal to 33% in the mean total Pain Rating Index (Melzack) and 50% showed a reduction of greater than or equal to 50%. Similar decreases were recorded on other pain indices and in the number of medical symptoms reported. Large and significant reductions in mood disturbance and psychiatric symptomatology accompanied these changes and were relatively stable on follow-up. These improvements were independent of the pain category. It was concluded that, this form of meditation could be used as the basis for an effective behavioral program in selfregulation for chronic pain patients.

The review of literature helped 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 for changing the physiological, biochemical and psychological variables.