Chapter-II

Review of Related Literature

The present chapter gives a detailed account of the available literature relevant to the present topic. In research terminology it is known as the review of literature. The researcher did his best to review the relevant literature based on earlier researchers’ findings, expert comments of the scholars, and views of the authorities in the field of sports and physical education and their role in the promotion of sports.

The main objective of the review of literature in the process of doing research is to unearth the fresh problems and to determine the objectives of the proposed research project. Moreover, such survey is helpful to delineate the results of the present study. The review of literature helps the researcher in supporting the results based discussion and in giving the suggestions by taking the supports of researchers of yester years. Keeping all these things in view, this chapter is devoted to a perusal of past literature that has relevance to the present study.
Campbell et al., (2014) compared the glycemic and metabolic responses to simulated intermittent games activity and continuous running exercise in type 1 diabetes. Nine patients (seven male, two female; 35±4 years; HbA1c 8.1±0.2% / 65±2 mmol/mol) treated on a basal-bolus regimen completed two main trials, a continuous treadmill run (CON) or an intermittent running protocol (INT). Patients arrived to the laboratory fasted at ~08:00 h, replicating their usual pre-exercise meal and administering a 50% reduced dose of rapid-acting insulin before exercising. Blood glucose (BG), K⁺, Na⁺⁺, pH, triglycerides, serum cortisol, and NEFA were measured at baseline and for 60 min post-exercise. Interstitial glucose was measured for a further 23 h under free-living conditions. Following exercise, BG declined under both conditions but was less under INT (INT -1.1±1.4 vs CON -5.3±0.4 mmol/L, P=0.037), meaning more patients experienced hypoglycemia (BG ≤ 3.5 mmol/L; CON n=3 vs INT n=2) but less hyperglycemia (BG ≥ 10.9 mmol/L; CON n=0 vs INT n=6) under CON. Blood lactate was significantly greater, and pH lower, with a temporal delay in K⁺ under INT (P<0.05). No conditional differences were observed in other measures during this time, or in interstitial glucose concentrations during the remaining 23 h after exercise. Simulated games activity carries a lower risk of early, but not
late-onset hypoglycemia than continuous running exercise in type 1 diabetes.

Serpiello et al., (2014) compared the effects of a futsal game (FUT) and moderate-intensity continuous exercise (MOD), on the skeletal-muscle protein signaling responses in young, healthy individuals. 16 men undertook an incremental exercise test and a resting muscle biopsy performed >48 h apart. They were then randomly allocated to either FUT (n=12) consisting of 2 x 20 min halves, or MOD (n=8) consisting of a work-matched running bout performed at an intensity corresponding to the individual ventilatory threshold 1. Work matching was achieved by means of triaxial accelerometers. Immediately after FUT and MOD, participants underwent a second biopsy to assess exercise-induced changes in protein signaling. Total and phosphorylated protein abundance was assessed via western blotting. Both FUT and MOD altered signaling responses in skeletal muscle. FUT increased total ATF2 protein abundance (p=0.048) and phosphorylation (p=0.029), while no changes occurred with MOD. Both exercise regimes increased ACC phosphorylation (p=0.01) and returned a trend for increased p38MAPK phosphorylation. Futsal may be employed as an alternative to continuous exercise to elicit muscle adaptations which may be associated with improved health outcomes. As only FUT increased ATF2
activation, this protein might be a target of future investigation on exercise-induced signaling.

Ferley et al., (2014) found out the effects of incline and level-grade interval treadmill training on indices of running economy (RE) (i.e., oxygen consumption [VO2] and blood lactate [BLa] responses of submaximal running) and muscle power. Thirty-two well-trained distance runners (age, 27.4 ± 3.8 years; body mass, 64.8 ± 8.9 kg; height, 173.6 ± 6.4 cm; and VO2max, 60.9 ± 8.5 ml·min(-1)·kg(-1)) received assignment to an uphill (G Hill = 12), level-grade (G Flat = 12), or control (G Con = 8) group. GHill and GFlat completed 12 interval and 12 continuous run sessions over 6 weeks, whereas GCon maintained their normal training. Dependent variables measured before and after training were VO2 and BLa at 2 separate velocities associated with lactate threshold (VLT) (VO2-60% and VO2-80%; and BLa-60% and BLa-80%, respectively); percentage of VO2max at lactate threshold (%VO2max at VLT); muscle power as assessed through a horizontal 5-jump test (5Jmax); and isokinetic knee extension and flexion at 3 angular velocities (90, 180, and 300°·s(-1)). Statistical significance was set to p ≤ 0.05. All groups significantly improved 5Jmax, VO2-60%, VO2-80%, BLa-60%, and BLa-80%. Additionally, GHill and GFlat significantly improved %VO2max at VLT. Other indices of RE and muscle power did not improve. They concluded that incline
treadmill training was effective for improving the components of RE, but insufficient as a resistance-to-movement exercise for enhancing muscle power output.

Gaetano and Rago (2014) conducted a study on the study periodization which it means the division of training season in specific periods in order to clearly define goals. Part of this periodized training was characterized by High Intensity Intermittent Training (HIIT), so important in soccer as many team sports, characterized by phases of high oxygen consumption alternated by recovery series. The research was conducted on a sample of 20 male Soccer players of 16.8 ± 1 years old members of a Sub-18 team of Italian National League “Beretti”. The athletes were divided into two groups according to their results of aerobic power detected by the Cooper test carried out at the beginning of the preparatory period: a group working with a higher internal load (90% HR), and another group performing the same, but holding a lower one (80% HR.). That division was made in such a way as to obtain the desired adaptations and improvements in both groups, because of their having different characteristics, and in such a manner as not to create high overloads that, producing lactate they would prevent the adaptations and improvements sought. This study shows us how the intermittent training leads to a significant increase in VO2max. The data collected were
subjected to a statistical study that showed improvements in physical performance of the different athletes thanks to the use of Periodization method integrated to High Intensity Intermittent Training. Significant, according to the method of periodization, the gradual increase of the applied load which allows the central nervous system (CNS) to adapt and achieve improvements. The aim of this study was to compare effects and improvements of an HIIT in two groups of Youth Soccer Players with different fitness characteristics, monitoring the Maximum Oxygen Consumption (VO2max) as parameter of internal load.

Currie et al., (2013) compared the effects of 12-weeks of HIT, and higher-volume moderate-intensity endurance exercise (END), on brachial artery flow-mediated dilation (FMD) and cardio respiratory fitness (VO2peak) in patients with CAD. Twenty-two patients with documented CAD were randomized into HIT (n=11) or END (n=11) based on pre-training FMD. Both groups attended 2 supervised sessions per week for 12-weeks. END performed 30-50 minutes of continuous cycling at 58% peak power output (PPO), while HIT performed 10, 1-minute intervals at 89% PPO separated by 1-minute intervals at 10% PPO per session. Relative FMD was increased post-training (END: 4.4 ± 2.6% vs. 5.9 ± 3.6%; HIT: 4.6 ± 3.6% vs. 6.1 ± 3.4%, p≤0.001 pre- vs. post-training) with no differences between groups. A training effect was also
observed for relative VO (END: 18.7 ± 5.7 ml·kg·min vs. 22.3 ± 6.1 ml·kg·min; HIT: 19.8 ± 3.7 ml·kg·min vs. 24.5 ± 4.5 ml·kg·min, p<0.001 for pre vs. post-training), with no group differences. Low-volume high-intensity interval exercise training provided an alternative to the current, more time intensive prescription for cardiac rehabilitation. HIT elicited similar improvements in fitness and FMD as END, despite differences in exercise duration and intensity.

Carminatti et al., (2013) compared physiological responses derived from an incremental progressive field test with a constant speed test i.e., intermittent versus continuous protocol. Two progressive maximum tests (Carminatti`s test (T-CAR) and the Vameval test (T-VAM)), characterized by increasing speed were used. T-CAR is an intermittent incremental test, performed as shuttle runs; while T-VAM is a continuous incremental test performed on an athletic track. Eighteen physically active, healthy young subjects (21.9 ± 2.0 years; 76.5 ± 8.6 kg, 1.78 ± 0.08 m, 11.2 ± 5.4% body fat), volunteered for this study. Subjects performed four different maximum test sessions conducted in the field: two incremental tests and two times to exhaustion tests (TTE) at peak test velocities (PV). No significant differences were found for PV (T-CAR = 15.6 ± 1.2; T-VAM = 15.5 ± 1.3 km·h(-1)) and maximal HR (T-CAR = 195 ± 11; T-VAM = 194 ± 14 bpm).
During TTE, there were no significant differences for HR (TTET-CAR and TTET-VAM = 192 ± 12 bpm). However, there was a significant difference in TTE (p = 0.04) (TTET-CAR = 379 ± 84, TTET-VAM = 338 ± 58 s) with a low correlation (r = 0.41). The blood lactate concentration measured at the end of the TTE tests, showed no significant difference (TTET-CAR = 13.2 ± 2.4 vs. TTET-VAM = 12.9 ± 2.4 mmol·l⁻¹). Based on the present findings, it was suggested that the maximal variables derived from T-CAR and T-VAM could be interchangeable in the design of training programmes. Key points T-CAR is an intermittent shuttle run test that predicts the maximal aerobic speed with accuracy, hence, test results could be interchangeable with continuous straight-line tests. T-CAR provides valid field data for evaluating aerobic fitness. In comparison with T-VAM, T-CAR may be a more favourable way to prescribe intermittent training using a shuttle-running protocol.

Ihsan et al., (2013) derived tissue oxygenation index (TOI) and total haemoglobin concentration (tHb) were examined during continuous (CR) and interval (INT) running. In a repeated measures design, 10 subjects twice performed 30 min of CR at 70% of their peak treadmill velocity, followed by 10 bouts of INT at 100%. Between trials, reliability of mean and amplitude changes in TOI and tHb during CR was determined. Muscle de-
oxygenation and re-oxygenation rates during INT were calculated using 3 analytical methods; i) linear modeling, ii) minimum and maximum values during work/rest intervals, and iii) mean values during work/rest intervals. Reliability was assessed using coefficient of variation (CV; %). During CR, mean TOI was more reliable (3.5%) compared with TOI amplitude change (34.7%), while mean tHb (12%) was similar to both absolute (9.2%) and relative (10.2%) amplitude changes. During INT, de-oxygenation rates analyzed via linear modeling produced the lowest CV (7.2%), while analysis using min-max values produced the lowest CV (9.3%) for re-oxygenation rates. In conclusion, while the variables demonstrated CVs lower than reported changes in training-induced adaptations and/or differences between athletes and controls (23- 450%), practitioners are encouraged to consider the advantages/disadvantages of each method when performing their analysis.

Dittrich et al., (2013) attempted to characterize the neuromuscular, biochemical, and endocrinal responses from a running to exhaustion mode at the maximal lactate steady state intensity during continuous and intermittent protocols. For this purpose twelve athletes performed an incremental treadmill test, several constant speed tests to determine the maximal lactate steady state at continuous and intermittent (5:1 ratio) models and
two randomized tests until exhaustion at such intensities. Knee extension torque and blood sampling were collected before and immediately after the time to exhaustion tests. The results showed a significant decrement (∼15%) in torque production after time to exhaustion tests for both exercise models. In addition to neuromuscular impairment, an acute increase of 65% and 38% was observed creatine kinase, during continuous and intermittent running, respectively. Regarding hormonal responses when compared to baseline measurements, cortisol increased by 132% and 121% in the continuous and intermittent protocols, respectively. No correlation was found between biochemical, endocrinial and the neuromuscular variables. The present findings showed that running until exhaustion performed at maximal lactate steady state, significantly impaired muscle strength and increased hormonal and muscle damage markers in two different protocols (i.e. continuous and intermittent) amongst trained runners.

Dittrich et al., (2013) determined and compared the time to exhaustion (TE) and the physiological responses at continuous and intermittent (ratio 5:1) maximal lactate steady state (MLSS) in well trained runners. Ten athletes (32.7 ± 6.9 years; VO2max 61.7 ± 3.9 mL·kg·min⁻¹) performed an incremental treadmill test, three to five 30-min constant speed
tests to determine the MLSS continuous and MLSS intermittent (5 min of running, interspaced by 1 min of passive rest) and two randomized TE tests at such intensities. Two-way ANOVA with repeated measures was used to compare the changes in physiological variables during the TE tests and between continuous and intermittent exercise. The intermittent MLSS velocity (MLSSint = 15.26 ± 0.97 km.h⁻¹) was higher than in the continuous model (MLSScon = 14.53 ± 0.93 km.h⁻¹), while the time to exhaustion at MLSS continuous was longer than MLSS intermittent (68 ± 11 min and 58 ± 15 min, p<0.05). Regarding the cardio respiratory responses, VO2 and R remained stable during both TE tests while HR, VE, and RPE presented a significant increase in the last portion of the tests. The results showed a higher tolerance to exercising during continuous MLSS compared with intermittent MLSS, in trained runners. Thus, the training volume of an extensive interval session (ratio 5:1) designed at MLSS intensity should take into consideration this higher speed at MLSS and also the lower TE, when compared with continuous exercise.

Houghton et al., (2013) found out the effects of prolonged running on Achilles tendon properties being assessed after a 60 min treadmill run and 140 min intermittent shuttle running (simulated cricket batting innings). Before and after
exercise, 11 participants performed ramp-up plantar flexions to maximum-voluntary-contraction before gradual relaxation. Muscle-tendon-junction displacement was measured with ultrasonography. Tendon force was estimated using dynamometry and a musculoskeletal model. Gradients of the ramp-up force-displacement curves fitted between 0-40% and 50-90% of the pre-exercise maximal force determined stiffness in the low- and high-force-range, respectively. Hysteresis was determined using the ramp-up and relaxation force-displacement curves and elastic energy storage from the area under the ramp-up curve. In simulated batting, correlations between tendon properties and shuttle times were also assessed. After both protocols, Achilles tendon force decreased (4% to 5%, P < .050), but there were no changes in stiffness, hysteresis, or elastic energy. In simulated batting, Achilles tendon force and stiffness were both correlated to mean turn and mean sprint times (r = -0.719 to -0.830, P < .050). Neither protocol resulted in fatigue-related changes in tendon properties, but higher tendon stiffness and plantar flexion force were related to faster turn and sprint times, possibly by improving force transmission and control of movement when decelerating and accelerating.
Sikiru and Okoye (2013) investigated the effect of interval training programme on PP in subjects with hypertension. Two hundred and forty five male patients with mild to moderate (Systolic Blood Pressure [SBP] between 140-179 & Diastolic Blood Pressure [DBP] between 90-109 mmHg) essential hypertension were age-matched and grouped into exercise and control groups. The exercise (work: rest ratio of 1:1) groups involved in an 8-weeks interval training programmes of between 45-60 minutes, at intensities of 60-79% of HR max (maximum heart rate), while the control group remained sedentary during this period. SBP, DBP, VO2max and PP were assessed. Findings of the study revealed significant correlation between PP and blood pressure; correlation of PP with SBP was much stronger (95% variance). Also, there was significant effect of the exercise training programme on SBP, DBP and PP. Changes in VO2max also negatively correlated with changes in PP ($r = -0.285$) at $p<0.05$. Moderate intensity interval training programmes are effective in the non-pharmacological management of hypertension and may prevent cardiovascular event through the down regulation of PP in hypertension.

Borzykh et al., (2012) examined with male Wistar rats that were treadmill-trained for 8 weeks using one of the two regimens: with the constant running speed or with alternating high-speed and low-speed intervals. Both training regimens led to an increase
of rat aerobic capacities and to a higher citrate synthase activity in the medial head of gastrocnemius muscle. No differences between the effects of two training regimens were observed. However, in contrast to constant-speed training the interval one resulted in myocardium hypertrophy and also in less pronounced changes in diaphragm muscle, such as slow-direction shift of myosin phenotype and reduction of muscle fiber cross-sectional area. Neither of the training regimens had an effect on corticosterone and thyroid hormones levels in rat blood, whereas the interval training resulted in a higher level of testosterone. Anabolic influence of testosterone during interval aerobic training may be favorable for heart hemodynamic capacity and force characteristics of the diaphragm.

Panissa et al., (2012) analyzed the effect of the time interval after high-intensity aerobic exercise on strength performance in individuals with different training backgrounds. Participants (n = 27) were divided into three groups according to their training backgrounds (aerobic, strength or concurrent) and submitted to eight sessions: (1) determination of the peak velocity (Vpeak) during the incremental treadmill test to exhaustion and familiarization of the evaluation of maximum strength (1RM) for the half-squat; (2) 1RM determination; and (3-8) randomly assigned experimental sessions consisting of either a strength
exercise (SE), four sets at 80% of the 1RM, in which maximum number of repetitions (MNR) and the total volume performed (TV) was computed, and five sessions consisting of high-intensity intermittent aerobic exercise (100% of Vpeak - 1 min:1 min) totaling 5 km, followed by an SE with varying recovery intervals between activities (30, 60 minutes, 4, 8, and 24 hours). Comparisons for MNR and TV were made using two-way variance analysis (group and time interval) with repeated measures in the second factor. When significant differences were detected (P < 0.05), a Bonferroni and Dunnet post-hoc test was used. There was an effect of group for MNR, with the Aerobic Group performing a higher MNR compared with Strength Group (P = 0.002). Moreover, there was an effect of the time interval for MNR and TV, with reduction after 30 (P < 0.001 for both variables) and 60 minutes intervals (P = 0.035; P = 0.007, respectively) compared with the control condition. Thus, it was concluded that the drop in performance related to the SE activity occurred with the same magnitude and time interval for each of the groups.

Hansen et al., (2012) found out the effect of aerobic interval training on blood pressure and myocardial function in hypertensive patients. A total of 88 patients (52.0±7.8 years, 39 women) with essential hypertension were randomized to aerobic
interval training (AIT) (>90% of maximal heart rate, correlates to 85-90% of VO(2max)), isocaloric moderate intensity continuous training (MIT) (~70% of maximal heart rate, 60% of VO(2max)), or a control group. Exercise was performed on a treadmill, three times per week for 12 weeks. Ambulatory 24-hour blood pressure (ABP) was the primary endpoint. Secondary endpoints included maximal oxygen uptake (VO(2max)), mean heart rate/24 hour, flow mediated dilatation (FMD), total peripheral resistance (TPR), and myocardial systolic and diastolic function by echocardiography. Systolic ABP was reduced by 12 mmHg (p < 0.001) in AIT and 4.5 mmHg (p = 0.05) in MIT. Diastolic ABP was reduced by 8 mmHg (p < 0.001) in AIT and 3.5 mmHg (p = 0.02) in MIT. VO(2max) improved by 15% (p < 0.001) in AIT and 5% (p < 0.01) in MIT. Systolic myocardial function improved in both exercise groups, diastolic function in the AIT group only. TPR reduction and increased FMD were only observed in the AIT group. This study indicated that the blood pressure reducing effect of exercise in essential hypertension was intensity dependent and that Aerobic interval training would be an effective method to lower blood pressure and improve other cardiovascular risk factors.

Assadi and Lepers (2012) compared the physiological responses and maximal aerobic running velocity (MAV) during an incremental intermittent (45-s run/15-s rest)
field test (45-15FIT) vs an incremental continuous treadmill test (TR) and to demonstrate that the MAV obtained during 45-15FIT (MAV45-15) was relevant to elicit a high percentage of maximal oxygen uptake (VO2max) during a 30-s/30-s intermittent training session. Oxygen uptake (VO2), heart rate (HR), and lactate concentration ([La]) were measured in 20 subjects during 2 maximal incremental tests and four 15-min intermittent tests. The time spent above 90% and 95% VO2max (t90% and t95% VO2max, respectively) was determined. Maximal physiological parameters were similar during the 45-15FIT and TR tests (VO2max 58.6±5.9 mL·kg(-1)·min(-1) for TR vs 58.5±7.0 mL·kg(-1)·min(-1) for 45-15FIT; HRmax 200±8 beats/min for TR vs 201±7 beats/min for 45-15FIT). MAV45-15 was significantly (P<.001) greater than MAVTR (17.7±1.1 vs 15.6±1.4 km/h). t90% and t95% VO2max during the 30-s/30-s performed at MAVTR were significantly (P<.01) lower than during the 30-s/30-s performed at MAV45-15. Similar VO2 during intermittent tests performed at MAV45-15 and at MAVTR could be obtained by reducing the recovery time or using active recovery. The results suggested that the 45-15FIT could be an accurate field test to determine VO2max and that MAV45-15 could be used during high-intensity intermittent training such as 30-s runs interspersed with 30-s rests (30-s/30-s) to elicit a high percentage of VO2max.
Rocco et al., (2012) evaluated the following: 1) the effects of continuous exercise training and interval exercise training on the end-tidal carbon dioxide pressure (PETCO2) response during a graded exercise test in patients with coronary artery disease; and 2) the effects of exercise training modalities on the association between PETCO2 at the ventilatory anaerobic threshold (VAT) and indicators of ventilatory efficiency and cardiorespiratory fitness in patients with coronary artery disease. Thirty-seven patients (59.7 ± 1.7 years) with coronary artery disease were randomly divided into two groups: continuous exercise training (n = 20) and interval exercise training (n = 17). All patients performed a graded exercise test with respiratory gas analysis before and after three months of the exercise training programme to determine the VAT, respiratory compensation point (RCP) and peak oxygen consumption. After the interventions, both groups exhibited increased cardiorespiratory fitness. Indeed, the continuous exercise and interval exercise training groups demonstrated increases in both ventilatory efficiency and PETCO2 values at VAT, RCP, and peak of exercise. Significant associations were observed in both groups: 1) continuous exercise training (PETCO2VAT and cardiorespiratory fitness r= 0.49; PETCO2VAT and ventilatory efficiency r= -0.80) and 2) interval exercise training (PETCO2VAT and cardio...
respiratory fitness \( r = 0.39 \); PETCO2VAT and ventilatory efficiency \( r = -0.45 \). Both exercise training modalities showed similar increases in PETCO2 levels during a graded exercise test in patients with coronary artery disease, which might be associated with an improvement in ventilatory efficiency and cardio-respiratory fitness.

Lamina and Okoye (2012) investigated the effect of interval training programme on blood pressure and lipid profile of subjects with hypertension. A total of 245 male patients with mild-to-moderate hypertension (systolic blood pressure [SBP] between 140 and 180 mmHg and diastolic blood pressure [DBP] between 90 and 109 mmHg) were age matched and grouped into interval and control groups. The interval (\( n = 140; \ 58.90 \pm 7.35 \) years) group was involved in an 8-week interval training (60-79% HR max reserve) programme of between 45 minutes and 60 minutes at a work/rest ratio of 1:1 of 6 minutes each, while the control hypertensive (\( n = 105; \ 58.27 \pm 6.24 \) years) group remained sedentary during this period. Cardiovascular parameters (SBP and DBP), VO2 max, TC, HDL, and atherogenic index (AI) were assessed. Student's t-test and Pearson correlation test were used in data analysis. Findings of the study revealed significant decreased effects of the interval training programme on SBP, DBP, TC AI, and significant increased effects on VO2 max and HDL.
level at P<0.05. There was also a significant correlation between changes VO\textsubscript{2} max and changes in AI. It was concluded that the interval training programme could be an effective adjunct nonpharmacological management of hypertension and a means of up regulation of HDL.

Stoylen et al., (2012) made a comparative study and reported that interval training at high relative intensity would yield significantly larger effects in terms of left ventricular remodeling compared with moderate continuous exercise training. In a three-armed randomized multicentre study of stable heart failure patients with left ventricular ejection fraction ≤35%, the effects of a 12-week programme of high-intensity interval training (HIT; 85-90\% of peak oxygen uptake, VO\textsubscript{2peak}) was compared with actual practice in Europe, represented by either an isocaloric programme of moderate continuous training (MCT; 50-60\% of VO\textsubscript{2peak}) and a recommendation of regular exercise (RE) of the individual patient’s own preference based on clinical practice at the local centre. The primary endpoint was reverse remodeling, defined as change in left ventricular end-diastolic diameter assessed by echocardiography. Secondary endpoints included peak oxygen uptake (VO\textsubscript{2peak}), biomarkers, quality of life, and level of physical activity assessed by questionnaires. In addition, long-term
maintenance of effects after the supervised training period was also determined. Assessments were made at baseline, after the 12-week intervention programme and at 1-year follow up. A total number of 200 patient’s on treatment per protocol, randomized to the three groups in a 1:1:1 manner, was estimated to detect clinically relevant differences in effect with HIT vs. MCT and RE (p < 0.05; statistical power 0.90) for the primary endpoint. Inclusion of patients started in May 2009 and would run until total number had been reached.

Buchheit et al., (2012) examined the cardio respiratory and muscle oxygenation responses to a sprint interval training (SIT) session in order to assess their relationships with maximal pulmonary O(2) uptake, on- and off- kinetics and muscle re oxygenation rate (Reoxy rate). Ten male cyclists performed two 6-min moderate-intensity exercises (≈90-95% of lactate threshold power output, Mod), followed 10 min later by a SIT session consisting of 6×30-s all out cycling sprints interspersed with 2 min of passive recovery. Kinetics at Mod onset and cessation were calculated. Cardio respiratory variables, blood lactate ([La](b)) and muscle oxygenation level of the vastus lateralis (tissue oxygenation index, TOI) were recorded during SIT. Percentage of the decline in power output (%Dec), time spent above 90% (t > 90% and Reoxy rate after each sprint were also recorded. Despite
a low mean 48.0 ± 4.1% of SIT performance was associated with high 90.4 ± 2.8% of muscle deoxygenating (sprint ∆TOI = -27%) and [La](b) (15.3 ± 0.7 mmol l(-1)) levels. Muscle deoxygenating and Reoxy rate increased throughout sprint repetitions (P < 0.001 for both). Except for t > 90% versus [r = 0.68 (90% CL, 0.20; 0.90); P = 0.03], there were no significant correlations between any index of aerobic function and either SIT performance or physiological responses, r = -0.41 (-0.78; 0.18); P = 0.24]. The results showed that SIT elicited a greater muscle O(2) extraction with successive sprint repetitions, despite the decrease in external power production (%Dec = 21%). Further, the findings obtained in a small and homogenous group indicated that performance and physiological responses to SIT were only slightly influenced by aerobic fitness level in this population.

Grossl *et al.*, (2012) compared time to exhaustion (TTE) at MLSS in continuous and intermittent (i.e., with pauses) exercise, investigating whether physiological variables differed between those exercise modes. Fourteen trained male cyclists volunteered for this investigation and performed an incremental test, several 30-min tests to determine two MLSS intensities (continuous and discontinuous protocol), and two randomized tests until exhaustion at MLSS intensities on a cycle ergometer. The intermittent or discontinuous protocol was performed using 5 min
of cycling, with an interval of 1 min of passive rest. TTE at intermittent MLSS was 24% longer than TTE at continuous exercise (67.8 ± 14.3 min vs. 54.7 ± 10.9 min; p < 0.05; effect sizes = 1.04), even though the absolute power output of intermittent MLSS was higher than continuous (268 ± 29 W vs. 251 ± 29 W; p < 0.05). Additionally, the total mechanical work done was significantly lower at continuous exercise than at intermittent exercise. Likewise, regarding cardiopulmonary and metabolic variables, the study observed greater responses during intermittent exercise than during continuous exercise at MLSS. Thus, for endurance training prescription, this was an important finding to apply in extensive interval sessions at MLSS. The results suggested that interval sessions at discontinuous MLSS should be used instead of continuous MLSS, as discontinuous MLSS allowed for a larger amount of total work during the exhaustion trial.

Sijie et al., (2012) evaluated the effects of a high intensity interval training (HIIT) programme on the body composition, cardiac function and aerobic capacity in overweight young women. Sixty female university students (aged 19-20, BMI ≥ 25 kg/m² and percentage body fat ≥ 30%) were chosen and then randomly assigned to each of the HIIT group, the moderate intensity continuous training (MICT) group and the non-training
control group. The subjects in both the HIIT and MICT groups underwent exercise training five times per week for 12 weeks. In each of the training sessions, the HIIT group performed interval exercises at the individualized heart rate (HR) of 85% of VO$_{2\text{max}}$ and separated by brief periods of low intensity activity (HR at 50% of VO$_{2\text{max}}$), while the MICT group did continuous walking and/or jogging at the individualized HR of 50% of VO$_{2\text{max}}$. Both of these exercise training programmes produced significant improvements in the subjects’ body composition, left ventricular ejection fraction, heart rate at rest, maximal oxygen uptake and ventilatory threshold. However, the HIIT group achieved better results than those in the MICT group, as it was evaluated by the amount of the effect size. The control group did not achieve any change in all of the measured variables. The tangible results achieved that the HIIT programme was an effective measure for the treatment of young women who were overweight.

Astorino et al., (2012) examined the effects of short-term high-intensity interval training (HIIT) on cardiovascular function, cardio respiratory fitness, and muscular force. Active, young (age and body fat = 25.3 ± 4.5 years and 14.3 ± 6.4%) men and women (N = 20) of a similar age, physical activity, and maximal oxygen uptake (VO$_{2\text{max}}$) completed 6 sessions of HIIT consisting of
repeated Wingate tests over a 2- to 3-week period. Subjects completed 4 Wingate tests on days 1 and 2, 5 on days 3 and 4, and 6 on days 5 and 6. A control group of 9 men and women (age and body fat = 22.8 ± 2.8 years and 15.2 ± 6.9%) completed all testing but did not perform HIIT. Changes in resting blood pressure (BP) and heart rate (HR), VO2max, body composition, oxygen (O2) pulse, peak, mean, and minimum power output, fatigue index, and voluntary force production of the knee flexors and extensors were examined pretraining and posttraining. Results showed significant (p < 0.05) improvements in VO2max, O2 pulse, and Wingate-derived power output with HIIT. The magnitude of improvement in VO2max was related to baseline VO2max (r = -0.44, p = 0.05) and fatigue index (r = 0.50, p< 0.05). No change (p> 0.05) in resting BP, HR, or force production was revealed. Data showed that HIIT significantly enhanced VO2max and O2 pulse and power output in active men and women.

Lamina and Okoye (2011) determined the effect of interval training program on WBC count and cardiovascular parameters in male hypertensive patients. A total of 245 male patients with mild to moderate (systolic blood pressure (SBP) between 140 mmHg and 179 mmHg and diastolic blood pressure (DBP) between 90 mmHg and 109 mmHg) essential hypertension were age matched and grouped into experimental and control groups.
The experimental ($n=140; \ 58.90\pm7.35 \text{ years}$) group involved in an 8-week interval training ($60-79\% \text{ HR max reserve}$) programme of between 45 minutes to 60 minutes, while the age-matched controls hypertensive ($n=105; \ 58.27\pm6.24 \text{ years}$) group remained sedentary during this period. Cardiovascular parameters (SBP, DBP, and VO$_2$ max) and WBC count were assessed. Student's t-test and Pearson correlation tests were used in data analysis. Findings of the study revealed a significant effect of the interval training programme on VO$_2$max, SBP, and DBP and WBC count at $P<0.05$ and VO$_2$max was negatively related to the WBC count ($r=-0.339$) at $P<0.01$. It was concluded that the interval training programme could be an effective adjunct for nonpharmacological management of hypertension and the therapeutic effect of exercise programmes might be mediated through suppression of inflammatory (WBC count) reaction.

Lamina (2011) investigated the effect of interval and continuous training programmes on blood pressure and serum uric acid (SUA) levels in subjects with hypertension. Three hundred and fifty-seven male patients with mild to moderate systolic blood pressure (SBP) between 140 and 179 and diastolic blood pressure (DBP) between 90 and 109 mm Hg essential hypertension were age-matched and grouped into interval, continuous, and control groups. The interval (work: rest ratio of
1:1) and continuous groups were involved in an 8-week interval and continuous training programme of 45-60 minutes, at intensities of 60-79% of heart rate maximum, whereas the control group remained sedentary during this period. SBP, DBP, maximum oxygen uptake (VO\textsubscript{2\text{max}}) and SUA concentration were assessed. One-way analysis of variance and Scheffe and Pearson correlation tests were used in data analysis. Findings of the study revealed significant effect of exercise training programme on VO\textsubscript{2\text{max}}, SBP, DBP, and SUA. However, there was no significant difference between the interval and continuous groups. Changes in VO\textsubscript{2\text{max}} negatively correlated with changes in SUA ($r = -0.220$) at $p < 0.05$. It was concluded that both moderate-intensity interval and continuous training programmes could be effective and neither seemed superior to the other in the nonpharmacological management of hypertension and might prevent cardiovascular events through the down regulation of SUA in hypertension. Findings of the study supported the recommendations of moderate-intensity interval and continuous training programmes as adjuncts for non pharmacological management of essential hypertension.
Baquet et al., (2010) examined the continuous-running training vs. intermittent-running training to find out if they had comparable or distinct impact on aerobic fitness in children. At first, children were matched according to their chronological age, their biological age (secondary sexual stages), and their physical activity or training status. Then, after randomization 3 groups were composed. Sixty-three children (X 9.6 ± 1.0 years) were divided into an intermittent-running training group (ITG, 11 girls and 11 boys), a continuous-running training group (CTG, 10 girls and 12 boys), and a control group (CG, 10 girls and 9 boys). Over 7 weeks, ITG and CTG participated in 3 running sessions per week. Before and after the training period, they underwent a maximal graded test to determine peak oxygen uptake (peak $\text{VO}_2$) and maximal aerobic velocity (MAV). Intermittent training consisted of short intermittent runs with repeated exercise and recovery sequences lasting from 5/15 to 30/30 seconds. With respect to continuous training sessions, repeated exercise sequences lasted from 6' to 20'. Training-effect threshold for statistical significance was set at $p < 0.05$. After training, peak $\text{VO}_2$ was significantly improved in CTG (+7%, $p < 0.001$) and ITG (+4.8%, $p < 0.001$), whereas no difference occurred for the CG (-1.5%). Similarly, MAV increased significantly ($p < 0.001$) in both CTG (+8.7%) and ITG (+6.4%) with no significant change for CG.
The results demonstrated that both continuous and intermittent-running sessions induced significant increase in peak Vo2 and MAV. Therefore, when adequate combinations of intensity/duration exercises were offered to prepubertal children, many modalities of exercises could be successfully used to increase their aerobic fitness. Aerobic running training is often made up of regular and long-distance running exercises at moderate velocity, which causes sometimes boredom in young children. During the developmental years, it seems, therefore worthwhile to use various training modalities, to make this activity more attractive and thus create conditions for progress and enhanced motivation.

Lamina (2010) compared the effect of interval and continuous training programmes in the management of hypertension. Three hundred fifty-seven male patients with essential hypertension were age matched and grouped into interval, continuous, and control groups. The interval (n=140; 58.90±7.35 years) and continuous (n=112; 58.63±7.22 years) groups were involved in 8 weeks of interval (60%-79% maximum heart rate) and continuous (60%-79% maximum heart rate) programmes of between 45 to 60 minutes, while the control group (n=105; 58.27±6.24 years) remained sedentary during this period.
Findings of the study revealed significant effect of both training programmes on maximum oxygen consumption, systolic blood pressure, diastolic blood pressure, heart rate, pulse pressure, and mean arterial pressure at P<.05. The maximum oxygen consumption significantly and negatively correlated with systolic blood pressure, diastolic blood pressure, rate-pressure product, pulse pressure, and mean arterial pressure at P<.01. It was concluded that both the training programmes were effective adjunct non pharmacological management of hypertension. The recommendation of the paper was that both interval and continuous training programmes should form part of the kit in the management of hypertension.

Campbell *et al.*, (2010) compared the effects of 12 weeks of caloric restriction and interval exercise (INT) and caloric restriction and continuous aerobic exercise (CON) on physiological outcomes in an obese population. Forty-four individuals (BMI > 30 kg·m⁻²) were randomized into the INT or CON group. Participant withdrawal resulted in 12 and 14 participants in the INT and CON groups, respectively. All participants were on a strict monitored diet. Exercise involved two 15-min bouts of walking performed on five days per week. Interval exercise consisted of a 2:1 min ratio of low-intensity (40-45% VO₂peak) and high-intensity (70-75% VO₂peak) exercise, while the CON group
exercised between 50-55% VO2peak. Exercise duration and average intensity (%VO2peak) were similar between groups. There were no significant differences (p > 0.05) between the two groups for any variable assessed apart from very low density lipoprotein (VLDL-C), which significantly decreased over time in the INT group only (p < 0.05, d = 1.03). Caloric restriction and interval exercise compared to caloric restriction and continuous aerobic exercise resulted in similar outcome measures apart from VLDL-C levels, which significantly improved in the INT group only.

Guimaraes et al., (2010) evaluated the effect of continuous vs. interval exercise training on arterial stiffness and blood pressure in hypertensive patients. Sixty-five patients with hypertension were randomized to 16 weeks of continuous exercise training (n=26), interval training (n=26) or a sedentary routine (n=13). The training was conducted in two 40-min sessions a week. Assessment of arterial stiffness by carotid-femoral pulse wave velocity (PWV) measurement and 24-h ambulatory blood pressure monitoring (ABPM) were performed before and after the 16 weeks of training. At the end of the study, ABPM blood pressure had declined significantly only in the subjects with higher basal values and was independent of training modality. PWV had declined significantly only after interval training from 9.44+/-0.91 to 8.90+/-0.96 m/s(-1), P=0.009 (continuous from
10.15+/−1.66 to 9.98+/−1.81 m s(−1), P=ns; control from 10.23+/−
1.82 to 10.53+/−1.97 m s(−1), P=ns). Continuous and interval
exercise training were beneficial for blood pressure control, but
only interval training reduced arterial stiffness in treated
hypertensive subjects.

Lamina and Okoye (2010) determined the effect of
continuous low intensity training programme on SUA level and
cardiovascular parameters in male subjects with hypertension.
Two hundred and seventeen male patients with mild to moderate
(systolic blood pressure [SBP] between 140-180 & diastolic blood
pressure [DBP] between 90-109 mmHg) essential hypertension
were age matched and grouped into continuous and control
groups. The continuous (n=112; 58.63 +/- 7.22 years) group
involved in on 8 weeks interval training (35-9% HR max reserve)
programme of between 45 minutes to 60 minutes, while age-
matched controls hypertensive (n=105; 58.27 +/- 6.24 years)
group remain sedentary during this period. Cardiovascular
parameters (SBP, DBP & VO$_{2\text{max}}$) and SUA were assessed.
Students ‘t’ and Pearson correlation tests were used in data
analysis. Findings of the study revealed significant effect of
interval training programme on VO$_{2\text{max}}$, SBP, and DBP and SUA
concentration at p < 0.05 and changes in VO$_{2\text{max}}$ negatively
correlated with SUA (r = -0.266) at p < 0.05. It was concluded that
low intensity continuous training programme could be an effective nonpharmacological management and might prevent cardiovascular event through the down regulation of SUA in hypertension.

Bryon et al., (2009) examined the early time course of adaptation of pulmonary O₂ uptake (VO₂p) (reflecting muscle O₂consumption) and muscle deoxygenation kinetics (reflecting the rate of O₂ extraction) were examined during high-intensity interval (HIT) and lower-intensity continuous endurance (END) training. Twelve male volunteers underwent eight sessions of either HIT (8–12 × 1-min intervals at 120% maximal O₂ uptake separated by 1 min of rest) or END (90–120 min at 65% maximal O₂uptake). Subjects completed step transitions to a moderate-intensity work rate (~90% estimated lactate threshold) on five occasions throughout training, and ramp incremental and constant-load performance tests were conducted at pre-, mid-, and posttraining periods. VO₂p was measured breath-by-breath by mass spectrometry and volume turbine. Deoxygenation (change in deoxygenated hemoglobin concentration; Δ[HHb]) of the vastus lateralis muscle was monitored by near-infrared spectroscopy. The fundamental phase II time constants for VO₂p (tVO₂) and deoxygenation kinetics {effective time constant, τ'=(time delay+t), Δ[HHb]} during moderate-intensity exercise were
estimated using nonlinear least-squares regression techniques. The τ\(\text{VO}_2\) was reduced by \(\sim 20\% (P < 0.05)\) after only two training sessions and by \(\sim 40\% (P < 0.05)\) after eight training sessions (i.e., post training), with no differences between HIT and END. The \(\tau'\Delta[\text{HHb}]\) (~20 s) did not change over the course of eight training sessions. These data suggest that faster activation of muscle \(\text{O}_2\) utilization is an early adaptive response to both HIT and lower-intensity END training. That \(\Delta[\text{HHb}]\) kinetics (a measure of fractional \(\text{O}_2\) extraction) did not change despite faster \(\text{VO}_{2p}\) kinetics suggests that faster kinetics of muscle \(\text{O}_2\) utilization are accompanied by adaptations in local muscle (microvascular) blood flow and \(\text{O}_2\) delivery, resulting in a similar “matching” of blood flow to \(\text{O}_2\) utilization. Thus faster kinetics of \(\text{VO}_{2p}\) during the transition to moderate-intensity exercise occurs after only 2 days HIT and END training and without changes to muscle deoxygenation kinetics, suggesting concurrent adaptations to microvascular perfusion.

Lamina et al., (2009) determined the effect of a continuous training programme on C-reactive protein (CRP) levels, and in the management of erectile dysfunction (ED) in older men with hypertension. In all, 22 men with hypertension and ED (mean age 61.8 years, sd 7.79) were involved in continuous training (35-59% of heart rate maximum reserve) for 8 weeks for 45-60 min, while
21 age-matched control hypertensives (mean age 64 years, sd 8.53) remained sedentary during this period. The International Index of Erectile Function (IIEF) questionnaire was used to assess the outcome of ED. The Mann-Whitney U-test and Spearman correlation were used to analyze the results of the changes in IIEF and CRP. There was a significant effect of continuous exercise training on erectile function and CRP levels in hypertensive men with ED (P < 0.05). It was concluded that a continuous training programme could decrease CRP levels and could be an effective means of noninvasive and nonpharmacological management of ED in men with hypertension.

Ciolac et al., (2009) evaluated the acute effects of 40-minute continuous (CE) or interval exercise (IE) using cycle ergometers on BP in long-term treated HPT. Fifty-two treated HPT were randomized to CE (n=26) or IE (n=26) protocols. CE was performed at 60% of reserve heart rate (HR). IE alternated consecutively 2 min at 50% reserve HR with 1 min at 80%. Two 24-h ambulatory BP monitoring were made after exercise (post exercise) or a non exercise control period (control) in random order. CE reduced mean 24-h systolic (S) BP (2.6+/−6.6 mm Hg, p=0.05) and diastolic (D) BP (2.3+/−4.6, p=0.01), and nighttime SBP (4.8+/−6.4, p<0.001) and DBP (4.6+/−5.2 mm Hg, p=0.001). IE reduced 24-h SBP (2.8+/−6.5, p=0.03) and nighttime SBP
(3.4+/7.2, \( p=0.02 \)), and tended to reduce night time DBP (\( p=0.06 \)). Greater reductions occurred in higher BP levels. Percentage of normal ambulatory BP values increased after CE (24-h: 42% to 54%; daytime: 42% to 61%; nighttime: 61% to 69%) and IE (24-h: 31% to 46%; daytime: 54% to 61%; nighttime: 46% to 69%). CE and IE reduced ambulatory BP in treated HPT, increasing the number of patients reaching normal ambulatory BP values. These effects suggested that continuous and interval aerobic exercise might have a role in BP management in treated HPT.

Adeyanju et al., (2009) assessed the effects of interval training on the lipid profiles of adolescent Nigerian boys (N.=30. and girls (N.=30). The lipid profiles assessed included the Very Low Density Lipoprotein-Cholesterol (VLDL-C); Low Density Lipoprotein-Cholesterol (LDL-C); and the High Density Lipoprotein-Cholesterol (HDL-C). Pre-, mid- and post-test values of these lipoprotein sub fractions were determined from blood samples obtained from participants 24 hours prior to training, after 6 weeks and at the end of exercise programme respectively. The subjects were randomly selected and divided into two equal groups of 30 subjects (M=15; F=15. for experimental (Interval training. and control. The experimental group was exposed to 12-week training while the control group did not participate in the
running programme. Findings revealed significant sex-specific reductions in VLDL-C (F=11.579; P<0.05), LDL-C (F=29.759; P<0.05) and a significant sex-specific increase in HDL-C (F=34.541; P<0.05). The greater modifications found in females than in males (except in HDL-C) due to training were possibly as a result of initial fitness level, enzymatic and hormonal modifications at sub-cellular level during training. Implications of the findings for health and fitness were discussed.

Torres et al., (2009) found out the concentration of blood lipids at the end and at post-24 h of two 14 km/90 min single exercise sessions: continuous exercise (CE) at 44.5 ± 5.6% VO$_{2\text{max}}$ and intermittent exercise (IE) at 39–72% VO$_{2\text{max}}$, in subjects with high levels of aerobic training. Fourteen male athletes (endurance runners) took part in this study and each completed a 24 h dietary record. The O$_2$ uptake and CO$_2$ production were recorded, and blood lactate and blood lipids were measured. The results showed that triacylglycerols were not modified by any kind of exercise. Total cholesterol was increased at the end of both exercises: 7.04% for CE ($p < 0.001$) and 4.23% for IE ($p = 0.001$). High-density lipoprotein cholesterol was increased at the end of IE: 11.38% ($p = 0.03$) and low-density lipoprotein cholesterol was increased only at the end of CE: 7.45% ($p = 0.006$). The increase of
lipids for CE was negatively correlated with aerobic fitness indicators (heart rate and % HR_{max} at lactate threshold), and was positively associated with energy expenditure. For IE, %HR_{max} and lactate were negatively correlated, and the respiratory exchange ratio was positively correlated, with the lipid increase. They concluded that in trained male athletes, a 14 km run in 90 min induced different changes of lipid profile if the exercise was done continuously or intermittently, and that in CE the extent of these increases was influenced by aerobic fitness.

Pupis and Cillik (2008), evaluated oxygen saturation of the blood during hypoxia, which ranged from 90% down to 75%, at the end of a three-week course. These results were also confirmed by the oxygen content in the inhaled air, which at the end of the period dropped down even below 9%, and that corresponded to a simulated altitude of about 7000 m. Spiroergometry revealed an increase in VO_{2max}, from 4105 ml.min^{-1} to 4364 ml.min^{-1}, VO_{2max}.kg^{-1} from 65,4 ml.min^{-1}.kg^{-1} to 69,9 ml.min^{-1}.kg^{-1} and submaximum performance W_{170} from 3, 34 W to 3, 40 W. Maximum performance in the 3-km walk improved by 13.7 seconds, the submaximum performance in the 10-km walk improved by 1:42 minutes. The load in the 10-km walk performed at the level of the anaerobic threshold showed an improvement of
1:29 minutes. The results did not find any significant changes in the haematological components; the values of haemoglobin and haematocrit remained almost unchanged. A mild increase was recorded in the medium erythrocyte volume, which increased from 96.8 fl to 98.2 fl, and in the iron-binding capacity, which increased from 52 µmol.l-1 to 58 µmol.l-1. As far as blood was concerned, They found an increase in the number of reticulocytes from 5.1000-1 to 7.1000-1, which amounts to 40%.

Gharbi et al., (2008) assessed the effects of continuous and intermittent exercise training on lactate kinetic parameters and maximal aerobic speed (MAS) using field tests. Twenty-four male sport students were equally divided into continuous (CT) and intermittent (IT) physically trained groups. Another six participants acted as non-trained controls (CG). The trained participants practised 6-days per week for 6 weeks. Before and after training, all participants completed an incremental exercise test to assess their MAS, and a 30-second supramaximal exercise followed by 30 minutes of active recovery to determine the individual blood lactate recovery curve. It was found that exercise training had significantly increased MAS (p< 0.001), the lactate exchange and removal abilities as well as the lactate concentrations at the beginning of the recovery ([La]- (0)); for both CT and IT groups; this was accompanied by a significant
reduction of the time to lactate-peak. Nevertheless, the improvement in MAS was significantly higher (p < 0.001) post-intermittent (15.1 % ± 2.4) than post-continuous (10.3 % ± 3.2) training. The lactate-exchange and removal abilities were also significantly higher for IT than for CT-group (P<0.05). Moreover, IT-group showed a significantly shorter half-time of the blood lactate (t-½-[La]) than CT-group (7.2 ± 0.5 min vs 7.7 ± 0.3 min, respectively) (p < 0.05). However, no significant differences were observed in peak blood lactate concentration ([La]peak), time to reach [La]peak (t-[La]peak), and [La]-(0) between the two physically-trained groups. It was concluded that both continuous and intermittent training exercises were equally effective in improving t-[La]peak and [La]peak, although intermittent training was more beneficial in elevating MAS and in raising the lactate exchange (γ1) and removal (γ2) indexes.

Lawton et al., (2004) compared the effects of continuous repetition and intra-set rest training on maximal strength and power output of the upper body. The 6 repetition maximum (6RM) and bench press throw power output against masses of 20, 30 and 40 kg of 26 elite junior male basketball and soccer players were tested on 2 separate occasions for reliability purposes. Subjects were then randomly assigned to either a continuous repetition (CR - 4 sets x 6 repetitions) or intra-set rest (ISR - 8
sets x 3 repetitions) training regime over 6-weeks. Volume (sets x repetitions x %6RM) between groups was equated and both groups completed all sets in the same time period (13 minutes and 20 seconds). The total concentric work time was determined to identify differences in training regimes. Independent sample t-tests on pre intervention and post intervention percentage change scores were analyzed for significant differences (p<0.05). The observed coefficients of variation (1.7% to 4.8%) and intra class correlation coefficients (r=0.87 to 0.98) indicated stability of these measures across testing occasions. The CR group significantly increased 6RM strength (9.7%) compared with the ISR group (4.9%). The total concentric work time was significantly longer in CR training than ISR (36.03+/− 4.03 s and 31.74+/−4.71 s; p=0.13). Power output increased across the 20, 30 and 40 kg loads ranged from 5.8% to 10.9% for both training groups but the between-group percentage change scores were not significantly different. Bench press training involving 4 sets of 6 continuous repetitions elicited a greater improvement in bench press strength than 8 sets of 3 repetitions at the same percentage load of their 6RM. Both ISR and CR training were equally effective in increasing power output.
Thomas et al., (1985) examined the effect of interval and continuous exercise programmes on plasma lipoproteins, apoproteins, and lecithin: cholesterol acyltransferase (LCAT). Thirty-six college male students (age 18-25 yrs.) were randomly assigned to a 5 mile continuous exercise group, 4 minute interval (1:1, work: rest), 2 minute interval (1:1-1/2, work: rest), or control. Workloads were equated by kcal expenditure/workout. The training groups exercised for one hour three times a week for 11 weeks. Neither interval nor continuous exercise programmes significantly altered plasma total cholesterol, high density lipoprotein cholesterol (HDL-C), apoprotein A-1 (Apo A-1), apoprotein B (Apo B), or LCAT. Posttest maximal oxygen consumption was significantly higher than pretest for the 4 minute interval and 5 mile continuous groups. Thus continuous exercise and long interval programmes resulted in gains in aerobic capacity, but none of the training programmes were effective in altering the plasma lipoproteins or apoproteins investigated.