Chapter II

REVIEW OF RELATED LITERATURE
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For any specific research project to occupy a place in the development of a discipline, the researcher must be thoroughly familiar with both the previous theory and research. To assure this familiarity, every research project in the behavioural sciences has a tradition to scan a review of the theoretical and research literature.

The literature related to any problem helps the scholar to discover what is already known, which would enable the investigator to have a deep insight, clear perspective and a better understanding of the chosen problem and various factors connected with the study. So a number of books, journals, and websites were referred. An attempt has been made in to the following pages to present briefly some of the important researches and studies conducted abroad and in India, as they have significant bearing on the present study.

The literature in any field forms the foundation upon which all future work will be built. If we fail to build upon the foundation of knowledge provided by the review of literature, the researcher might miss some work already done on the same topic. The reviews of the literature have been classified under the following headings and arranged as per chronological order.

The literature in any field forms the foundation up on which all future work will be done.
1. Studies on effect of walking on cardiovascular patients
2. Studies on effect of walking on diabetic patients
3. Studies on effect of physical exercise on cardiovascular patients
4. Studies on effect of physical exercise on diabetic patients
5. Summary of the literature.

1. Studies on the effect of walking on cardiovascular patients

Parr et al., (2008) determined which physiological variables conduce to walking intolerance in patients with peripheral arterial disease (PAD). The physiological response to a graded treadmill exercise test (GTT) in patients with PAD was characterised. Thirty-one patients diagnosed with PAD were included in the study. During a GTT, peak oxygen consumption (VO\(_{2}\)peak), peak minute ventilation (VE(peak)), peak heart rate and peak venous lactate concentrations were measured and compared with those from a comparison group. Ankle-brachial index (ABI) was measured at rest and after exercise. It was concluded that, perceived discomfort in these patients is not caused by elevated blood lactate concentrations, a low ABI or limiting cardiorespiratory effort but by other factors not measured in this study.

Crowther et al., (2008) examined the effects of a 12-month exercise programme on lower limb mobility, walking performance, peak physiological responses, and physical activity levels in individuals with symptoms of intermittent claudication due to peripheral arterial disease (PAD-IC). Participants (n = 21) with an appropriate history of PAD-IC, ankle-brachial pressure index (ABI) <0.9 in at least one leg and a positive
Edinburgh claudication questionnaire response were prospectively recruited. The results of this study confirm that a 12-month supervised exercise programme will result in improved walking performance, but does not have an impact on lower limb mobility, peak physiological responses, or physical activity levels of PAD-IC patients.

Le Faucheur *et al.*, (2008) estimated the walking capacity of patients who have peripheral arterial disease with intermittent claudication, although treadmills are not accessible to most physicians. We studied 24 patients (6 women) with arterial claudication, weight 81 kg. It was concluded that, outdoor walking capacity measured by a low-cost GPS is a potentially innovative way to study the walking capacity of patients with peripheral arterial disease. It opens new perspectives in the study of walking capacity for vascular patients with claudication under free-living conditions or for physicians who do not have a treadmill.

Regensteiner *et al.*, (2002) assessed whether cilostazol, a phosphodiesterase III inhibitor, improves treadmill and community-based walking ability and health-related quality of life (HQL) in patients with intermittent claudication resulting from peripheral arterial disease (PAD). Retrospective meta-analysis of data pooled from six Phase 3, multicenter, double-blind, placebo-controlled, parallel-group, randomized studies. Patients were recruited from outpatient ambulatory medical care facilities. ABI; maximal walking distance (MWD); pain-free walking distance on a graded and constant-load treadmill; and HQL, measured. It was concluded that, treatment with cilostazol was associated with greater improvements in community-based walking ability and HQL in patients
with intermittent claudication than treatment with placebo. These improvements correlated with increased MWD.

McDermott et al., (2001) described gait alterations associated with impaired walking endurance in patients with and without lower-extremity peripheral arterial disease (PAD) and determined whether the Caltrac accelerometer provides a valid measure of physical activity in PAD. Cross-sectional. SETTING: Academic medical center. Participants underwent measurement of the ankle brachial index (ABI), leg length, and 6-minute walk. Steps per minute and step length were measured during the first and last 100 feet of the 6-minute walk. Participants wore a Caltrac accelerometer, sensitive to vertical acceleration, during the 6-minute walk and for 7 continuous days. It was concluded that, Walking performance in PAD patients who completed 6 minutes of walking was largely determined by a decline in walking velocity rather than slower initial walking velocity. ABI was more closely associated with cadence than step length.

Lee et al (2001) examined the relation between physical activity, specifically investigating walking (a light-to-moderate activity depending on pace), and CHD among women, including those at high risk for CHD. Three hundred and seventy two healthy female health professionals aged 45 years or older enrolled throughout the United States between September 1992 and May 1995, with follow-up to March 1999. Correlation of CHD with energy expended on all activities, vigorous activities, and walking. The results indicate that even light-to-moderate activity is associated with lower CHD rates in women. At least 1 hour of
walking per week predicted lower risk. The inverse association with physical activity was also present in women at high risk for CHD, including those who were overweight, had increased cholesterol levels, or were smokers.

2. Studies on effect of walking on diabetic patients

Praet et al., (2008) compared the clinical benefits of a twelve month exercise intervention programme consisting of either brisk walking or a medical fitness programme in type II diabetes patients. We randomised 92 type II diabetes patients to either three times a week of 60 min brisk walking or medical fitness programme. Primary outcome was the difference in changes in HbA1c values at 12 months. Secondary outcomes were differences in changes in blood pressure, plasma lipid concentrations, insulin sensitivity, body composition, physical fitness, programme adherence rate and health-related quality of life. It was concluded that, equally effective intervention to modulate glycaemic control and cardiovascular risk profile in type II baseline examination during 1970-2002 and were followed for hypertension incidence. Physical activity was self-reported and CRF was quantified from the duration of a maximal treadmill test. It was concluded that, both physical activity and CRF are associated with lower risk of developing hypertension in a graded fashion.

Kurl et al., (2008) investigated the prognostic significance of risk scores and exercise workload with respect to stroke. Exercise workload was measured by exercise test with an electrically braked cycle ergometer performed at baseline. Sample of 1639 men (42-60 years) without history
of type 2 diabetes or atherosclerotic cardiovascular disease including coronary heart disease, stroke or claudication were selected as subjects. It was concluded that, low exercise workload predicts an especially high risk for stroke in the presence of high risk score.

Williams (2008) determined the dose–response relationships of fitness to incident hypertension, hypercholesterolemia, and diabetes independent of activity. Self-reported physician–diagnosed incident diabetes, hypercholesterolemia, and hypertension were compared to baseline running distance in 29,139 men and 11,985 women followed prospectively for 7.7 and 7.4yr, respectively. It was concluded that, higher cardio respiratory fitness reduces the odds for hypertension, hypercholesterolemia, and diabetes, independent of physical activity and is an important risk factor separate from physical activity improve insulin resistance and to prevent diabetic complications. At first, mild aerobic exercise (walking, cycling and swimming), which enhances insulin-signaling pathway, is recommended after medical check-ups. If aerobic exercise alone is not effective, the combination of aerobic and resistance training could be considered. The resistance training increases skeletal muscle volume and strength. This combination therapy would bring about not only improvement of insulin resistance but also restoration of quality of life for aged diabetic subjects.

Davenport et al., (2008) developed to document the effectiveness of a structured low-intensity walking protocol on capillary glucose control in GDM women. Ten GDM women followed conventional management of diet and insulin therapy, plus a low-intensity walking
programme (W) from diagnosis to delivery. Capillary glucose concentrations, insulin requirements, and pregnancy outcomes were compared with a matched cohort by body mass index (BMI), age, and insulin usage (20 GDM women who followed conventional management alone (C)). It was concluded that, an effective role in glucose regulation for this structured walking program.

Oshida et al., (2006) discussed the exercise therapy for aged diabetic peoples. The purposes of exercise therapy for diabetes are to improve insulin resistance and to prevent diabetic complications. At first, mild aerobic exercise (walking, cycling and swimming), which enhances insulin-signaling pathway, is recommended after medical check-ups. If aerobic exercise alone is not effective, the combination of aerobic and resistance training could be considered. The resistance training increases skeletal muscle volume and strength. This combination therapy would bring about not only improvement of insulin resistance but also restoration of quality of life for aged diabetic subjects.

Kriska (2003) demonstrated that physical activity plays an important role in type 2 diabetes prevention. Their activity goals resembled public heath recommendations; 150 min weekly of moderate intensity physical activity (brisk walking). The flexibility of this goal will make it easier to adopt by individuals of all ages and backgrounds and has the potential for being maintained over time

Albright et al., (2000) discussed exercise and type II diabetes. Physical activity, including appropriate endurance and resistance training,
is a major therapeutic modality for type II diabetes. Individuals with type II diabetes should strive to achieve a minimum cumulative total of 1,000 kcal x wk (-1) from physical activities. Those with type II diabetes generally have a lower level of fitness (VO₂ max) than non-diabetic individuals. Although walking may be the most convenient low-impact mode, some persons, because of peripheral diabetes patients when compared with more individualized medical fitness programmers.

3. Studies on effect of Physical Exercises on Cardiovascular Patients

Apor (2009) determined the effects and mechanisms of a single bout of physical load and of the regular exercise (training) on the carbohydrate and fat metabolism are reviewed. During exercise and in the following couple of hours sugar utilization improves, "activity functions like insulin". Proper exercise contributes to using up the fat reserves, and slimmer body, fat reduction can be maintained by the combination of exercise and diet-control. Instructions in "exercise for everybody" and particularly for both type diabetics are decreased. In prevention of cardio-metabolic pathologies the most important measure were avoiding the overweight state by rational alimentation and regular physical activity.

Metsios S et al., (2009) investigated associations between levels of physical activity and CVD risk profile in RA patients. Levels of physical activity were assessed in 65 RA patients (43 females). Using the International Physical Activity Questionnaire, patients were allocated into three groups: active, moderately active and inactive. Anthropometric characteristics were assessed and compared among the three groups. It was concluded that physically inactive RA patients have significantly
worse CVD risk profile compared with physically active patients. The possible beneficial impact of increased physical activity, including structured exercise, to the CVD risk of RA patients needs to be accurately assessed in prospective studies.

De Feo et al., (2009) reviewed the literature regarding the usefulness of 6-min walking test for the evaluation of patients entering a cardiac rehabilitation programme early after cardiac/thoracic surgery. The test is feasible and safe, even in elderly and frail patients, shortly after admission to an in-hospital rehabilitation program. The results of the test is influenced by many demographic and psychological variables, such as age, sex, co morbidity, disability, self-reported physical functioning, and general health perceptions; contrasting data correlate walked distance with left ventricular ejection fraction.

Wilson (2009) predicted the coronary heart disease. While standardized baseline measurements and modern technology aid in the development of increasingly accurate CHD risk algorithms, recent reports have shown that simple prediction tools using a basic set of variables, including age, systolic blood pressure, smoking, hypertension, exercise, body mass index, diabetes, and family history are predictive of CHD risk and can potentially be self-administered.

Chase et al., (2009) investigated the relationship between physical activity, cardiorespiratory fitness (CRF), and the development of hypertension in initially normotensive individuals. Men Participants were 16,601 men aged 20-82 years who completed a baseline examination
during 1970-2002 and were followed for hypertension incidence. Physical activity was self-reported and CRF was quantified from the duration of a maximal treadmill test. It was concluded that, both physical activity and CRF are associated with lower risk of developing hypertension in a graded fashion.

Lyerly et al., (2008) examined the relationship between exercise ECG responses and mortality in 2854 men with documented diabetes mellitus (mean age 49.5 years) who completed a maximal treadmill exercise test during the period from 1974 to 2001 and who were without a previous cardiovascular disease (CVD) event at baseline. Mortality due to all causes, CHD, and CVD were the main outcome measures across categories of exercise ECG responses, with stratification by cardiorespiratory fitness, quantified as treadmill test duration. It was concluded that, among men with diabetes mellitus, equivocal and abnormal exercise ECG responses were associated with higher risk of all-cause, CVD, and CHD mortality.

Headley et al., (2008) determined the effect of moderate-intensity aerobic exercise on blood pressure responses within the laboratory for 60 min post exercise and in the subsequent 24 h period in patients with chronic kidney disease. Twenty-four subjects with stages 2-4 chronic kidney disease on antihypertensive medication completed this study. During the exercise or the non-exercise period, blood pressure was taken at 10 min intervals for 60 min. Subjects then wore an ambulatory blood pressure monitor for the next 24 h. It was concluded that, acute aerobic
exercise leads to reduced blood pressure for at least 60 min within the laboratory in chronic kidney disease patients.

Terra et al., (2008) verified the effect of progressive RT on BP, HR, and RPP in elderly women with controlled hypertension. Twenty elderly women with a sedentary lifestyle, monitored with anti-hypertensive medication, participated in a 12-week RT programme (resistance training group - RTG). Twenty-six elderly women with controlled hypertension did not engage in physical exercise during the study period, and composed the control group. It was concluded that, progressive RT reduced SBP, MBP, and RPP values at rest of hypertensive elderly women who were on anti-hypertensive treatment.

Wenger et al., (2008) discussed Coronary heart disease in women preventive heart-health behavioral changes by women and aggressive coronary risk reduction can decrease the number of women disabled and killed by CHD. Angina is the predominant initial and subsequent presentation of CHD in women; categorization of chest pain and risk stratification of women assumes pivotal roles. Younger women have substantially higher mortality rates than men following myocardial infarction and coronary bypass surgery. Although these women have more comorbidity and risk factors, other issues including biological differences, treatment differences, and psychosocial factors require management strategies tailored to the unique needs of women.

Kelley and Kelley (2008) examined the effects of aerobic exercise on selected coronary heart disease (CHD) risk factors using data from
previously published meta-analyses. Using a random effects model, the effects of aerobic exercise on glycosylated hemoglobin (HbA1c), resting systolic blood pressure, low-density lipoprotein cholesterol, and body mass index were either statistically significant or demonstrated a trend for statistical significance. The results of this review reinforce the idea that aerobic exercise is an important non pharmacologic intervention for improving selected CHD risk factors.

Moholdt et al., (2008) discussed the patients with established coronary heart disease (CHD) are encouraged to be physically active to prevent disease progression and to prolong life. The amount and intensity of exercise required for risk reduction in patients with CHD is not yet fully resolved. Population-based prospective cohort study with 18 years of follow-up. It was concluded that, the exercise training reduced all-cause and cardiovascular mortality in men and women with CHD.

Weinstein et al., (2008) studied the combined association of physical activity and body mass index on CHD. Prospective cohort study of 38,987 women free of cardiovascular disease, cancer, and diabetes at baseline in the Women's Health Study, with 10.9 mean years of follow-up. Weight, height, and recreational activities were reported on entry. It was concluded that, the risk of CHD associated with elevated body mass index is considerably reduced by increased physical activity levels. However, the risk is not completely eliminated, reinforcing the importance of being lean and physically active.
Mourad et al., (2008) examined the relationship between regular exercise and major cardiovascular events in hypertensive elderly with established coronary heart disease (CHD) in the primary care setting. The PREHACOR study recruited 3193 hypertensive patients, 67% male, with CHD. The result indicated that, regular exercise is significantly associated with fewer major cardiovascular events in hypertensive elderly subjects with established CHD.

Piperidou and Bliss (2008) explored the effects of exercise training on physical and psychosocial function among CHD patients, by analysing the content of relevant research reports. The findings showed that although there is sufficient evidence that exercise training has a number of effects that are beneficial in treatment and secondary prevention of CHD, different aspects of exercise characteristics (mode, frequency, intensity and duration) for different cardiac patient groups, warrant additional investigation.

Bunescu et al., (2008) described the prevalence and distribution of cardiovascular risk factors in a primary care setting in Romania. Patients aged 25-65 years on the lists of four general practitioners in Iasi (Romania), selected by 1/5 systematic sampling, were invited for a cardiovascular risk evaluation (interview, physical examination, blood tests for cholesterol and glucose). Prevalence rates for coronary heart disease (CHD), diabetes (DM) and other risk factors were estimated, SCORE risk was determined, and treatment targets were evaluated. It was concluded that, there were relevant gender differences in modifiable cardiovascular risk factors. Many patients failed to meet treatment target.
Chenniappan et al., (2007) discussed coronary heart disease and insulin resistance. LDL cholesterol as well as HDL cholesterol and triglycerides should be treated appropriately through lifestyle changes. Urine should be tested for micro-albumin at least annually. Low-dose (81 mg) aspirin is appropriate for patients over age 45 years for primary prevention of coronary heart disease. Evidence-based treatments and therapeutic goals can build a practical framework for comprehensive outpatient management of patients with type II diabetes and insulin resistance.

Williams (2007) examined the relationship between changes in reported vigorous exercise and self-reported physician-diagnosed diabetes in 25,988 active men. The dose-response relationship between changes in reported vigorous exercise (running distance, change in kilometers per week) and self-reported physician-diagnosed diabetes was followed prospectively for 7.8 +/- 1.8 years (means +/- SD). It was concluded that, vigorous exercise significantly reduces diabetes incidence, due in part to the prevention of age-related weight gain and in part to other exercise effects.

Halverstadt et al., (2007) discussed endurance exercise training improves plasma lipoprotein and lipid profiles and reduces cardiovascular disease risk. One hundred sedentary, healthy 50- to 75-year-olds following a standardized diet was studied before and after 24 weeks of aerobic exercise training. Lipoprotein and lipid analyses, using both conventional and NMR measures were performed at baseline and after 24 weeks of exercise training. These results show that 24 weeks of
endurance exercise training induced favorable changes in plasma lipoprotein and lipid profiles independent of diet and baseline or change in body fat.

Lazarevic et al., (2006) investigated the effects of regular aerobic exercise on glycaemic control, insulin resistance, cardiovascular risk and oxidative stress-defense parameters in overweight and obese type II diabetic patients. It was concluded that, regular aerobic exercise has beneficial effects on glycaemic control, insulin resistance, cardiovascular risk, oxidative stress-defense parameters in overweight and obese type II diabetics.

Li et al., (2006), discussed the comparative importance of physical inactivity and obesity as predictors of coronary heart disease (CHD) risk remains unsettled. Three hundred and ninety three women, 34 to 59 years of age, in the Nurses' Health Study from 1980 to 2000 were selected as subjects. These participants did not have cardiovascular disease and cancer at baseline. It was concluded that, obesity and physical inactivity independently contribute to the development of CHD in women.

Kelley and Kelley (2006), examined the effects of aerobic exercise on lipids and lipoproteins in adult men. Inclusion criteria were randomized controlled trials, aerobic exercise >/=8 weeks, adult men >/=18 years of age, studies published in journal, dissertation, or master's thesis format, studies published in the English-language between January 1, 1955 and January 1, 2003, and assessment of one or more of the following lipids and lipoproteins: total cholesterol (TC), high-density
lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDLC), and triglycerides (TG). It was concluded that, aerobic exercise reduces TC and TG and increases HDL-C in men 18 years of age and older.

Church et al., (2006), quantified the independent and joint relations of cardio respiratory fitness (hereafter, fitness) and body mass index (BMI; calculated as weight in kilograms divided by the square of height in meters) with CVD mortality in men with diabetes. Participants comprised of men with no history of stroke or myocardial infarction and who were diagnosed as having diabetes, had a medical examination, including a maximal exercise test during 1970 to 1997 with mortality surveillance to December 31, 1998; and had a BMI of 18.5 or greater and less than 35.0. The main outcome measure was CVD mortality across levels of fitness with stratification by BMI. The result showed that, low fitness level was associated with increased risk of CVD mortality within normal weight, overweight, and class 1 obese weight categories.

Donovan et al., (2005), designed to investigate the effect of exercise intensity on cardio respiratory fitness and coronary heart disease risk factors. Maximum oxygen consumption, lipid, lipoprotein, and fibrinogen concentrations were measured in 64 previously sedentary men before random allocation to a non exercise control group, a moderate-intensity exercise group or a high-intensity exercise group. The result suggests that high-intensity training is more effective in improving cardio respiratory fitness than moderate-intensity training of equal energy cost.
These data also suggest that changes in coronary heart disease risk factors are influenced by exercise intensity.

Weinstein et al. (2004), examined the relative contributions and joint association of physical activity and BMI with diabetes. Prospective cohort study of 37,878 women free of cardiovascular disease, cancer, and diabetes with 6.9 years of mean follow-up. Weight, height, and recreational activities were reported at study entry. The result showed that, although BMI and physical inactivity are independent predictors of incident diabetes, the magnitude of the association with BMI was greater than with physical activity in combined analyses.

Sato et al., (2003), analysed the beneficial effects of physical exercise on the decreased insulin sensitivity caused by detrimental lifestyle were reviewed based on experimental evidences. The major purpose of physical exercise for primary prevention and treatment of lifestyle-related diseases is to improve insulin sensitivity. It is known that, during physical exercise, glucose uptake by the working muscles rises 7 to 20 times over the basal level, depending on the intensity of the work performed. It was found that, combined with other forms of therapy, mild exercise training increases insulin action despite no influence on body mass index or maximal oxygen uptake.

Hu et al., (2003), examined the relationship between various sedentary behaviors, especially prolonged television (TV) watching, and risk of obesity and type II diabetes in women. Prospective cohort study conducted from 1992 to 1998 among women from 11 states in the Nurses'
Health Study. The obesity analysis included 50,277 women who had a body mass index (BMI) of less than 30 and were free from diagnosed cardiovascular disease, diabetes, or cancer and completed questions on physical activity and sedentary behaviors at baseline. The diabetes analysis included 68,497 women who at baseline were free from diagnosed diabetes mellitus, cardiovascular disease, or cancer. The result showed that, independent of exercise levels, sedentary behaviors, especially TV watching, were associated with significantly elevated risk of obesity and type II diabetes, whereas even light to moderate activity was associated with substantially lower risk.

Halverstadt et al. (2003), discussed plasma high-density lipoprotein cholesterol (HDL-C) levels are an important independent risk factor for cardiovascular disease (CVD) that can be modified through exercise training. Eighty-three sedentary, healthy 50- to 75-year-old subjects were weight-maintained on an American Heart Association Step 1 Diet and then studied before and after aerobic exercise training. It was concluded that the LIPG genotype is associated with inter-individual variability in HDL-C and its sub fractions and their response to exercise training.

Kumagai et al (2002), investigated the relationships among the resting systolic (SBP) and diastolic blood pressure (DBP) or SBP response during exercise with insulin resistance evaluated by a homeostasis model (HOMA-IR), abdominal fat accumulation (visceral fat area [VFA], subcutaneous fat area [SFA]) by computed tomography (CT), and an estimation of the maximal oxygen uptake (V*O2max) in 63
Japanese middle-aged male patients with type II diabetes mellitus (type II DM). The result showed that, insulin resistance was suggested to be independently associated with the resting DBP and SBP response to standardized exercise intensity in type II DM patients.

Delis et al., (2000), determined the effect of IPC(foot) treatment on claudication distance and arterial hemodynamics in patients with intermittent claudication caused by peripheral vascular disease. Thirty-seven patients with stable intermittent claudication were admitted to this prospective controlled study. Of these, 25 patients received for 4.5 months, and the other 12 patients acted as control patients. Both groups were advised to exercise unsupervised for a minimum of 1 hour daily and received aspirin. Data analysis is based on nonparametric statistics, the Wilcoxon signed ranks test, and the Mann-Whitney test for intra-group and inter-group comparisons, respectively. It was concluded that, intermittent pneumatic foot compression used at home for 4.5 months increases claudication distance by over 100%. Associated increases in r-ABI by 18%, p-eABI by 110%, and arterial calf inflow by 36% suggest an improved collateral circulation. Maximum benefit seems to be offered over the initial 3 months. Treatment benefits are maintained 1 year after treatment.

Wei et al., (2000), evaluated the association of low cardio respiratory fitness and physical inactivity with mortality in men with type II diabetes. One thousand two hundred and sixty three men with type II diabetes who received a thorough medical examination between 1970 and 1993 were selected as subjects. It was concluded that, Low cardio
respiratory fitness and physical inactivity are independent predictors of all-cause mortality in men with type II diabetes. Physicians should encourage patients with type II diabetes to participate in regular physical activity and improve cardio respiratory fitness.

Rimmer et al., (2000) compared the effects of 3 different exercise training regimens on cardio respiratory fitness and coronary risk factor reduction in subjects with unilateral stroke. Fifty-five subjects with unilateral ischemic stroke were assigned to the following groups: intensity (n=18), duration (n=19), and therapeutic exercise (n=18). It measures peak oxygen consumption (VO2peak), sub maximal oxygen consumption (VO2), lipid panel, and resting blood pressure. It was concluded that, both MISD and LILD conditions achieved greater clinical and significant gains in coronary risk reduction compared with TE.

4. Studies on effect of Physical Exercises on Diabetic Patients

Hordern et al (2008), determined the effects of a 4-week exercise training intervention on blood glucose, insulin sensitivity, BMI (body mass index) and cardio respiratory fitness in patients with Type II diabetes, and to identify and establish criteria for patients who are more likely to improve their blood glucose from short-term exercise training. BMI, waist circumference, blood pressure, blood lipid profile, blood glucose, insulin, insulin sensitivity and QUICKI, beta-cell function, and VO2max were measured at baseline and at 4 weeks. It was concluded that, apparently healthy patients with Type II diabetes, a 4-week exercise intervention improved cardio respiratory fitness, BMI and
triacylglycerols. Elevated blood glucose and HbA1c predicted improvements in blood glucose.

Williams (2008), determined the relationships of running intensity with antihypertensive, LDL-cholesterol-lowering, and anti-diabetic medication use when adjusted for running volume (km x d(-1)). Self-reported medication use was compared cross-sectionally to running pace (m x s (-1) during usual run) in 25,552 male and 29,148 female National Runners' Health Study participants. Although these results do not prove causality, they show that exercise intensity is inversely associated with the prevalence of hypertension, hypercholesterolemia, and diabetes independent of exercise volume and cardio respiratory fitness (10-km performance), suggesting that the more vigorous the exercise, the healthier the health benefits.

Bordenave et al., (2008), quantified the magnitude of changes in insulin sensitivity (SI) and glucose effectiveness (SG) in response to acute exercise in type II diabetic (T2D) patients, as previously studied in non-diabetic subjects. Seven T2D patients and seven non-diabetic controls participated in the study. The result indicated that, a single bout of exercise at moderate intensity in type II diabetics did not improve SG, but markedly improved the low SI values found in these patients, indicating that the acute effects of exercise on SI are quantitatively important in the interpretation of training-related SI changes and may even be therapeutically useful on their own. Surrogates such as homoeostasis model assessment (HOMA) and quantitative insulin-sensitivity check index (QUICKI) were not sensitive enough to detect this
increase in \( S(I) \) and should probably be used with caution in the follow-up of exercise protocols in diabetic patients.

Lima \textit{et al.}, (2008), verified the occurrence of post-exercise hypotension (PEH) in type II diabetics (DM(2)) and the effects of exercise intensity on post-exercise blood pressure (BP). Eleven men and women with DM(2) of fasting blood glucose and 126+/-10/75+/-7mmHg of resting BP performed an incremental test (IT) for cardiovascular evaluation and anaerobic threshold (AT) determination. Then, participants randomly underwent 2 exercise sessions (90% and 110% AT) and a control session (CON). In all sessions, BP was measured at resting, during 20min of exercise/control and at each 15min through 120min of post-exercise recovery (R15-R120). It was concluded that, both exercise intensities evoked reductions in SBP while DBP and MAP were reduced only after 110%. Despite the higher intensity exercise to be more effective in promoting BP reductions, we suggest caution while prescribing exercise for DM(2).

Gaesser (2007), determined the role of exercise as a cornerstone in prevention and treatment of cardiovascular disease (CVD), type II diabetes (T2D), and the metabolic syndrome. Physical activity and cardio respiratory fitness are also associated with reduced mortality rates among persons with CVD, T2D, and metabolic syndrome. Exercise has definite acute effects on a number of risk markers for CVD and T2D, in addition to more substantial benefits with chronic training. It was concluded that, both aerobic and resistance exercise have therapeutic value, largely
independent of weight loss, and should be included in exercise programmes.

Schäfer et al (2007), determined lifestyle intervention is effective in the prevention of type II diabetes in individuals with impaired glucose tolerance (IGT). Data from 181 subjects (133 with NGT and at risk for type II diabetes and 48 with IGT) who participated in the Tuebingen Lifestyle Intervention Programme with increase in physical activity and decrease in caloric intake were included into this study. Body fat distribution was quantified by whole-body magnetic resonance (MR) tomography and liver fat and intra myocellular fat by (1)H-MR spectroscopy. It was concluded that, moderate weight loss under a lifestyle intervention with reduction in total, visceral and ectopic fat and increase in insulin sensitivity improves glucose tolerance in individuals with IGT but not with NGT. In individuals with NGT, the beneficial effects of a lifestyle intervention on fat distribution and insulin sensitivity possibly prevent future deterioration in glucose tolerance.

Raguso et al., (2007), investigated the impact of lifestyle programmes, including diet and physical training, on the incidence of diabetes, confirming physical exercise as a cornerstone in the strategy of the prevention and treatment of type II diabetes. Although public health recommendations regarding regular physical activity are available, however often little is done by governments to implement them. Finally, the general practitioner is pivotal in counseling patients regarding their lifestyle and therefore in affecting a large number of people.
Rana et al., (2007), examined the individual and joint association of obesity and physical activity with the development of type II diabetes. A total of 68,907 female nurses who had no history of diabetes, cardiovascular disease, or cancer were selected as subjects. It was concluded that, Obesity and physical inactivity independently contribute to the development of type II diabetes; however, the magnitude of risk contributed by obesity is much greater than that imparted by lack of physical activity.

De Feo et al., (2006), discussed exercise and diabetics. Regular aerobic exercise reduces of visceral fat mass and body weight without decreasing lean body mass, ameliorates insulin sensitivity, glucose and blood pressure control, lipid profile and reduces the cardiovascular risk. For these reasons, regular aerobic physical activity must be considered an essential component of the cure of type II diabetes mellitus. In this regard, individual behavioral strategies have been documented to be effective in motivating sedentary type II diabetic subjects to the adoption and the maintenance of regular physical activity.

Bassuk et al., (2005), studied that physically active individuals have a 30-50% lower risk of developing type II diabetes than do sedentary persons and that physical activity confers a similar risk reduction for coronary heart disease. Protective mechanisms of physical activity include the regulation of body weight; the reduction of insulin resistance, hypertension, atherogenic dyslipidemia, and inflammation; and the enhancement of insulin sensitivity, glycemic control, and fibrinolytic and endothelial function. It was concluded that, moderate
increases in physical activity may offer the best balance between efficacy and feasibility to improve metabolic and cardiovascular health in largely sedentary populations.

Stewart K.J. (2004), conducted a study on Role of exercise training on cardiovascular disease in persons who have type II diabetes and hypertension. Exercise training is an essential component in the medical management of patients who have type II diabetes and hypertension. Regular exercise improves the cardio-vascular health of individuals who have these conditions through multiple mechanisms. These mechanisms include improvements in endothelial vasodilator function, left ventricular diastolic function, arterial stiffness and systematic inflammation and reducing left ventricular mass. Exercise training also reduces total and abdominal fat, which mediate improvements in insulin sensitivity and blood pressure, and possibly, endothelial function. Persons who are in a pre diabetic stage or those who have the metabolic syndrome may be able to prevent or delay the progression to overt diabetes by adopting a healthier lifestyle, of which increasing habitual levels of physical activity is a vital component. Most persons who have diabetes and hypertension or are at risk for these conditions should be able to initiate an exercise programme safely after appropriate medical screening and the establishment of an individualized exercise prescription. Many cardiac re-habilitation and clinical exercise programmes can accommodate patients who have type II diabetes and hypertension. Such programmes can establish individualized exercise prescriptions and provide an
environment that is conducive for "lifestyle change" that underlies long-term compliance to exercise and risk factor modification.

Flemming Dela, et al., (2004) studied physical training changes β-cell function in type II diabetic patients. In healthy young subjects, training increases insulin sensitivity but decreases the capacity to secrete insulin. Patients, stratified into "moderate" and "low" secretors according to individual C-peptide responses to an intravenous glucagons test, were randomly assigned to a training programme (ergometer cycling 30-40 min/day, including at least 20 min at 75% maximum oxygen consumption (VO_{2}\text{ max}), 5 days / wk for 3 mo) or a sedentary schedule. Before and after the intervention (16 h after last training bout), a sequential hyperglycemic (90 min at 11, 18, and 25mM) clamp was performed. An intravenous bolus of 5 g of arginine was given at the end. Training increased VO_{2}\text{ max} 17 ± 13% and decreased heart rate during submaximal exercise (P < 0.05). During the 3 mo of sedentary lifestyle, insulin and C-peptide responses to the clamp procedures were unchanged in both moderate and low secretors. Likewise, no change in β-cell response was seen after training in the low secretors (n = 5). In contrast, moderate secretors (n = 9) showed significant increases in β-cell responses to 18 and 25mM hyperglycemia and to arginine stimulation. Glucagon responses to arginine as well as measures of insulin sensitivity and Hb A_{1c} levels were not altered by training. In conclusion, in type II diabetic patients, training may enhance β-cell function if the remaining secretory capacity is moderate but not if it is low. The improved β-cell
Fenicchia, et al., (2004) conducted a study on the effects of acute and chronic resistance training on glucose and insulin responses to a glucose load in women with type II diabetes. Subjects consisted of type II diabetic women (n = 7) and age-matched controls (n = 8) with normal glucose tolerance. All subjects participated in 3 oral glucose tolerance tests: pretraining, 12 to 24 hours after the first exercise session (acute) and 60 to 72 hours after the final training session (chronic). Exercise training consisted of a whole body resistance exercise programme using weight-lifting machines 3 days per week for 6 weeks. Resistance training was effective in increasing strength of all muscle groups in all subjects. Integrated glucose concentration expressed as area under the curve (AUC) was $3,355.0 \pm 324.6$ mmol/L min pretraining, improved significantly ($P < .01$) after the acute bout of exercise ($2,868 \pm 324.0$ mmol/L min), but was not improved with chronic training ($3,206.0 \pm 337.0$ mmol/L min) in diabetic subjects. A similar pattern of significance was observed with peak glucose concentration (pre: $20.2 \pm 1.4$ mmol/L, acute: $17.2 \pm 1.7$ mmol/L; chronic: $19.9 \pm 1.7$ mmol/L). There were no significant changes in insulin concentrations after any exercise bout in the diabetic subjects. There were no changes in glucose or insulin levels in control subjects. An acute bout of resistance exercise was effective in improving integrated glucose concentration, including reducing peak glucose concentrations in women with type II diabetes, but not age-matched controls. There were no significant changes in insulin...
concentrations for either group. Resistance exercise offers an alternative to aerobic exercise for improving glucose control in diabetic patients. To realize optimal glucose control benefits, individuals must follow a regular schedule that includes daily exercises.

Santeusanio, et al., (2003). conducted a study on physical activity has acute and chronic effects on glucose, lipid and protein metabolism in Type II diabetic patients. Long-term effects of regular aerobic exercise reduces visceral fat mass and body weight without decreasing lean body mass, ameliorates insulin sensitivity, glucose and BP control, lipid profile and reduces the cardiovascular risk. For these reasons, regular aerobic physical activity must be considered as an essential component of the curve of Type II diabetes mellitus. In this regard, individual behavioural strategies have been documented to be effective in motivating sedentary Type II diabetic subjects to the adoption and the maintenance of regular physical activity. Exercise-induced activation of counter-regulatory hormones might trigger an acute metabolic rearrangement in severe insulin-deficient subjects. Thus, diabetic patients, before starting exercise sessions, must be carefully educated about the consequences of physical activity on their blood glucose and the appropriate modifications of diet and insulin therapy.

Castaneda (2003). Conducted a study on regular physical activity and exercises are important components in the prevention of diabetes. In addition to lowering blood glucose, exercise improves insulin action, contributes to weight loss, and reduces several risk factors for cardiovascular disease. The association between increased levels of
physical activity and a reduced occurrence of diabetes' long-term complications suggests that regular physical activity has a protective role. This association has been shown in the Diabetes Prevention Program. In which physical activity in the form of walking for 30 minutes/day on most days of the week was encouraged. Most people with diabetes, like people without diabetes, fall to meet national physical activity goals. Sedentary lifestyles have been linked to 23% of deaths from leading chronic diseases, including heart disease and diabetes. Given the epidemic nature of diabetes in the world during the 21st century, diabetes management through physical activity and structured exercise should be considered an adjunct to diabetes.

Maiolo, et al., (2003) conducted a study on the effect of physical activities of various intensities on the energy expenditure of type II diabetic men. Interventions that focus on changing lifestyles through the combined use of dietary management, weight reduction, and increased physical activity are essential for management type II diabetes mellitus (T2DM). The objective of the present study was to examine mildly obese T2DM patients [n = 10; mean age (+/-SD), 51.29 +/- 6.80 years; body mass index (BMI), 30.26 +/- 6.19 kg/m (2); and glycosylated haemoglobin (HbA(1c)), 8.16 +/- -1.16%]) and to compare them with normoglycaemic persons (n = 10; age, 53.00 +/- 9.48 years; BMI, 27.63 +/- 3.33 kg/m(2), and HbA (1c), 5.85 +/- 0.56%) in terms of energy expenditure while performing physical activities of various intensities (i.e. light, moderate, and heavy). The resting metabolic rate for T2DM patients was significantly higher than that for healthy controls (2200+/-
The values of energy expenditure at all three levels of physical activity were comparable between the two groups. Physical activity seems to have various beneficial effects on mildly obese T2DM patients because it increases the plasma glucose consumption, resulting in similar energy expenditure in comparison with normal glycaemic individuals.

Ryan (2003) focuses on the roles of physical activity and weight reduction in reducing the risk for development of type II diabetes and the metabolic syndrome. The mechanisms by which obesity and detraining lead to insulin resistance and type II diabetes are discussed and, conversely, the mechanisms by which insulin resistance might be reversed by physical activity are addressed. It was concluded that, for a successful public health approach to chronic disease prevention, we cannot rely completely on pharmaceuticals, but must implement environmental changes to encourage healthy lifestyles.

Sacks et al (2002) conducted exploratory analyses of participant characteristics, lipid risk factors, and risk reduction in this group. Among 13,173 participants with coronary heart disease were selected as subjects. The result indicated that, among patients with CHD who have low LDL-C, diabetics have much higher subsequent CHD event rates than do nondiabetics. Pravastatin reduced the event rate in diabetics to that of non-diabetic participants. The results also suggest enhanced therapeutic potential for improving HDL-C and triglycerides in patients with CHD who have low LDL-C concentrations.
Chipkin et al (2001) discussed the exercise and diabetics. Beyond the acute impact of physical activity, long-term exercise behaviors have been repeatedly associated with decreased rates of type II 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. 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.

Ishii, et al, (2001) conducted a study on the effect of exercise training on serum leptin levels in type II diabetes. In this study 50 sedentary subjects with type II diabetes were enrolled in either 6 weeks of aerobic exercise training with diet therapy (n = 23) or diet therapy alone (n = 27). The training programme consisted of walking and cycle ergo meter exercise for 1 hour at least 5 times per week, with the intensity; of exercise maintained at 50% of maximum oxygen uptake. Serum leptin levels decreased significantly in the exercise training (TR) group (7.2 +/- 3.6 to 4.6 +/- 2.5 ng/mL, P <.05), but not in the sedentary (SED) group (6.9 +/- 3.4 to 5.6 +/- 2.9 ng/mL). Leptin levels standardized for percentage body fat (dividing serum leptin level by percentage body fat) after treatment were lower in the TR subjects compared with the SED subjects. Body weight and percentage body fat
decreased in all patients; however, no significant changes were observed in either group. Fasting concentrations of plasma insulin and cortisol and the urinary excretion of 17 – hydroxycorticosteroid (17-OHCS) did not differ between the groups either before or after treatment. Fasting plasma glucose and hemoglobin A1c (HbA1c) improved significantly in both groups, although no significant differences were observed between the groups either before or after treatment. Ventilator threshold increased significantly in the exercise training subjects. This study demonstrates that exercise training in type II diabetic subjects reduces serum lipin krelis independent of charges in body fat mass, insulin of glucocorticoids.

Kirk AF, et al., (2001) evaluates the effect of exercise consultation on promotion of physical activity in people with Type II diabetes. Twenty-six sedentary people with Type II diabetes were randomly assigned to receive an exercise consultation and standard exercise information (experimental) or standard exercise information alone (control). Exercise consultation is a cone-to-one discussion, based on the transtheoretical model, designed to educate, strengthen motivation and develop realistic strategies to promote physical activity. Changes from baseline at five weeks were assessed in (a) stage of exercise behaviour (b) physical activity levels (7-day recall questionnaire and an accelerometer) (c) quality of life (SF-36 Health Survey and 22-Item Well-Being Questionnaire). 82% (9/11) of participants receiving a consultation increased their stage of exercise behaviour compared to 33% (4/12) of controls (chi2 = 5.4, P = 0.02). Physical activity counts/week increased by 4% (1636 067/1696 191) in the experimental group and decreased by 9% (1560 960/1725 510) in controls. A significant difference was
recorded for the change in activity counts per week from baseline to follow-up between the experiments taking part in sport or leisure activity increased by 55% (6/11) in the experimental group and decreased by 6% (1/12) in controls. Positive changes were evident in the experimental group, compared to controls, in both quality of life questionnaires.

Wilmore JH et al., (2001) determine the relationship between changes in maximal oxygen uptake (VO2 max) and sub maximal markers of aerobic fitness and changes in risk factors for cardiovascular disease (CVD) and non-insulin-dependent diabetes mellitus (NIDDM) consequent to a 20-week endurance training program. The 502 participants in this study were healthy and previously sedentary men (n = 250) and women (n = 252) of varying age (17 to 65 years) and race (blacks n = 142; whites n = 360) who had completed the HEIRTAGE Family Study testing and training protocol. Following baseline measurements, participants trained on cycle ergometers 3 days/week for a total of 60 exercise sessions starting at the heart rate (HR) associated with 55% VO2 max for 30 minutes/session. This was progressively increased to the HR associated with 75% of VO2 max for 50 minutes/session, which was maintained during the last 6 weeks. VO2 max, heart rate at 50 W, power output at 60% of VO2 max, lipids and lipoproteins, resting blood pressure, body composition including abdominal fat (computed tomography [CT] scan), and blood glucose and insulin at rest and at peak following an intravenous glucose tolerance test (IVGTT) were determined both before and after training. Following training, there were significant increases in VO2 max (16%) and the power output at 60% of VO2 max and a significant decrease in HR at 50W. These changes in markers of aerobic fitness were significantly correlated only to the changes in the body composition variables and the lipids and lipoproteins. Further, there was considerable individual variation in response for all
variables studied. Finally, when risk factor data were analyzed by quartile of change in VCO2 max, there were few significant relationships. It is concluded that there is a significant relationship between changes in markers of aerobic fitness and changes in several risk factors for CVD and NIDDM. However, the magnitude of these relationships is small.

Sato (2000) conducted a study on regular physical exercise has been known to be beneficial in the treatment of type II diabetes. In Epidemiological studies of physical exercise, the previous non-randomized studies suggested that a life-style intervention programme 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.
Schneider et al., (2000) demonstrated a beneficial effect of regular physical activity on levels of HgbAC in patients with type II diabetes mellitus, largely due to an increase in insulin sensitivity. Benefits are related to short-term improvements in insulin sensitivity following individual exercise bouts. Because of the high incidence of occult coronary disease, patients need a cardiovascular evaluation when initiating an exercise program. It was concluded that, high intensity exercise may result in retinal hemorrhage and transient worsening of diabetic proteinuria. The most common complication is hypoglycemia. A combination of aerobic and light resistance exercise is appropriate.

5. Summary of the Literature

The reviews are presented under four sections such as effect of walking on cardiovascular patients (n=6), effect of walking on diabetic patients (n=7), effect of physical exercise on cardiovascular patients (n=31) and effect of physical exercise on cardiovascular patients (n=24) in chronological order. All the research studies presented in this section proved that walking and physical exercise programme contribute significantly for better preventive process of cardiovascular and diabetic diseases. The research studies reviewed are from many journals available in the websites such as www.pubmed.com, ERIC websites etcetera, employ the aforesaid concept.

The review of literature helped the researcher from the methodological point of view too. It was learnt that most of the research studies cited in this chapter on content analysis and experimental design, as the appropriate methods for finding out the lapses and remediation.