Chapter-II

REVIEW OF RELATED LITERATURE

The research scholar has gone through different literatures available in the library of Lakshmibai National University of Physical Education, Gwalior, All India Institute of Medical Sciences, New Delhi, Thiruvananthapuram, Kottayam Medical Colleges, at and different sites of Internet.

Saraswati (2002) conducted a study on management of diabetics mellitus through six week of Yoga training (N=15) were selected as subjects of 11 male and females. The age ranged from 30 to 65 with a mean age of 48.53 years. BMI ranged from 17.25 – 31.62 Kg/m². The initial test result of fasting blood glucose was in the range of 93 – 412 mg% with a mean of 213 mg% post lunch glucose was in the range of 116 – 550 mg% with a mean of 273 mg%. The yogic practice which administered was Shatkarmas, Asanas, and Pranayamas.

The practices were very effective in controlling blood sugar levels and also in decreasing the amplitude of risk factors of DM and CDS. The change was more pronounced at the fasting level than the P.P. Level. If
combined with dietary regulations, the results could be even more impressive. It is predicted that over a period of time a sufferer from diabetes mellitus could completely cure this metabolic disorder. If yogic principles become an integrated part of life.

*Gore* (1988) conducted a study on Yogic treatment for diabetes through 5 weeks of Yoga training (N=9) were selected as subjects. Beneficial effect of Yoga training was observed on 6 out of 9 diabetics in respect of fasting and post – prandial blood sugar level, sugar in urine glucose tolerance test, and medication in the first 3 weeks of Yogic training. The sugar level is more or less stabilized after some reduction. After 3rd week onward there is further gradual reduction in both fasting and post prandial blood sugar which is significant. A Yogic treatment with an emphasis on tranquilization and relaxation of the patient was seen effective in controlling diabetes mellitus especially when the exercise element was avoided in diabetic practices.

*Patients* (2003) with chronic disease typically become severely de-conditioned, which often leads to physical disability. Every effort should be made to recommend and encourage patients to adopt and maintain a program of physical activity. Although there are no specific exercise guidelines for
many chronic conditions, patients should be instructed to start a routine of physical activity that is gradual for most days of the week, working up to 30 minutes per session at an exertion level that is easily tolerated. It is critical that assessment of physical functioning and recommendations for physical activity be included as a part of routine medical care. In doing so, we change the expectations of patients and family members, and work toward optimizing physical functioning and quality of life.

A recent study by American Diabetic Association (2005) has demonstrated a consistent beneficial effect of regular physical activity training on carbohydrate metabolism and insulin sensitivity, which can be maintained for at least 5 years. These studies used physical activity regimens at an intensity of 50 – 80% VO₂ max. Three to four times a week for 30 – 60 minutes a session. Improvements in Hb A1C were generally 10 – 20% of baseline and were most marked in patients with type – II diabetes have impaired fibrinolytic activity associated with elevated level of Plasminogen Activator Inhibitor – 1 (PAI-1), the major naturally occurring inhibitor (t-PA).

Jain, S.C. et. al., (2002) study was conducted study to asses the effect of a simple and acceptable Yoga conditioning programme in elderly type II (NIDDM) patients on various parameters including Glycated Hemoglobin
(G.H.B.); erythrocyte lipid pre-oxidation, Na KATP are and Fibrinolysis in 21 diabetics (aged 53 + 4 years) before and after 3 months of Yoga training. The Yoga training did not alter body mass index but significantly decreased waist to hip ratio (WHR), ESR triglycerides, Lipid peroxidation levels and plasma fibrinogen and increased Na KATP activity. This study gives a rationale for the application of Yoga conditioning in elderly NIDDM patients.

O'Shea (1987) undertook this study: (i) to see if aerobic exercise is safe for women with gestational diabetes and their fetuses and (ii) to see if exercise improve carbohydrate metabolism in woman with gestational diabetes and help them maintain normal blood glucose level without the need for insulin therapy. He recruited six diet-controlled women with gestational diabetes between 25 and 39 weeks gestation. The women were beginning to demonstrate a need for insulin by increasing fasting blood glucose level inspite of good dietary compliance. The exercise session was conducted in the fetal monitoring unit at New York Hospital using a cycle ergometer to gradually raise maternal heart rate 75% of their age predicted maximum for 20 minutes. Maternal and fetal well being were assessed as 'normal' by continuous monitoring by an abstertician prior to during and following exercise. This exercise produced no unsafe change in
lactate level, PH, blood pressure or fetal heart rate. Observation indicates that sub-maximal aerobic exercise up to 75% of the maternal age predicate \( \text{max} \). Was safe for both woman with gestational diabetes and their fetuses. A 50 gm 3 hour glucose tolerance test was performed immediately after exercise and repeated without exercise either two days before or after the exercise session, to assess the affects of exercise on carbohydrate metabolism in women with gestational diabetes. His finding showed no significant change in carbohydrates metabolism resulting from the one testing session. This suggests that only one exercise session was insufficient to determine whether exercise can improve carbohydrate metabolism in women with gestational diabetes. Therefore further research should be designed to determine what duration and frequency of aerobic exercise, if any, will help improve carbohydrate metabolism in women with gestational diabetes.

Mosher (1990) in her study of the effects of an aerobic circuit training programme on cardio-respiratory endurance, metabolic control and muscular strength in adolescent males with type-I diabetes mellitus, gave training of 45 minutes to 10 male adolescents with type I diabetes and 11 non-diabetic male adolescents, aged 12 – 21 years. A 2 2 ANOVA with repeated measures was utilized with group (diabetic, non-diabetic) as between
subjects factor and time (pre-post) as the within subject factor. Statistical significance was accepted at the \( P = 0.05 \) level. The results of the study showed significant increase in \( \text{VO}_2 \, \text{max} \), resting cardiac output and muscular strength in both the groups and also significant decrease in LDL-C and hemoglobin concentration were seen in diabetic group. The results also indicated that a programme of aerobic circuit training effective in improving cardio-respiratory endurance, metabolic control and muscular strength in Type – I adolescent diabetics.

Sahay et.al. (1991) studied the effect of yogic practices on the exercise tolerance in diabetics and in patients with diabetes and hypertension. Seven diabetics (Group A) and 5 patients with diabetes and hypertension (Group B) have been investigated with reference to exercise tolerance while undergoing yogic practices. Graded sub-maximal exercise tolerance was studied in these patients in the beginning and after 8 weeks of yogic practices. The following parameters were studied in both groups before and after the graded exercise tolerance test: blood glucose, lactate, pyruvate and pyruvate lactate ratio. The patients demonstrated a good control of blood glucose and blood pressure with reduction in drug requirements. Their exercise tolerance increased as noted by their ability to carry out exercise for longer periods. The lactate levels did not rise
significantly after exercise at the end of the training period. The absence of
increase in the blood lactate and the increase in their ability to perform
exercise for longer periods indicate that their anaerobic threshold was
postponed. Physical training exercises also improve exercise performance
and postpone anaerobic threshold but yxic practices seem to be so without
increasing oxygen consumption.

Dwyer (1993) determined the relationship between metabolic control
of individuals with type II diabetes, as assessed by glycosylated hemoglobin
and the characteristics of oxygen kinetics during exercise. 16 individuals
with type II diabetes with a mean age of 56.5 years were taken as the
subjects. First day, consisted of health habits questionnaire, medical history
screening and ergometer tests. The second day subjects performed three
sub-maximal exercise bouts at 10% below the gas-exchange ventilatory
threshold. The analyses of the data revealed that glycosylated hemoglobin
was not significantly correlated with the percentage of peak oxygen uptake
along with P50 of the blood and concentration of 2, 3 diphosphoglycerate in
RBC. In conclusion, no relationships were found between metabolic control
in individuals with type II diabetes and their oxygen kinetics during
exercise.
Sackey and Jefferson (1996) studied the relationship between physical activity, glycaemic control and skinfold thickness in children with diabetes. Patients recorded details of activity in a home diary over a 6 days period and provided eight serial capillary dried blood spots for glucose analysis during a 24 hours period. Levels of activity were assessed using a semi-quantitative scoring scheme. No correlation was found between total activity score and glycaemic control. However, the activity score before 9 am showed significant correlation with blood glucose after lunch ($P = 0.005$) and fructosamine ($P = 0.004$), the time of rising in the morning showed significant correlation with blood glucose after lunch ($P = 0.004$) with fructosamine ($P = 0.004$). The time of rising in the morning showed significant correlation with blood glucose after lunch ($P = 0.004$) and with fructosamine ($P = 0.004$). A significant correlation was found between activity and glycaemic control warrants further investigation, as it suggests that patients who engage in energetic activity early in the morning may achieve lower blood glucose and fructosamine levels than their less active pears.

Wallberg et al. (1998) examined a study on exercise in the management of non-insulin dependent diabetes mellitus. 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 programme are beneficial, especially from a cost-benefit perspective. Physical activity exerts pronounced effects on substrate utilization 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 normalizing 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 would be incorporated into the medical care systems 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 VO2 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 ischemic 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 exercise 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.
Nermoem et al (1998) sought a study to determine whether moderate exercise influences hyupo-glycaemic responses in insulin-dependent diabetes mellitus (IDDM). Ten patients with IDDM and no history of hypo-glycaemia, unawareness or autonomic neuropathy were included. The patients were studied in random order on 4 occasions: twice during euglycaemia (once at rest and once on a treadmill) and twice during a gradual drop in blood glucose from 5 to 2 mmol/l once at rest and once on a treadmill). Blood samples for hormones and glucose were drawn, and a symptom questionnaire was filled out every 5 min. Cognitive tests were performed at the start and end of each study. Glucose thresholds for hormones and symptoms are reported as the plasma glucose level at which responses were more than two standard deviations above basal level and continued to increase. The threshold for adrenaline and noradrenaline release came at a significantly higher blood glucose level during exercise than at rest: 2.7 ± 0.2 vs 2.1 ± 0.2 mmol/l (P<0.05) for adrenaline and 2.7 ± 0.2 vs 2.0 ± 0.1 mmol/l (P<0.01) for noradrenaline. Thresholds for neuroglycopenic symptoms were also at a significantly higher blood glucose level during exercise: 2.6 ± 0.2 vs 2.0 ± 0.2 mmol/l (P<0.05). During hypoglycaemia, patients showed a non-significant trend towards a lower score on cognitive tests during exercise than at rest. It is concluded that
moderate exercise during a gradual drop in blood glucose does not mask hypoglycaemic responses in patients with IDDM.

**Scheen** (1998) examined an aggressive weight reduction treatment in the management of Type 2 diabetes. Most with Type 2 diabetes are significantly overweight, and diet-induced weight loss can provide marked improvement in their glycaemic control. As conventional therapy combining diet and exercise usually has a poor long-term success rate, more aggressive weight reduction programmes have been proposed for the treatment of severely obese diabetic patients, including very low calorie diets, anti-obesity drugs and bariatric surgery. Very low calorie diets usually have a remarkable short-term effect, and energy restriction and weight reduction are positive factors for the glycaemic control of obese diabetic subjects. However, the long term efficacy of these methods remains doubtful since weight regain is a common phenomenon. Although anti-obesity (anorectic) drugs may help patients to follow a restricted diet and lose weight, their overall efficacy on body weight and glycaemia is generally modest, and their long-term safety still questionable. Interestingly, serotonergic anorectic agents have been shown to improve both the insulin sensitivity and glycaemic control of obese diabetic patients independently of weight loss. Bariatric surgery may be helpful in well-selected patients. The
correction of weight excess after successful gastroplasty fully reverses the abnormalities of insulin secretion, clearance and action on glucose metabolism present in markedly obese non-diabetic patients, and allows interruption of reduction of insulin therapy and anti-diabetic oral agents in most obese diabetic patients. In conclusion, weight loss is a major goal in treating obese patients with Type 2 diabetes, and aggressive weight reduction programmes may be used in selected patients refractory to conventional diet and drug treatment. However, long-term prospective studies are needed for more precise determination of the role of such a strategy in the overall management of obese diabetic patients.

Mosher et.al (1998) studied the effect of aerobic circuit exercise training on adolescents with well-controlled insulin-dependent diabetes mellitus.

To test the safety and effects of exercise conditioning on cardio-respiratory fitness, body composition, muscle strength, glucose regulation, and lipid / cholesterol level. Ten male adolescents with insulin-dependent diabetes mellitus (IDDM) and 10 adolescent non-diabetic (ND) subjects. Pre-test, post-test intervention trial with control group. Mixed endurance and callisthenic / strength activities performed at a rapid pace three times weekly for 12 weeks.
Only one subject with IDDM experienced hypoglycemia after a single exercise session. Both subject groups improved their cardio-respiratory endurance ($P < 0.05$). Lean body mass of IDDM subjects increased by 3.58 ($P < 0.05$). Subjects with and without IDDM lowered their percent body fat ($P < 0.05$ and 0.001, respectively). Strength improvement of IDDM subjects ranged from 13.78 ($P < 0.001$) to 44.48 ($P < 0.01$), depending upon the maneuver. Fasting blood plasma glucose for all subjects was unchanged by training, buty glycosylated hemoglobin A1c of IDDM subjects was reduced by 0.08 percentage point ($P < 0.05$). Reductions of HbA1c benefited subjects exhibiting poor preconditioning glycemic control. Low-density lipoprotein cholesterol was decreased in subjects with IDDM ($P < 0.05$), but not total cholesterol or triglycerides.

Adolescents with IDDM undergoing aerobic circuit training improve their cardio-respiratory endurance, muscle strength, lipid profile and glucose regulation. Aerobic circuit training is safe for properly trained and monitored adolescent diabetics.

**Dyck et.al (1998)** had investigated the prevention of NIDDM among Aboriginal people. Rates of diabetes and its complication have reached epidemic proportions among North American Aboriginal peoples. This
appears largely due to changes in diet and activity levels associated with a shift away from traditional lifestyles. Since exercise has been shown to be effective in preventing non-insulin dependent diabetes mellitus (NIDDM), Aboriginal communities may be able to reduce their rates of the disease by incorporating exercise programs into their public health programs. They also described a pilot project in Saskatoon, Saskatchewan, whose ultimate purpose was to evaluate the effect of exercise in preventing gestational diabetes. This would also reduce the risk of developing NIDDM for both women and their offspring.

Araki (1999) reported that diet and exercise are basic measures of treatment of diabetes mellitus. To prevent the development and progression of atherosclerotic disease as well as microangiopathy, diet management should be focused on the reductions of conventional risk factors for atherosclerosis such as hyperglycemic, dyslipidemia and hypertension. To control these risk factors, both total energy and fat intake should be reduced. A diet high in mono and poly-unsaturated fatty acids, and dietary fibers are recommended to diabetic patients, but the ideal ratio of saturated, mono-saturated and poly-saturated fatty acids should be determined from clinical and epidemiological studies in the future. A high concentration of plasma
homocysteine is a new risk factor for atherosclerotic disease in diabetic patients. To reduce plasma homocysteine, diet enriched in folate and vitamin B₁₂ may be recommended. A high intake of flavonoid, one of antioxidants, may be also recommended in diabetic patients because of its counteraction against increased oxidative stress in diabetes mellitus. Exercise therapy is an effective measure for improving glycemic control in Type 2 diabetic patients. However, the most appropriate kinds and strength of exercise in diabetic patients with complications or elderly diabetic patients still remain unknown. The dietary regimen or exercise of diabetic patients should be determined individually according to the risk factors, complications, and psychological and socio-economic conditions.

Walker et.al. (1999) examined the impact of a 12 week walking program on body composition and risk factors for cardiovascular disease in women with type 2 diabetes and in normoglycemic women with first-degree diabetic relatives. These were 11 postmenopausal women with type 2 diabetes and 20 normoglycemic women of similar age and BMI who were asked to walk 1 hour per day on 5 days each week for 12 weeks. Fitness (estimated VO₂ max) was assessed with a 1.6 km walking test; body composition was measured by dual-energy X-ray absorptiometry; and sex hormone, metabolic and lipid concentrations were measured in serum.
After 12 weeks, estimated VO₂ max improved in both groups (P < 0.005). In the diabetic women, BMI and fat content of the upper body and android waist region decreased (P < 0.05). Concentrations of fasting blood glucose (P < 0.05) HbA1c (P < 0.05), total cholesterol (P < 0.005), and LDL cholesterol (P < 0.05) decreased, while HDL cholesterol and sex hormones were unchanged. In contrast, normoglycemic women failed to lose body fat after 12 weeks of exercise in a walking program. However, their HbA1c, total cholesterol, LDL cholesterol, sex hormone-binding globulin, and total testosterone concentrations decreased (P < 0.05). On pooling the data and including diabetes as a categorical grouping variable, stepwise multiple regression analysis indicated that the change in centralized body fat, but not the change in VO₂ max, was related to change in fasting blood glucose.

Twelve weeks of walking increased the fitness of diabetic and normoglycemic women. Improvement of fasting blood glucose was related to the loss of centralized body fat rather than to improved fitness.

Halle et al., (1999) examined the influence of 4 weeks intervention by exercise and diet on low-density lipoprotein sub-fractions in obese men with type 2 diabetes. Insulin resistance is associated with dyslipoproteinaemia characterized by increased serum triglycerides, reduced high-density lipoprotein 2 (HDL2) cholesterol, and increased small, dense low-density
lipoprotein (LDL) sub-fraction particles. Physical activity and weight reduction are known to improve insulin resistance and dyslipoproteinemia, but their influence on LDL sub-fractions in diabetic patients is unknown. Therefore they investigated the effect of 4 week intervention program of exercise (2,200 kcal/wk) and diet 1,000 kcal/d : 508 carbohydrate, 258 protein, and 258 fat; polyunsaturated / saturated fat ratio, 1.0) on glycemic control and HDL and LDL sub-fractions in 34 obese patients with non-insulin-dependent diabetes age, 49 ± 9 years; body mass index (BMI), 33.1 ± 5.1 kg/m². Reductions in body weight (P < 0.001) and improvements in fasting blood glucose, insulin, fructosamine (P < 0.001), and free fatty acids (P < 0.01) by intervention were associated with reductions in serum cholesterol and apolipoprotein B (Apo B) concentrations in very-low-density lipoprotein (VLDL) (P < 0.01), intermediate-density lipoprotein (IDL), and small dense (< 1.040 g/ml) LDL particles (P < 0.001). The data underline the positive influence of weight reduction induced by exercise and diet on insulin resistance and lipoprotein metabolism in obese diabetic patients, particularly showing improvements of the LDL sub-fraction profile with a decrease of small, dense LDL particles. This is of particular importance, as these particles have been shown to be associated with coronary artery disease.
**Eriksson** (1999) investigated the exercise and the treatment of type 2 diabetes mellitus. Exercise has long been considered a cornerstone in the treatment regimen for patients with type 2 (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 2 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 (e.g. patients with type 2 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 of glucose metabolism in patients with type 2 diabetes mellitus compared with the amount of research involving aerobic endurance exercise. The incidence of type 2 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 2 diabetes mellitus. Therefore, based on the
published studies reviewed, this author proposes that an optimal exercise programme for individuals with type 2 diabetes mellitus should include components that improve cardio-respiratory fitness, muscular strength and endurance, i.e. 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 2 diabetes mellitus can undertake an individualized exercise programme without significantly increased risks of complications.

Peirce (1999) studied about diabetes and exercise. Exercise is frequently recommended in the management of type 1 and 2 diabetes mellitus and can alone and when combined with diet and drug therapy, physical activity can result in improvements in glycaemic control in type 2 diabetes. In addition, exercise can also help to prevent the onset of type 2 diabetes, in particular in those at higher risk, and has an important role in reducing the significant worldwide burden of this type of diabetes. Recent studies have improved our understanding of the acute and long-term physiological benefits of physical activity, although the precise duration, intensity, and type of exercise have yet to be fully elucidated. However, in type 1 diabetes, the expected improvements in glycaemic control with
exercise have not been clearly established. Instead significant physical and psychological benefits of exercise can be achieved while careful education, screening and planning allow the metabolic, microvascular and macrovascular risks to be predicted and diminished.

Zinker (1999) determined the nutrition and exercise in individuals with diabetes. Individuals with type 1 Insulin-Dependent Diabetes Mellitus (IDDM) and type 2 Non-Insulin Dependent Diabetes Mellitus (NIDDM) diabetes should be encouraged to exercise. Although there is an absence of consistent evidence that adaptations to routine exercise improve glucose control in type 1 diabetes, there is evidence that shows improved glucose control in individuals with type 2 diabetes. Although both groups benefit from exercise, the merit and suitability of routine exercise is measured by the extent to which the advantageous adaptive effects of regular exercise surpass the risks of a sole bout of exercise. In addition, when considering acute versus routine exercise, special considerations must be given to children with diabetes and older adults at risk for insulin resistance. Finally, a greater research focus is needed on engaging in competitive and recreational sports so that children and adults with diabetes may participate safely in activities such as baseball, swimming, basketball, soccer and hockey.
Albright et.al. (2000) had described that physical activity, including appropriate endurance and resistance training is a major therapeutic modality for type 2 diabetes. Unfortunately, too often physical activity is an underutilized therapy. Favourable changes in glucose tolerance and insulin sensitivity usually deteriorate within 72 hr of the last exercise session: consequently, regular physical activity is imperative to sustain glucose-lowering effects and improved insulin sensitivity. Individuals with type 2 diabetes should strive to achieve a minimum cumulative total of 1,000 kcal x wk (-1) from physical activities. Those with type 2 diabetes generally have a lower level of fitness (VO₂ max) than non-diabetic individuals. And therefore, exercise intensity should be at a comfortable level (RPE 10-12) in the initial periods of training and should progress cautiously as tolerance for activity improves. Resistance training has the potential to improve muscle strength and endurance, enhance flexibility and body composition, decrease risk factors for cardiovascular disease, and result in improved glucose tolerance and insulin sensitivity. Modifications to exercise type and / or intensity may be necessary for those who have complications of diabetes. Individuals with type 2 diabetes may develop autonomic neuropathy, which affects the heart rate response to exercise and as a result, ratings of perceived exertion rather than heart rate may need to be used for moderating intensity
of physical activity. Although walking may be the most convenient low-impact mode, some persons, because of peripheral neuropathy and/or foot problems, may need to do non-weight-bearing activities. Outcome expectations may contribute significantly to motivation to begin and maintain an exercise program. Interventions designed to encourage adoption of an exercise regimen must be responsive to the individual’s current stage of readiness and focus efforts on moving the individual through the various “stages of change”.

Laakeen et al. (2000) examined the aerobic exercise and the lipid profile in type 1 diabetic men. Despite the potential importance of favourable changes in the lipid profile produced by aerobic exercise, training-induced lipid profile changes in atherosclerosis-prone type 1 diabetes mellitus (DM) have not heretofore been adequately addressed.

They assessed the effect of a 12 to 16 week aerobic exercise program on cardio-respiratory fitness and the lipid profile in young men with type 1 DM. Generally active men aged 20 – 40 years with type 1 DM (N = 56) were randomized into training (N = 28) and control (Untrained, N = 28) groups after baseline measurements. Training consisted of 30 – 60 min moderate-intensity running 3 – 5 times a week for 12 – 16 week. For the 42 men finishing the study, peak oxygen consumption (VO₂ peak) increased
significantly only in the trained group. Total and low-density lipoprotein (LDL) cholesterol and apolipoprotein (apo) B decreased and the high density lipoprotein (HDL) apo A-1 ratio increased in the trained group. HDL and apo A-1 increased in both groups. The exercise programme brought about improvements in the HDL / LDL and apo A-1 / apo B ratios and apo Band triglyceride levels when comparing the relative (8) changes in the trained versus control group. In the trained group, men with HDL / LDL ratios below the group median at baseline showed even more favourable changes in their lipid profile than those with higher initial HDL / LDL ratios. Body mass index, percent body fat and hemoglobin A1c did not change during the training period in either group.

Endurance training improved the lipid profile in already physically active type 1 diabetic men, independently of effects on body composition or glycemic control. The most favourable changes were in patients with low baseline HDL / LDL ratios, likely the group with the greatest benefit to be gained by such changes.

Locke et al. (2000) mentioned in their study that there is tremendous potential for improving glycemic control, insulin sensitivity and cardiovascular risk factors through increased physical activity in individuals with Type 2 diabetes. The demonstrated effects of structured endurance
exercise on select outcomes compare favourably with those of typical pharmacological treatment modalities. Adherence to these types of program is problematic, however. We know less about the expected effects of lifestyle-based physical activity. Preliminary results require further investigation, given the apparent acceptability of these programs in this population, however. The effects of resistance training on cardiovascular risk factors to date likely limit its application as an adjunctive therapy for individuals with type 2 diabetes. The question is no longer "can exercise / physical activity benefit the individual with type 2 diabetes?" the answer is Yes. Future research needs to refine questions regarding type, dose, and magnitude of effects of physical activity (and its subcategory exercise) on glycemic control, insulin sensitivity, and on risk factors for cardiovascular disease within the context of program acceptability and feasibility.