Chapter II

REVIEWS OF RELATED LITERATURE
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Studies on yoga and diabetes

Amitha\(^1\) (2009) Diabetes is a metabolic disorder, which has become a major health challenge worldwide. South East Asian counties 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, type-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, 30\(^{th}\) 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 ± 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. Results of 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.

Rashmi Vyas\(^2\) (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 Aljasir3 (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.

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.

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 ± 18 to 140 ± 16 mg% and postprandial level decreased from 280 ± 20 to 200 ± 18 mg%. Glycosylated Hb showed a decrease from 10 ± 0.30 to 7.80 ±0.5 after Pranayam. 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 ≤ 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 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 utilisation and fat redistribution in NIDDM. Yogasanas may be used as an adjunct with diet and drugs in the management of Type II diabetes.

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.

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.

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 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 gave these patients training in yoga asanas and were pursed 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, PEFR, 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.

Sahay \(^{11}\) (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.

Gore (1987-88) investigated the beneficial effect of yoga training was observed on six out of nine diabetics in respect of fasting and post-prandial 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.

Chen, et. al. (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 community-dwelling 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) Wait-list 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.

Tseng, et. al.,14 (February 2007) this study reports the development and evaluation of a new yoga exercise programme for older adults, called the Silver Yoga Programme. BACKGROUND: Yoga practice is associated with numerous health improvements, including reduced cardiovascular risk, body mass index and blood pressure. Yoga is also associated with improved respiration, psychological health and pain management. Studies have suggested the beneficial effects of yoga in the older population. METHOD: The study was conducted in 2005 and it had two phases. Phase I consisted of sending a survey to 10 experts to help develop the Silver Yoga Programme. A hard copy and a video containing detailed descriptions and demonstrations of the programme were then sent to the experts for review and critique regarding the clarity and feasibility of the yoga postures. Phase II was an enquiry into older adults' views on the programme using a quantitative
evaluation and semi-structured qualitative inquiry. Fourteen women participants from a senior activity centre were interviewed individually after 1 month of Silver Yoga group practice, three times per week, 70 minutes per session. They were asked to evaluate the appropriateness of postures based on the criteria of difficulty, acceptability, feasibility and helpfulness. Five open-ended questions asked participants to reflect on their yoga experiences.

RESULTS: Participants’ mean ratings of the acceptability, feasibility and helpfulness of the four aspects of the programme (warm-up, Hatha yoga, relaxation and guided-imagery meditation) ranged from 8.8 +/- 1.9 to 9.3 +/- 1.5; mean ratings of the difficulty of the programme revealed that relaxation and guided-imagery meditation were fairly easy to follow (0.1 +/- 0.3 and 0.1 +/- 0.3 respectively), but the postures in the Hatha yoga were relatively challenging (2.1 +/- 2.6). CONCLUSION: The Silver Yoga Programme should undergo further pilot testing with larger samples of older adults before it is taken up internationally as a health-promotion activity for older adults.

Smith, et. al.,15 (June 2007) this study was determined to compare yoga and relaxation as treatment modalities at 10 and 16 weeks from study baseline to determine if either of modality reduces subject stress, anxiety, blood pressure and improve quality of life. DESIGN: A randomized comparative trial was undertaken comparing yoga with relaxation. PARTICIPANTS: One hundred and thirty-one subjects with mild to moderate levels of stress were recruited from the community in South Australia. INTERVENTIONS: Ten weekly 1- h sessions of relaxation or hatha yoga. MAIN OUTCOME MEASURES: Changes in the State Trait Personality Inventory sub-scale anxiety, General Health Questionnaire and
the Short Form-36. RESULTS: Following the 10 week intervention stress, anxiety and quality of life scores improved over time. Yoga was found to be as effective as relaxation in reducing stress, anxiety and improving health status on seven domains of the SF-36. Yoga was more effective than relaxation in improving mental health. At the end of the 6 week follow-up period there were no differences between groups in levels of stress, anxiety and on five domains of the SF-36. Vitality, social function and mental health scores on the SF-36 were higher in the relaxation group during the follow-up period. CONCLUSION: Yoga appears to provide a comparable improvement in stress, anxiety and health status compared to relaxation.

Oken, et. al., (February 2006) there are potential benefits of mind-body techniques on cognitive function because the techniques involve an active attentional or mindfulness component, but this has not been fully explored. OBJECTIVE: To determine the effect of yoga on cognitive function, fatigue, mood, and quality of life in seniors. DESIGN: Randomized, controlled trial comparing yoga, exercise, and wait-list control groups. PARTICIPANTS: One hundred thirty-five generally healthy men and women aged 65-85 years. INTERVENTION: Participants were randomized to 6 months of Hatha yoga class, walking exercise class, or wait-list control. Subjects assigned to classes also were asked to practice at home. MAIN OUTCOME MEASURES: Outcome assessments performed at baseline and after the 6-month period included a battery of cognitive measures focused on attention and alertness, the primary outcome measures being performance on the Stroop Test and a quantitative electroencephalogram (EEG) measure of alertness; SF-36 health-related quality of life; Profile of Mood States; Multi-Dimensional Fatigue
Inventory; and physical measures related to the interventions. RESULTS:

One hundred thirty-five subjects were recruited and randomized. Seventeen subjects did not finish the 6-month intervention. There were no effects from either of the active interventions on any of the cognitive and alertness outcome measures. The yoga intervention produced improvements in physical measures (e.g., timed 1-legged standing, forward flexibility) as well as a number of quality-of-life measures related to sense of well-being and energy and fatigue compared to controls. CONCLUSIONS: There were no relative improvements of cognitive function among healthy seniors in the yoga or exercise group compared to the wait-list control group. Those in the yoga group showed significant improvement in quality-of-life and physical measures compared to exercise and wait-list control groups.

Carlson, et. al.,17 (October 2006) this study was determine to physical activity provides a number of physical and psychological benefits to cancer survivors, including lessening the impact of detrimental cancer-related symptoms and treatment side-effects (e.g., fatigue, nausea), and improving overall well-being and quality of life. The purpose of the present pilot study was to examine the physical and psychological benefits afforded by a 7-week yoga program for cancer survivors. METHOD: Eligible participants (per-screened with PAR-Q/PAR-MED-X) were randomly assigned to either the intervention (n=20) or control group (n=18). All participants completed pre- and post-testing assessments immediately before and after the yoga program, respectively. RESULTS: The yoga program participants (M age=51.18 (10.33); 92% female) included primarily breast cancer survivors, on average 55.95 (54.39) months post-diagnosis. Significant differences between the intervention and the control group at
post-intervention were seen only in psychosocial (i.e. global quality of life, emotional function, and diarrhea) variables (all p's <0.05). There were also trends for group differences, in the hypothesized directions, for the psychosocial variables of emotional irritability, gastrointestinal symptoms, cognitive disorganization, mood disturbance, tension, depression, and confusion (all p's <0.10). Finally, there were also significant improvements in both the program participants and the controls from pre- to post-intervention on a number of physical fitness variables. CONCLUSIONS: These initial findings suggest that yoga has significant potential and should be further explored as a beneficial physical activity option for cancer survivors. Future research might attempt to include a broader range of participants (e.g. other types of cancer diagnoses, male subjects), a larger sample size, and a longer program duration in an RCT.

Harinath, et. al.,\textsuperscript{18} (April 2004) this study to evaluate effects of Hatha yoga and Omkar meditation on cardio respiratory performance, psychology profile, and melatonin secretion. SUBJECTS AND METHODS: Thirty healthy men in the age group of 25-35 years volunteered for the study. They were randomly divided in two groups of 15 each. Group 1 subjects served as controls and performed body flexibility exercises for 40 minutes and slow running for 20 minutes during morning hours and played games for 60 minutes during evening hours daily for 3 months. Group 2 subjects practiced selected yogic asanas (postures) for 45 minutes and Pranayama for 15 minutes during the morning, whereas during the evening hours these subjects performed preparatory yogic postures for 15 minutes, Pranayama for 15 minutes, and meditation for 30 minutes daily, for 3 months. Orthostatic tolerance, heart rate, blood pressure, respiratory rate, dynamic lung function (such as forced vital capacity, forced expiratory volume in 1
second, forced expiratory volume percentage, peak expiratory flow rate, and maximum voluntary ventilation), and psychologic profile were measured before and after 3 months of yogic practices. Serial blood samples were drawn at various time intervals to study effects of these yogic practices and Omkar meditation on melatonin levels. RESULTS: Yogic practices for 3 months resulted in an improvement in cardiorespiratory performance and psychologic profile. The plasma melatonin also showed an increase after three months of yogic practices. The systolic blood pressure, diastolic blood pressure, mean arterial pressure, and orthostatic tolerance did not show any significant correlation with plasma melatonin. However, the maximum night time melatonin levels in yoga group showed a significant correlation ($r = 0.71, p < 0.05$) with well-being score. CONCLUSION: These observations suggest that yogic practices can be used as psychophysologic stimuli to increase endogenous secretion of melatonin, which, in turn, might be responsible for improved sense of well-being.

Parshad,19 (June 2004) this study investigated the state of the mind and that of the body are intimately related. If the mind is relaxed, the muscles in the body will also be relaxed. Stress produces a state of physical and mental tension. Yoga, developed thousands of years ago, is recognized as a form of mind-body medicine. In yoga, physical postures and breathing exercises improve muscle strength, flexibility, blood circulation and oxygen uptake as well as hormone function. In addition, the relaxation induced by meditation helps to stabilize the autonomic nervous system with a tendency towards parasympathetic dominance. Physiological benefits which follow, help yoga practitioners become more resilient to stressful conditions and reduce a variety of important risk factors for various diseases, especially cardio-respiratory diseases.
Asnani, et. al., (January 2001) this study was undertaken to observe any beneficial effect of yogic practices during training period on the young trainees. 54 trainees of 20-25 years age group were divided randomly in two groups i.e. yoga and control group. Yoga group (23 males and 5 females) was administered yogic practices for the first five months of the course while control group (21 males and 5 females) did not perform yogic exercises during this period. From the 6th to 10th month of training both the groups performed the yogic practices. Physiological parameters like heart rate, blood pressure, oral temperature, skin temperature in resting condition, responses to maximal and submaximal exercise, body flexibility were recorded. Psychological parameters like personality, learning, arithmetic and psychomotor ability, mental well being were also recorded. Various parameters were taken before and during the 5th and 10th month of training period. Initially there was relatively higher sympathetic activity in both the groups due to the new work/training environment but gradually it subsided. Later on at the 5th and 10th month, yoga group had relatively lower sympathetic activity than the control group. There was improvement in performance at submaximal level of exercise and in anaerobic threshold in the yoga group. Shoulder, hip, trunk and neck flexibility improved in the yoga group. There was improvement in various psychological parameters like reduction in anxiety and depression and a better mental function after yogic practices.

Ray, et. al., (December 2001) this study was to reports on the effect of yogic exercises on aerobic capacity are few. There is also no literature available on the effect of yogic exercise on perceived exertion (PE) after maximal exercise. In this study the effect of training in Hatha yogic exercises on aerobic capacity and PE after maximal exercise was observed.
METHODS: Forty men from the Indian army (aged 19-23 yr) were administered maximal exercise on a bicycle ergometer in a graded work load protocol. The oxygen consumption, carbon dioxide output, pulmonary ventilation, respiratory rate, heart rate (HR) etc., at maximal exercise and PE score immediately thereafter were recorded. The subjects were divided into two equal groups. Twelve subjects dropped out during the course of study. One group (yoga, n = 17) practiced Hatha yogic exercises for 1 h every morning (6 days in a week) for six months. The other group (PT, n = 11) underwent conventional physical exercise training during the same period. Both groups participated daily in different games for 1 h in the afternoon. In the 7th month, tests for maximal oxygen consumption (VO2Max) and PE were repeated on both groups of subjects. RESULTS: Absolute value of VO2Max increased significantly (P < 0.05) in the yoga group after 6 months of training. The PE score after maximal exercise decreased significantly (P < 0.001) in the yoga group after 6 months but the PT group showed no change.

INTERPRETATION & CONCLUSION: The practice of Hatha yogic exercises along with games helps to improve aerobic capacity like the practice of conventional exercises (PT) along with games. The yoga group performed better than the PT group in terms of lower PE after exhaustive exercise.

Gimbel, 22 (December 1998) this study is hatha yoga and meditation as adjunctive therapies for promoting and maintaining wellness offer an excellent example of the mind-body connection at work. Hatha yoga creates balance, physically and emotionally, by using postures, or asanas, combined with breathing techniques, or Pranayama. Meditation and guided imagery not only support the physical and emotional work being done by the postures and breathing, they open the door to self-actualization to create the perfect
union of the mind, body, and spirit. This report discusses the definitions of hatha yoga, meditation, and imagery and their clinical applications. Three case studies from private practice are presented.

**Studies on Aerobics and Diabetes**

Ivy 23 (November 1997) Recent Epidemiological studies indicate that individuals who maintain a physically active lifestyle are much less likely to develop impaired glucose tolerance and non-insulin-dependent diabetes mellitus (NIDDM). Moreover, it was found that the protective effect of physical activity was strongest for individuals at highest risk of developing NIDDM. Reducing the risk of insulin resistance and NIDDM by regularly performed exercise is also supported by several aging studies. It has been found that older individuals who vigorously train on a regular basis exhibit a greater glucose tolerance and a lower insulin response to a glucose challenge than sedentary individuals of similar age and weight. While the evidence is substantial that aerobic exercise training can reduce the risk of impaired glucose tolerance and NIDDM, the evidence that exercise training is beneficial in the treatment of NIDDM is not particularly strong. Many of the early studies investigating the effects of exercise training on NIDDM could not demonstrate improvements in fasting plasma glucose and insulin levels, or glucose tolerance. The adequacy of the training programmes in many of these studies, however, is questionable. More recent studies using prolonged, vigorous exercise-training protocols have produced more favourable results. There are several important adaptations to exercise training that may be beneficial in the prevention and treatment of insulin resistance, impaired glucose tolerance and NIDDM. An increase in abdominal fat accumulation and loss of muscle mass are highly associated with the development of
insulin resistance. Exercise training results in preferential loss of fat from the central regions of the body and should therefore contribute significantly in preventing or alleviating insulin resistance due to its development. Likewise, exercise training can prevent muscle atrophy and stimulate muscle development. Several months of weight training has been found to significantly lower the insulin response to a glucose challenge without affecting glucose tolerance, and to increase the rate of glucose clearance during a euglycaemic clamp. Muscle glucose uptake is equal to the product of the arteriovenous glucose difference and the rate of glucose delivery or muscle blood flow. While it has been known for many years that insulin will accelerate blood glucose extraction by insulin-sensitive peripheral tissues, recent evidence suggests that it can also acutely vasodilate skeletal muscle and increase muscle blood flow in a dose-dependent manner. A reduced ability of insulin to stimulate muscle blood flow is a characteristic of insulin-resistant obese individuals and individuals with NIDDM. Exercise training, however, has been found to help alleviate this problem, and substantially improve the control of insulin over blood glucose. Improvements in insulin resistance and glucose tolerance with exercise training are highly related to an increased skeletal muscle insulin action. This increased insulin action is associated with an increase in the insulin-regulatable glucose transporters, GLUT4, and enzymes responsible for the phosphorylation, storage and oxidation of glucose. Changes in muscle morphology may also be important following training. With exercise training there is an increase in the conversion of fast twitch glycolytic IIb fibres to fast twitch oxidative IIa fibres, as well as an increase in capillary density. IIa fibres have a greater capillary density and are more insulin-sensitive and -responsive than IIb fibres. Evidence has been provided that morphological changes in muscle, particularly the capillary density of the muscle, are associated with changes
in fasting insulin levels and glucose tolerance. Furthermore, significant
correlations between glucose clearance, muscle capillary density and fibre
type have been found in humans during a euglycaemic clamp. Exercise
training may also improve control over hepatic glucose production by
increasing.

Wellberg-Henriksson\textsuperscript{24} (January 1998) The incidence of non-insulin-
dependent diabetes mellitus (NIDDM) has increased worldwide during the
last decades, despite the development of effective drug therapy and
improved clinical diagnoses. NIDDM is one of the major causes of disability
and death due to the complications accompanying this disease. For the well-
being of the patient, and from a public healthcare perspective, the
development of effective intervention strategies is essential in order to
reduce the incidence of NIDDM and its resulting complications. For the
patient, and for society at large, early intervention programmes are
beneficial, especially from a cost-benefit perspective. Physical activity
exerts pronounced effects on substrate utilisation and insulin sensitivity,
which in turn potentially lowers blood glucose and lipid levels. Exercise
training also improves many other physiological and metabolic
abnormalities that are associated with NIDDM such as lowering body fat,
reducing blood pressure and normalising dyslipoproteinaemia. Clearly,
regular physical activity plays an important role in the prevention and
treatment of NIDDM. Since physical activity has been shown in prospective
studies to protect against the development of NIDDM, physical training
programmes suitable for individuals at risk for NIDDM should be
incorporated into the medical care system to a greater extent. One general
determinant in a strategy to develop a preventive programme for NIDDM is
to establish a testing programme which includes \( VO_2_{\text{max}} \) determinations for
individuals who are at risk of developing NIDDM. Before initiating regular physical training for people with NIDDM, a complete physical examination aimed at identifying any long term complications of diabetes is recommended. All individuals above the age of 35 years should perform an exercise stress test before engaging in an exercise programme which includes moderate to vigorously intense exercise. The stress test will identify individuals with previously undiagnosed ischaemic heart disease and abnormal blood pressure responses. It is important to diagnose proliferative retinopathy, microalbuminuria, peripheral and/or autonomic neuropathy in patients with NIDDM before they participate in an exercise programme. If any diabetic complications are present, the exercise protocol should be modified accordingly. The exercise programme should consist of moderate intensity aerobic exercise. Resistance training and high intensity exercises should only be performed by individuals without proliferative retinopathy or hypertension. Once enrolled in the exercise programme, the patient must be educated with regard to proper footwear and daily foot inspections. Fluid intake is of great importance when exercising for prolonged periods or in warm and humid environments. With the proper motivation and medical supervision, people with NIDDM can enjoy regular physical exercise as a means of enhancing metabolic control and improving insulin sensitivity.

Sato 25 (December 2000) Regular physical exercises has been known to be beneficial in the treatment of type II diabetes. Epidemiological studies of physical exercise: previous non-randomized studies suggested that a lifestyle intervention program involving diet and/or exercise reduced the progression of impaired glucose tolerance (IGT) to type II diabetes. Recent randomized controlled intervention trials also showed that diet and/or
exercise intervention led to a significant decrease in the incidence of
diabetes among those with IGT. Endocrinological and metabolic effects of
exercise: in well controlled diabetic patients, physical exercise promotes
utilization of blood glucose and lowers blood glucose levels. On the other
hand, in poorly controlled diabetic patients with ketosis, physical exercise
results in further rises in blood glucose, free fatty acids and ketone body
concentrations. Long-term gentle regular jogging increases insulin action in
respect of both carbohydrate and lipid metabolism despite no influence on
body mass index or maximal oxygen uptake. A significant correlation was
observed between delta MCR (insulin sensitivity) and average daily steps
Our recent data suggested that the improvement of insulin action by physical
exercise was attributed, at least in part, to the increase in insulin-sensitive
GLUT4 (glucose transporter 4) on the plasma membrane in skeletal muscle.
In conclusion, as an adjunct to other forms of therapy, mild regular physical
exercise will play an important role in primarily preventing type II diabetes.

Krotkiewski (December 1985) Obese subjects with normal glucose
tolerance (n = 55), and, in another study, a group of patients with Type II
(non-insulin-dependent) diabetes (n = 33), and controls (n = 13) matched for
body weight and age but with normal glucose tolerance, participated in an
individualized physical training program for 3 months. Under controlled
dietary conditions, metabolic studies were performed before and in steady
state after the last exercise session after training in the subjects showing
signs of physical training in VO2 max and heart rate measurements. No
changes occurred in body weight, body cell mass, body fat or adipose tissue
cellularity. Oral glucose tolerance was improved in the patients with diabetes
mellitus only. In both diabetic and control subjects initially elevated C-
peptide concentrations decreased, while low C-peptide values increased and
which was particularly pronounced in diabetic subjects with subnormal values. Peripheral insulin values did not change. Glucose disposal rate measured with the glucose clamp technique was similar in diabetic patients and control subjects. An improvement was seen at both submaximal and maximal insulin levels in both groups, correlating with improvement in glucose tolerance in the diabetic subjects. No changes were found in adipocytes in insulin binding or the antilipolytic effect of insulin at submaximal insulin levels, but there was a normalization of a decreased glucose incorporation into triglycerides. These results indicate that both insulin secretion and effectiveness are altered by physical training in different ways in different clinical entities. They suggest that in insulin resistant conditions with high insulin secretion (as indicated by high C-peptide concentrations) the increased peripheral insulin sensitivity is followed by a decreased insulin secretion. This is not associated with an improvement of glucose tolerance. In Type II diabetes with low insulin secretion, an increased insulin secretion results from physical training, perhaps due to accompanying sensitization of the autonomic nervous system. Peripheral insulin concentrations are not altered, suggesting that the extra insulin produced is captured by the liver. This mechanism as well as the improved peripheral insulin responsiveness seen in the whole body and also seen at the cellular level, probably both contribute to an improvement in glucose tolerance.

Lehmann 27 (December 1996) increased physical activities should be part of the treatment for non insulin-dependent diabetic patients. Increased physical activity delays the onset of non insulin-dependent diabetes mellitus (NIDDM) or even prevents the disease in about 50% of susceptible individuals (positive family history of NIDDM, body-mass index > 25,
hypertension or gestational diabetes). Regular exercise has been shown to lower plasma triglyceride and to increase high-density lipoprotein cholesterol levels. Exercise has also beneficial effects on hypertension, body composition and fat distribution. Improved glucose tolerance has been achieved in type II diabetic patients in as little as one week with an exercise program. The beneficial effect of regular exercise on glucose control appears to reflect the cumulative effect of transient improvement in glucose tolerance following each individual bout of exercise. Increased insulin sensitivity is lost after as little as three days of inactivity. Most studies suggest that the maximum benefit from exercise is most likely to occur in patients with mild diabetes in whom insulin resistance and hyperinsulinemia are present (patients with fasting blood glucose of < 11 mm). The recommended frequency and duration of exercise is three times per week or every other day and, as adjunct for weight reduction, five to seven times per week for 30 to 45 min. at intensity of 50 to 70% VO2max (or 60 to 80% of maximal the heart rate). Because of the high incidence of ischemic heart disease in type II diabetic patients, patients older than 35 years of age should undergo a graded exercise stress electrocardiogram. Attention should be paid to foot-care and the use of appropriate footwear and diabetic late complications, such as autonomic and peripheral neuropathy. Older obese NIDDM patients can achieve significant metabolic benefits from low-intensity programs, such as daily walking, which can be easily incorporated into daily living. Taking the necessary precautions, most patients with diabetes can take part in a monitored exercise program safely.

Zierath (September 1993) The relationship between obesity and type II diabetes mellitus is well established and a majority of type II diabetic individuals are classified as obese. The pathogenesis of type II diabetes
mellitus is not fully understood; however, multiple organ systems are involved, including abnormalities of insulin secretion, peripheral insulin resistance and hepatic insulin resistance. The goal of the treatment for the obese diabetic is to normalise these alterations and achieve normoglycaemia. Traditionally, the initial therapy, aiming to accomplish weight reduction, is diet and exercise. In obese type II diabetic patients, the whole body insulin-dose response curve is markedly depressed. A single exercise session improves and partially normalizes both insulin responsiveness and sensitivity for glucose utilization. Furthermore, a single bout of physical activity often results in decreased plasma glucose levels, which persists into the postoperative period. Type II diabetes patients participating in regular exercise programmes can potentially improve their metabolic control. An improved glucose control in both lean and obese type II diabetic patients under the age of 55 years has been demonstrated by improved HbA1C levels and glucose tolerance tests following physical training programmes. The effect of regular exercise on the metabolic control in these younger patients does not appear to be correlated with weight reduction. For most type II diabetic men over 55 years of age, physical training is not a feasible form of therapy because of other interfering diseases which may complicate or severely hinder all physical training apart from very low intensity exercise for 10 weeks or up to 2 years demonstrate no change in HbA1C levels, glucose tolerance or bodyweight. Thus, there is a clear difference in metabolic response to regular exercise between younger and older type II diabetic patients. The younger patient appears to be more inclined to respond to physical training with improvements in the metabolic control. The reason for this apparent difference is not clear, but possible explanations may include differences in training intensity, the presence or degree of complicating diseases, pre training level of metabolic control or bodyweight.
Type II diabetics are predisposed to cardiovascular disease and are characterised by hyperlipidaemia. In obese type II diabetic individuals, physical training improves the blood lipid profile as measured by decreased levels of triglycerides and total cholesterol. In young, overweight diabetics, improved lipid profiles can be achieved despite no change in bodyweight, while no apparent effects are reported for lean patients.

Chipkin (August 2001) as rates of diabetes mellitus and obesity continue to increase, physical activity continues to be a fundamental form of therapy. Exercise influences several aspects of diabetes, including blood glucose concentrations, insulin action and cardiovascular risk factors. Blood glucose concentrations reflect the balance between skeletal muscle uptake and ambient concentrations of both insulin and counter insulin hormones. Difficulties in predicting the relative impact of these factors can result in either hypoglycemia or hyperglycemia. Despite the variable impact of exercise on blood glucose, exercise consistently improves insulin action and several cardiovascular risk factors. Beyond the acute impact of physical activity, long-term exercise behaviors have been repeatedly associated with decreased rates of type 2 diabetes. While exercise produces many benefits, it is not without risks for patients with diabetes mellitus. In addition to hyperglycemia, from increased hepatic glucose production, insufficient insulin levels can foster ketogenesis from excess concentrations of fatty acids. At the opposite end of the glucose spectrum, hypoglycemia can result from excess glucose uptake due to increased insulin concentrations, enhanced insulin action or impaired carbohydrate absorption. To decrease the risk for hypoglycemia, insulin doses should be reduced prior to exercise, although some insulin is typically still needed. Although precise risks of exercise on existing diabetic complications have not been well studied, it
seems prudent to consider the potential to worsen nephropathy or retinopathy, or to precipitate musculoskeletal injuries. There is more substantive evidence that autonomic neuropathy may predispose patients to arrhythmias. Of clear concern, increased physical activity can precipitate a cardiac event in those with underlying CAD. Recognizing these risks can prompt actions to minimize their impact. Positive actions that are part of exercise programs for diabetic patients emphasize SMBG, foot care and cardiovascular functional assessment. SMBG provides critical information on the impact of exercise and is recommended for all patients before, during and after exercise. More frequent monitoring (and for longer periods following exercise) is recommended for those with hypoglycemia unawareness or those performing high-intensity exercise. Preventing the sequelae of an exercise-induced severe hypoglycemic reaction can be as simple as carrying glucose tablets or gel, a diabetic identification bracelet or card, or exercising with an individual who is aware of the circumstances. In addition to blood glucose concentrations, proper foot care is critical to people with diabetes who exercise and includes considering type of shoe, type of exercise, inspection of skin surfaces and appropriate evaluation and treatment of lesions (calluses and others). Those with severe neuropathy can consider alternatives to weight-bearing exercises. Precipitation of clinical CAD is of great concern for all diabetic patients participating in exercise activities. Although a sufficiently sensitive and specific screening test for coronary disease has not been identified, those planning an exercise program of moderate intensity or greater should be evaluated. Initial cardiac assessment should include exercise testing as well as identifying risk for autonomic neuropathy. In addition to noting maximal heart rate and blood pressure as well as ischemic changes, exercise tolerance testing can identify anginal thresholds and patients with asymptomatic ischemia. Those without
symptoms should be counseled regarding target pulse rates to avoid inducing ischemia. Ischemic changes need to be evaluated for either further diagnostic testing or pharmacological intervention. For patients with diabetes mellitus, the overall benefits of exercise are clearly significant. Clinicians and patients must work together to maximize these benefits while minimizing risks for negative consequences. Identifying and preventing potential problems beforehand can reduce adverse outcomes and promote this important approach to healthy living.

Eriksson (June 1993) Exercise has long been considered a cornerstone in the treatment regimen for patients with Type II (non-insulin-dependent) diabetes mellitus. Aerobic endurance exercise has traditionally been advocated as the most suitable exercise mode. Several exercise studies have evaluated the effect of exercise on insulin sensitivity and glycaemic control in patients with type II diabetes mellitus. However, the results obtained have been highly heterogeneous regarding the effect of exercise on insulin sensitivity and glycaemic control. Only in certain subgroups (example patients with Type II diabetes mellitus under 55 years of age, those with diabetes treated through diet and those who have diabetes with fairly good metabolic control), does exercise seem to be beneficial with regard to improvement in glycaemic control. There has been little research into the effects of resistance training on glucose metabolism in patients with type II diabetes mellitus compared with the amount of research involving aerobic endurance exercise. The incidence of Type II diabetes mellitus increases with increasing age, partly because of the decline in muscle mass associated with aging. This corresponds with a decline in metabolic function, supporting the usefulness of resistance training. Available studies support the usefulness of resistance training in the treatment of Type II diabetes
Therefore, based on the published studies reviewed, this author proposes that an optimal exercise programme for individuals with Type II diabetes mellitus should include components that improve cardio respiratory fitness, muscular strength and endurance, a combination of aerobic endurance training and circuit-type resistance training. Programmes combining various modes of exercise positively influence patient compliance with the exercise programme. The vast majority of patients with type II diabetes mellitus can undertake an individualized exercise programme without significantly increased risks of complications.

Thamos (July 2000) BACKGROUND: Exercise is generally recommended for people with type II diabetes mellitus. However, some studies evaluate an exercise intervention including diet or behaviour modification or both, and the effects of diet and exercise are not differentiated. Some exercise studies involve low participant numbers, lacking power to show significant differences which may appear in larger trials. OBJECTIVES: To assess the effects of exercise in Type II diabetes mellitus. SEARCH STRATEGY: Trials were identified through the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, EMBASE and manual searches of bibliographies. Date of last search was March 3, 2005. SELECTION CRITERIA: All randomized controlled trials comparing any type of well-documented aerobic, fitness or progressive resistance training exercise with no exercise in people with type 2 diabetes mellitus. DATA COLLECTION AND ANALYSIS: Two authors independently selected trials, assessed trial quality and extracted data. Study authors were contacted for additional information. Any information on adverse effects was collected from the trials. MAIN RESULTS: Fourteen randomised controlled trials comparing exercise against no exercise in type
II diabetes were identified involving 377 participants. Trials ranged from eight weeks to twelve months duration. Compared with the control, the exercise intervention significantly improved glycaemic control as indicated by a decrease in glycated haemoglobin levels of 0.6% (-0.6 % HbA1c, 95% confidence interval (CI) -0.9 to -0.3; P < 0.05). This result is both statistically and clinically significant. There was no significant difference between groups in whole body mass, probably due to an increase in fat free mass (muscle) with exercise, as reported in one trial (6.3 kg, 95% CI 0.0 to 12.6). There was a reduction in visceral adipose tissue with exercise (-45.5 cm (2), 95% CI -63.8 to -27.3), and subcutaneous adipose tissue also decreased. No study reported adverse effects in the exercise group or diabetic complications. The exercise intervention significantly increased insulin response (131 AUC, 95% CI 20 to 242) (one trial), and decreased plasma triglycerides (-0.25 mmol/L, 95% CI -0.48 to -0.02). No significant difference was found between groups in quality of life (one trial), plasma cholesterol or blood pressure.

CONCLUSIONS: The meta-analysis shows that exercise significantly improves glycaemic control and reduces visceral adipose tissue and plasma triglycerides, but not plasma cholesterol, in people with type II diabetes, even without weight loss.

Engelson (October 2006) HIV has classically been a wasting disease. However, in the United States, obesity is increasingly common among HIV-infected individuals receiving effective antiviral treatment. The risks of obesity are unclear in HIV, although the increased prevalence of diabetes and cardiovascular disease in the presence or absence of obesity causes growing concern. This study aimed to assess the effects of weight
loss (through energy restriction combined with aerobic and resistance exercise) on body composition, body fat distribution, resting energy expenditure, quality of life (QOL), strength and fitness, and metabolic risk factors in obese, HIV-infected women. Eighteen HIV-infected women with a body mass index of 30 or more completed a 12-week weight loss program. Before and after the intervention, body composition and fat distribution by dual energy x-ray absorptiometry and whole-body magnetic resonance imaging, resting energy expenditure by indirect calorimetry, quality of life, strength, and fitness were measured. Insulin sensitivity by intravenous glucose tolerance test and circulating cardiovascular risk factors (including lipids, tissue plasminogen activator, and plasminogen activator inhibitor 1) were measured in a subset (n = 9). Daily food intake and total body weight decreased (mean +/- SD) by 3195 +/- 477 kJ and 6.7 +/- 4.2 kg, respectively. Weight lost was 95.5% fat by dual energy x-ray absorptiometry or 6.2 L of subcutaneous adipose tissue, 0.7 L visceral adipose tissue, and 0.8 L skeletal muscle by magnetic resonance imaging. Resting energy expenditure fell approximately 419 kJ, strength and fitness increased by 28.9% +/- 18.5% and 36.8% +/- 41.6%, respectively, and quality of life improved in 11 of 13 dimensions. There was significant insulin resistance in the subset with metabolic measurements at baseline, and at follow-up there was no improvement in fasting glucose, insulin, or insulin sensitivity, nor was there any change in fasting lipids, tissue plasminogen activator, or plasminogen activator inhibitor 1. There was no significant change in CD4 count or HIV viral load. In conclusion, moderate weight loss achieved by a short-term program of diet and exercise in obese HIV-positive women appears safe and induces loss of adiposity in both the subcutaneous adipose tissue and visceral adipose tissue regions. Despite reduced food intake, weight and fat loss, as well as improvements in strength, fitness, and quality of life, the lack
of improvement in metabolic parameters suggests that additional interventions may be necessary to reduce the risk of diabetes and cardiovascular disease in this population.

Carrel (October 2005) BACKGROUND: Obesity and poor physical fitness constitute a health problem affecting an increasing number of children. Causes include a pervasive "toxic" environment that facilitates increased caloric intake and reduced physical activity. An effective strategy for prevention and treatment of childhood obesity likely includes a collaborative effort in the school setting.

OBJECTIVE:

To determine whether a school-based fitness program can improve body composition, cardiovascular fitness level, and insulin sensitivity in overweight children. DESIGN: Fifty overweight middle school children with a body mass index (BMI) above the 95th percentile for age were randomized to lifestyle-focused, fitness-oriented gym classes (treatment group) or standard gym classes (control group) for nine months. Children underwent evaluation of fasting insulin and glucose levels, body composition by means of dual energy absorptiometry, and maximum oxygen consumption (V02 max) treadmill testing at baseline (before the school year) and at end of the school year.

SETTINGS: Rural middle school and an academic children’s hospital.

MAIN OUTCOME MEASURES:

Baseline test results for cardiovascular fitness, body composition, and fasting insulin and glucose levels. RESULTS: At baseline, there were no differences between groups before intervention (values for age, 12 +/- 0.5 years [all results, mean +/- SD]; BMI [calculated as weight in kilograms
divided by the square of height in meters], 31.0 +/- 3.7; percentage of body fat, 36.5% +/- 4.6%; lean body mass, 41.4 +/- 8.6 kg; and \( V_0(2)_{\text{max}} \), 31.5 +/- 5.1 ml/kg per minute). Compared with the control group, the treatment group demonstrated a significantly greater loss of body fat (loss, -4.1% +/- 3.4% vs -1.9% +/- 2.3%; \( P = .04 \)), greater increase in cardiovascular fitness (\( V_0(2)_{\text{max}} \), 2.7 +/- 2.6 vs 0.4 +/- 3.3 mL/kg per minute; \( P<.001 \)), and greater improvement in fasting insulin level (insulin level, -5.1 +/- 5.2 vs 3.0 +/- 14.3 micro IU/ml [-35.4 +/- 36.1 vs 20.8 +/- 99.3 pmol/L]; \( P = .02 \)).

CONCLUSIONS: Children enrolled in fitness-oriented gym classes showed greater loss of body fat, increase in cardiovascular fitness, and improvement in fasting insulin levels than control subjects. The modification to the school physical education curriculum demonstrates that small but consistent changes in the amount of physical activity has beneficial effects on body composition, fitness, and insulin levels in children. Partnering with school districts should be a part of a public health approach to improving the health of overweight children.

Claude evaluated approximately 21,000 male participants aged 40 to 84 years who were initially free of diagnosed type 2 diabetes mellitus. After 5 years of follow-up, the outcome showed an inverse correlation between incidence of type 2 diabetes, and the frequency of vigorous exercise. Men who engaged in vigorous physical activity at once per week had a 29% lower risk of developing diabetes, compared with men who performed no vigorous exercise. In agreement with previous studies (Helmrich et al. 1991), the inverse relationship between exercise and risk of this metabolic disorder was particularly pronounced among overweight men. However,
there was still a significant reduction after data adjustment for Body Mass Index as well as for age.

Studies on Health Related Physical Fitness

Denise  35  (March 1993) Previous studies of associations between physical activity and Health-Related Physical Fitness have focused on only the cardiovascular endurance and body composition components of fitness, the purpose of present study was to examine the associations between multiple measures of physical activity and multiple components of Health-Related Physical Fitness in fourth grade children. The study involved a cross sectional survey of 528 healthy fourth graders (274 boys, 254 girls,) attending seven elementary schools in a suburban southern California city. Ninety eight percent of eligible students participated; 85% were non-hispanic whites. Six child physical activity measures (monitoring by accelerometer, parent report, and child self reports of weekday activity, weekend activity, summer involvement activity lessons and in youth sports) were summarized as a physical activity (PA) index. This index of habitual physical activity was examined in relation to measures of fine components of HRF. Results indicated there were significant associations for both boys and girls between the PA index and the mile run ($r = -16$), sit-ups ($r = .11$), and the sit-and reach test ($r = .10$). There were significant correlation’s for boys between the PA index and seven of skinfolds ($r = - .14$) and pull-ups ($r = .23$), but not for girls. The results suggest that active children appear to engage in a sufficient variety of activities to enhance multiple components of Health-Related Physical Fitness. These results provide additional support for the U.S. public Health service year 2000 objectives for children’s physical activity.
Taha (March 1994) This study involved 170 British and 173 Kuwaiti 15 to 16 year old boys, chosen at random from within the public school systems of England and Kuwait, the students took part in a survey and HRF tests. The standard deviation, means, mode, percentile ranking and significant difference (P< .05) of the two groups were calculated. Survey results indicated that more than half of the Kuwait boys were not involved in any PA other than PE; less then one quarter of the British boys were not involved in extra PA of the British 49% come to school walking or by bike; in contrast 71% of the Kuwait came to school by car, HRP test results which strikingly collaborated by physical activity survey were recorded on the one mile walk / run; 31% (n = 47) of the British and 80% (n = 68) of the Kuwaiti subjects could not finish a mile in less than eight minutes. Although this is not a normative study, it does give some indications about the British and Kuwaiti boys’ physical activity habits and HRF levels. The findings indicated a need for further investigation of the levels of PA within PE as well as a need for more education in physical education.

Health related fitness standards are developed to depict the minimum standards of fitness children and youths need to lead healthy lives. According to Blair (1986) a child who passes the test should have a healthy physical activity level. The current health related fitness status of sighted children has been determined by Looney and Plowmom (1990) utilizing the fitnessgram criterion referenced physical fitness test. In their study the percentage of children who passed each item were as follows: Sit and reach: M = 90%, F = 97%; MBMI = 88%, F = 85%; mile run: M = 77%, F = 60%; Sit-ups: M = 65%, F = 57%; and last, push-up: M = 73%, F = 32%. This study was conducted to determine if children with visual impairments
could pass the minimum health related fitness standard in comparison to their sighted peers. Forty two children with visual impairments were assessed on their passing rates utilizing the same items on the fitnessgram. The results of the study were Sit and Reach: M = 77.5%, F = 75%; MBMI = 45%, F = 76.9%; mile run: M= 31.6%, F= 12%; Sit-up: M= 55%, F = 57.7%; Push-up: M= 20%; F = 34.6%. In almost every daily activity an individual who is blind expends more energy than sighted individuals (Buell, 1982). In order to meet this need children with visual impairments should be able to pass the fitnessgram criterion – referenced physical fitness test. The results of this study indicate that children with visual impairments scored considerably lower on passing rates than their sighted peers on most health related fitness items. Therefore, these children are not maintaining a healthy physical activity level. These results suggest that youths with visual impairments are less fit than their sighted peers. In addition, there is a definite need for more attention to physical activity and physical fitness for individuals with visual impairments.

Arlene 37 (March1993) The purpose of this study was to examine the effects of a 10 weeks fitness program on low fit children’s health related fitness and blood lipid levels. Participants 78 (14 girls / 14 boys), 3rd and 4th grade students who failed to attain at least 3 of 4 (Excluding pull-ups) Physical Best Fitness Standards. All participants were pre and post-tested on sub maximal and maximal cardio respiratory responses during treadmill exercises, skinfold thickness, mile walk/run, sit-ups, and sit and reach. A resting fasted blood sample was also collected at pre and post-testing to measure Total Cholesterol (TC), Triglyceride (TG), High Density Lipoprotein (HDL) and Low Density Lipoprotein (LDL) cholesterol. The treatment group (N = 18) participated three days / week for 60 min/day in a
vigorous activity program designed to maintain heart rates corresponding to 60-80% of the pre-test Vo_2 max. Results of an ANCOVA indicated that the treatment group performed significantly better on the mile walk/run and sit and reach. No significant differences were detected in cardio-respiratory responded during sub maximal and maximal treadmill exercise, average skin fold thickness, TC, HDL, and LDL. TG level was significantly lower in the treatment group on the post-test (62.2 ± 28.2 versus 86.9 ± 15.1 mg/dl). These results suggest that a vigorous activity program improves mile run time, flexibility, and TG level but does not improve body fatness or cardio-respiratory fitness as measured during treadmill exercise. Further research is warranted to examine the impact of activity versus exercise in the physical as well as psychological health of young low fit children.

Reston (March 1993) American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD, 1980) inaugurated the Health-Related Physical Fitness Test (HRPFT). The test was designed to measure the physical fitness components associated with health. The test battery includes a distance run to assess cardio-respiratory endurance, skin fold measurements to determine body composition, one minute sit ups to measure neuromuscular function of the lower trunk and abdominal strength and endurance, and sit and reach to determine lower back and hamstring flexibility. From 1982 through 1984, the United States, Department of Health and Human Services Office for Disease Prevention and Health Promotion in joint cooperation with American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) and other agencies conducted the National Children and Youth Fitness Study (NCYFS). This was the first nationwide assessment of youth fitness in nearly a decade. The findings revealed that only half the youth participated in appropriate
physical activity essential for the maintenance of cardio-respiratory function. The results of the study also revealed that youths had become better as compared to 1960’s.

Seong Lee (1980) The primary purpose of the study conducted by Lee was to investigate the relationships of age, gender and body size to the performance of Korean middle and high school students on each of the six test items comprising the Korean Youth Physical Fitness Test (KYPFT). The subjects were comprised of 8512 boys and girls, ages 12 through 19 years, who were enrolled in middle and high schools in Korea. In this study, age and gender were found to be important factors in classifying and evaluating students’ performance on the KYPFT. Thus, the important contribution of this study is that percentile rank norms based on age and gender have been developed and presented for each of the six tests comprising the KYPFT. Through all age groups boys performed better than girls in the 100 M dash, sit-ups, softball throw, and standing long jump. The performance of boys continued to improve through age 17 or 18. The conclusions in agreement with the findings of this study: a) Age and gender have been found to be significantly related to performance on each test; b) Age alone disregarding body size is sufficient to establish achievement standards on the physical fitness tests for boys and girls separately. C) Girls likewise differ on all tests except for the softball throw.

Patterson, et al., (April 1996) expressed his views regarding the inclusion of flexibility component in the physical fitness test battery with the validity and reliability of the test item meant for flexibility. He further stated that the evidences and anatomical basis, most of the physical fitness test batteries must include some test item of flexibility. The sit and reach
test has history for inclusion in fitness batteries. Wells and Dillon (1952) carried out a study in which they compared sit and reach test scores with scores form another field test. More recently, Jackson and Baker (1986), and Jackson and Longford (1989) have examined the criterion-related validity. Results indicating moderate validity as a measure of hamstring flexibility, but relatively low validity as a measure of lower and back flexibility. In their findings, they concluded that the Backsaver Sit and reach test appears to be similar to the sit and reach test in that it is primarily a test of hamstring flexibility.

Jose (December 1996) conducted a study for Macao population on physical fitness. The purpose of the study was to establish the norms for Youth Fitness of Macao and to make comparisons of the juvenile’s fitness indices between Macao and some Asian countries. Ranged from grade five of elementary school to grade three of senior high school 1547 students were tested. The physical fitness test battery consists of 20 items on body anthropometry, physiological ability and motor fitness and a questionnaire with 49 questions about diet, habit and family. The tests covered six same items which were used in “Asia Youth Health Related Fitness Test” (AYHFT), and the questionnaire includes the questions of the consciousness on sports proposed by the Asian Regional Board of International Council for Health, Physical Education and Recreation (ICHPER). The statistical inference was used to make comparisons between means of the population and the correlation between the variables. Finally, the database of the sample Macao Juvenile Health Related Fitness was established for the reference of Macao concerned to improve youth fitness and guidance to physical education. The results of the study suggested improving Juvenile’s Fitness of Macao.
Sidhu and Singh (July 1996) conducted a study on preadolescent boys, with a view to find out the relationship, if any between body measurements and physical performance tests during growth, measurements. The study included height, lengths measurements of foot and thigh and calf circumference and skinfold. Physical performance law’s measured through Sargent jump, vertical jump and 200 meters run. The results indicated that on the child grows, the capacity to perform the physical activity also improves. Mean scores of Sargent jump and 200 M running time for eight year old boys were 20.4 centimeters and 48.8 second respectively. The values improved to 27.0 cm and 1.2 sec respectively at the age of 13 years. Correlation of coefficient between various anthropometric measurements and physical performance tests indicated that the relationship between performance and body measurements also changes with age. The height values of correlation of coefficient had been contained at age 12, among all the six age groups studied.

Alston (1965) conducted a study on the physical performance of high school girls on 3 physical tests. The Virginia physical fitness test, AAHPER youth fitness test and North Carolina physical fitness test were administered to 60 girls in grades 9, 10 and 11. The correlation between the Virginia and the AAHPER tests was 0.89, between the AAHPER and the North Carolina 0.79 and between the two state tests 0.80. The mean differences of the 3 tests in standard score terms were not significant at the 0.01 level. The 3 tests gave essentially equivalent results for assessing the physical fitness of high school girls.
Jennifer, et. al.,44 (March 2004) Many university and colleges offer a required health-related fitness course with the goal of eliciting positive behavioral changes. Though numerous studies have addressed the effectiveness of such courses on health behavior change, less is known regarding the potential of the educational intervention to modify the mediators of health behavior outcomes. Therefore, the purpose of this study was to determine if the required health-related fitness course garnered a change in self-reported social support, perceived barriers to exercise, and exercise confidence. Data were collected from 1,136 participants that were categorized into two groups (a) control: students not exposed to the health-related fitness course was to promote positive physical activity patterns using behavioral change strategies such as goal setting and assessment, peer group strategy and reinforcement, and the development of personalized exercise prescriptions. Participants responded to three sets of Likert scale type questions before and after the 15-week intervention. The data were analyzed using chi-square tests. In terms of social support from friends, the health-related fitness course elicited a 6.5% increase(p<.05), in the number of participants reporting their friends gave them rewards for being physically active, more often. There was a 5.7% increase in the number reporting their friends gave them helpful reminders to be physically active, and a 6.0% increase of those reporting their friends helped them plan events around physical activities. In terms of perceived barriers to exercise, there was a 13% increase (p<.05) in the number who reported they strongly disagreed or disagreed that exercise was not one of their priorities. Regarding exercise confidence, no significant differences were found between the experimental and control groups. Inclusion, the health-related fitness course potentially had a small effect on social support, and little or no effect on barriers to physical activity and exercise confidence. Therefore, it would be prudent to
incorporate additional educational strategies designed to reduce barriers to exercise and to foster exercise confidence.

Thomas (2005) Previous research has investigated the perceived effects of required conceptually-based basic physical education activity courses. While the findings of these studies are been positive, it is important to recognize the results of these studies were based on student perception and not on actually measured or determined health related fitness (HRF) knowledge. The purpose of this study was to establish differences in determined HRF knowledge perceived HRF knowledge, attitude towards HRF, and current exercise habits in college students following completion of a required conceptually based HRF course. Two instruments were used in this study. The first was designed to measure current knowledge in the four health related areas of fitness and nutrition. The second instrument was used to determine HRF attitudes and activity habits. Student attitudes about the importance of health and fitness were determined by having students respond to specific questions using a 5-point likert scale ranging from very important” to no importance.” A similar scale, ranging from all of the time to never, was used to determine how frequently health-fitness and nutrition related factors influenced student decisions regarding their current exercise and nutrition habits. In addition to the attitudinal data, self-reported activity habits for the month prior to the pretest and posttest were determined and recorded in terms of mode, frequency, duration, and distance. All reported activity was subdivided into four categories, aerobic,” individual, team, and other. To standardize participant activity habits, as well as determine each participant’s total aerobic score, all reported activities were converted to aerobic points, based on Cooper’s (1982) system. Once homogeneity between the experimental and a control group was established, paired t tests
were conducted to determine significant differences in the tested variables from pretest to posttest on the treatment group. Results indicated statistically significant differences in how students rated their perceived level of knowledge rearing health and nutrition, \( t(76)=5.470, p=.000 \), as well as in determined student HRF knowledge, \( t(77)=16.541, p=.000 \). Statistically significant gains were also demonstrated in student attitudes towards physical fitness, \( t(72)=4.822, p=.000 \), and the value they placed on the course, \( t(71)=3.945, p=.000 \). No statistical differences in activity points earned in team, individual, aerobic, other, or total categories were noted. It was concluded that following completion of a HRF course, students demonstrate significantly greater perceived and determined HRF knowledge.
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