CHAPTER II

REVIEW OF RELATED LITERATURE

2.0 INTRODUCTION

The review of related literature is an important component of the research process. The review of related literature involves the systematic identification, location and analysis of documents containing information related to research problems.

A research work is not meaningful without a thorough analysis of related works. Such related literature should be completed before proceeding with the actual conduct of the study. A familiarity with the literature in a problem area helps the researcher to discover what is already known, what others attempted to find out, what method attacks have been promising and what problems remain to be solved.

Practically all human knowledge can be found in books and library. So extensive use of the library and thorough investigation of related literature are essential in planning and carrying out the kind of searching involved.

Survey of related literature serves the following purposes as,

1. To show whether the evidence already available solves the problems adequately without further investigation, and thus to avoid the risk of duplication.
2. To provide ideas, theories, explanation or hypotheses valuable in formulating the problem.

3. To suggest methods of research appropriate to the problem.

4. To locate comparative data useful in the interpretation of the results.

5. To contribute the general scholarship of the investigator

Hence, review of related literature is a valuable guide to define the problem, recognizing its significance, suggesting promising data, gathering tools and devices appropriate to the study design and also sources of data. Only those studies that are relevant to the present study are included in the review.

The review of related literature for better understanding of the study and to interpret the results has been presented in this chapter. A study of relevant literature is an essential step to get a full picture of what has been done and said abroad and in one’s own country with regard to the problem under study. The reviews were confined to the libraries of Alagappa University, Karaikudi; Lakshmibai National Institute of Physical Education, Gwalior. This chapter gives an in-depth study of review of related literature after referring various libraries, journals, magazines, periodicals, survey books and internet.

2.1 REVIEW OF RELATED LITERATURE

Hopkins, et., al., (1990) Conducted a study to determine the effect of low-impact aerobic dance on sedentary elderly women (N=53), functional fitness
was measured by items from the proposed American Alliance of Health, physical education, Recreation, and Dance (AAHPERD) fitness test for older adults. After 12 weeks of low-impact aerobic dance, the group motor control/coordination, including cardiorespiratory Endurance, strength/endurance, body agility, flexibility, body fat, and balance.

**Blumenthal, et., al., (1991)** This study reports the physiologic effects of up to 14 months of aerobic exercise in 101 older (greater than 60 years) men and women. After an extensive baseline physiologic assessment (Time 1), in which aerobic capacity and blood lipids were measured, subjects were randomized to an aerobic exercise condition (cycle ergometry, 3 times per week for 1 hour), nonaerobic yoga (2 times per week for 1 hour), or a waiting list non-exercise control group for 4 months, and then underwent a second (Time 2) assessment. At the completion of the second assessment, all remaining subjects completed 4 months of aerobic exercise and were reevaluated (Time 3). Subjects were given the option of participating in 6 additional months of supervised aerobic exercise, and all available subjects completed a fourth assessment (Time 4) 14 months after their initial baseline evaluation. Results indicated that subjects generally exhibited a 10 to 15% improvement in peak oxygen consumption after 4 months of aerobic exercise training, and a 1 to 6% improvement in aerobic power with additional aerobic exercise training. On the other hand, subjects, especially men, continued to have improvements in submaximal exercise performance (i.e., anaerobic threshold). In addition, aerobic exercise was associated with an improved lipid profile; subjects participating in aerobic exercise for up to 14
months exhibited increased levels of high-density lipoprotein cholesterol. Maintenance of regular aerobic exercise for an extended time interval is associated with greater cardiovascular benefits among older adults than has been reported previously.

**Thomsen and Ballor. (1991)** Examined the effects of aerobic capacity (peak oxygen uptake) and aerobic dance experience on the Physiological responses to an aerobic dance routine. The heart rate (HR) and VO2 responses to three levels (intensities) of a aerobic dance were measured in 27 women. Experienced aerobic dancers (AD) (mean peak VO2=42ml. kg-1. min-1) were compared to subjects with limited aerobic dance experience of high (HI) (peak VO2 grater then 35ml. kg-1. min-1) and Low (LO) (peak VO2 less then 35ml.kg-1. min-1) aerobic capacities. The results indicated the LO group exercised at a higher percentage of peak heart rate and peak VO2 at all three dance levels than did either the HI or AD groups (HI=AD). Design of aerobic dance routines must consider the exercise tolerance of the intended audience. In mixed groups, individuals with low aerobic capacities should be shown how and encouraged to modify the activity to reduce the level of exertion.

**Stucchi, et.,al.,(1991)** Studied the effects of exercise on plasma lipids and lipoproteins, high density lipoprotein(HDL) subclass cholesterol levels and low density lipoprotein (LDL), subclass composition and metabolism in Yucatav miniature swime following two years of training. The exercise protocol produced significant Training effects. Post-heparian lipolytic activity was also significantly increased. Although plasma cholesterol and triglycerides
did not differ significantly (P=0.08) between the exercised and control groups, multivariate analysis indicated a strong association between lipoprotein lipase (LPL) and HDL2-C (P<.0001). Although HDL-CL levels rose only slightly (P<0.09) with exercise, a significant shift was noted in the distribution of cholesterol from the HDL3 to the HDL2 fractions, perhaps mediated by the substantial increase in LPL activity. Exercise had little effect on the chemical composition of the major lipoprotein classes, however the triglyceride content of the lighter LDL1 subclass exercise resulted in a significant decrease in triglycerides concomitant with a significant increase in free cholesterol levels. In contrast with the small reduction in fractional catabolic rates (FCR) in either subclass, production rates of the exercised group were reduced, which accounted for the reduction in LDL subclass pool size. These data indicated that exercise produces subtle but significant changes in lipoprotein metabolism that have been associated with reduced risk of atherosclerosis.

Garber, et.,al., (1992) In order to compare the physiological effects of an 8 week aerobic dance program to those of a walk-jog exercise training program, 60 male and female university employees aged between 24-48 years were randomly assigned to an aerobic dance program (N=22),a walk job program (N=24), or a sedentary control group (N=15). Subjects who had an exercise compliance rate less then or equal to 85% were dropped from the study, as were control subjects who had scheduling conflicts or illness precluding post treatment testing. Thirty five subjects completed the 8 week period with a compliance rate greater then or equal to 85% leaving 14 in the
aerobics group, 11 in the walk – jog group and 10 in the control group. Significant increases (p<0.001) in maximal oxygen uptake occurred in both the aerobics (+3.9ml/kg-1/min-1) and walk-jog group (+3.4ml/kg-1/min-1), while no significant change was observed in the control group. Peak heart rate decreased significantly (p<0.05) in the aerobics (-4b/min-1) following the treatment period. Body weight, peak respiratory exchange ratio and peak minute ventilation remained the same in the aerobics, walk - jog and control groups throughout the treatment period. It is concluded that aerobic dance programs can result in similar improvements in aerobic power as a walk-jog program. Thus, an aerobic dance program is an effective alternative to a traditional walk-jog training regime.

**Deblieck, et., al., (1992)** In their study assessed the sum of seven skin folds, body fat and body weight from eleven male collegiate Cyclists during six weeks of aerobic interval training. Weekly training consisted of four consecutive days of interval training and five continuous training sessions. Percent body fat was significantly decreased from a base line value of 8.7±8.8% by 14% and 22% following 4 and 6 weeks of high intensity training respectively. Body weight did not change with training suggesting an increase in lean body mass. These results suggest that decreases in calorie intake are not necessary for significant reduction in per cent body fat.

**Hoeger, et., al., (1992)** Directly examined the training effects of an identical aerobics program performed on land (low-impact) and in the water. Forty-nine untrained female subjects (water n = 20; land n= 15; control n = 14)
participated in the 8-week study with the experimental groups exercising 3 times per week. The aerobic portion of the training session was 20 minutes in duration with exercise intensity maintained between 70-85% of HRR. Both the land-based (low-impact) and shallow water aerobics groups made similar gains in aerobic fitness, with a 14.8% relative improvement in estimated VO2max using a Bruce protocol (pre = 31 ± 6.8, post = 35.6 ± 7.0 ml/kg/min) observed in the shallow water aerobics group. Total treadmill time was also significantly increased (by one minute) following shallow water training. In agreement with Hoeger, et al., a smaller yet significant 5.6% increase in VO2max (34.8 ± 4.1 to 36.7 ± 5.2 ml/kg/min) and an improved run time to exhaustion (pre = 15.8 ± 3.7 min, post = 19.4 ± 5.0 min) was also observed by Abraham (1994) following eleven weeks of shallow water aerobics.

**Raymond Desharnais, et., al., (1992)** Studied on Aerobic Exercise and the Placebo Effect: A Controlled Study. An experiment was conducted with 48 healthy young adults engaged in a supervised 10-week exercise program to determine whether a placebo effect is involved within the exercise-psychological enhancement connection. Based on an expectancy modification procedure, one-half of the subjects were led to believe that their program was specifically designed to improve psychological well-being (experimental condition) whereas no such intervention was made with the second half (control condition). Expectations for psychological benefits and aerobic capacity [VO2max] were measured before and after completion of the program. Self-esteem, as the indicator of psychological well-being, was
measured on four specific occasions: at the beginning, after the fourth and seventh weeks, and upon completion of the training program. The results showed similar significant increases in fitness levels in both conditions. Moreover, self-esteem was significantly improved over time in the experimental but not in the control condition. These findings provide evidence to support the notion that exercise may enhance psychological well-being via a strong placebo effect.

Aellen Hollmann and Boutellier. (1993) Studied the effects of aerobic and anaerobic training on lipoprotein concentration in 45 healthy untrained men. Thirty three subjects exercised four times per week during nine weeks on a bicycle ergometer. Sixteen trained with an intensity above the anaerobic threshold (blood lactate concentration > 4 mmol 1-1) and 17 trained with an intensity below the aerobic threshold. In addition, twelve subjects served as controls. The calculated caloric expenditure of the two training groups was similar. In all three groups, total cholesterol, total high density lipoprotein (HDL), HDL, subfractions (HDL2-HDL3) and low density lipoprotein (LDL) were measured. Training had a significant influence on HDL, HDL2, LDL/HDL, HDL2/HDL3 and cholesterol/HDL. With anaerobic training these variables changed in the opposite direction compared with aerobic training which influenced the lipoprotein profile in the desired direction. Cholesterol, HDL3 and did not alter during the nine weeks of training. After nine weeks of training, the higher the blood lactate concentration during exercise (representing training intensity) was, the higher resting LDL/HDL ratio was
found. The correlation between these two variables was highly significant. They concluded that training above the anaerobic threshold has no or even negative effects on blood lipoprotein profiles. Therefore beneficial adaptations intensities are below the anaerobic threshold.

**Lim and Lee. (1994)** Evaluated the effects of 20 weeks basic military training program on body composition, VO2 max and aerobic fitness of obese recruits. Forty of the most obese recruits going through a 20 weeks basic military training (BMT) program were selected from a cohort of 197 obese recruits. Their TPW, BF, FFW, VO2 max, time taken to achieve VT (VTtime) and maximal heart rate (HR max) were measured before, in the middle and at the end of the program. The means for each of these variables measured in the 3 occasions were analysed for significant differences with repeated measures analysis of variance. Variables that achieved significant difference were further analyzed for pair wise difference with the post – hoc Tukey test. The critical value was set at $P<0.05$. Mean TBW and BF decreased slightly from 108.33 $\pm$ 13.1 kg to 90.82 $\pm$ 12.3kg ($P<0.001$) and 34.2$\pm$1.2% to 23.9$\pm$2.3 %( $P<0.001$) respectively. Mean FW decreased slightly from a mean of 71.5$\pm$ 8.6kg to 69.2$\pm$8.8kg which was not significantly different ($P<0.05$). Mean VO2 max increased from 28.1$\pm$ 6.3ml.kg ‘min’ to 32.1$\pm$ 5.1 “min” ($P<0.001$), and Mean VTtime on similar exercise protocol increased from 13.3$\pm$ 12.1 beats min-1 to 177.3$\pm$10.1 beats min-1 ($P<0.01$). In the post hoc tukey test, significant differences were found for TBW BF and FW in all the pairwise comparisons (pre Vs mid, mid Vs post, and pre Vs post tests) pairwise comparisons were
also significant in the pre Vs mid test for VO2 max, HR max and VTtime, These three variables were also found to be significant in the pre Vs post test comparisons, HR max and VTtime, but not significant in the mid Vs post test comparisons. From the results of this study, it was concluded that the 20 weeks BMT program was effective for BF reduction and maintenance of FFW in the process of TBW loss. The increase in aerobic fitness was also significant (P<0.05) although improvement in VO2 max was mild.

. **Hardman and Hudson. (1994)** Examined the effectiveness of brisk walking as a means of improving endurance fitness and influencing serum lipid and lipoprotein variables in previously sedentary women. Walkers (n=10, mean (s.e.m) age 47.3 (2.0) years) followed a programme of brisk walking means (s.e.m) speed 1.76(0.03) ms-1 for) 12 weeks, after which the training stimulus was withdrawn. Controls (n=10, mean 9 (s.e.m) age 41.6 (1.2) years) maintained their habitual sedentary lifestyle throughout. Endurance fitness was determined using laboratory measures of responses to treadmill walking. Serum lipid and lipoprotein variables were determined in venous blood (12th fasted). Body fatness was assessed by anthropometry and dietary practice using the 7 day weighed food intake technique. Measurements were repeated after 12 and 24 weeks. Brisk walking resulted in a decrease in heart rate and blood lactate concentration during exercise, while detraining was accompanied by a reversal of these changes. Changes in body mass the ratio of circumferences at the waist and hip did not differ between groups but the sum of four skinfolds decreased with brisk walking and increased detraining. High density lipoprotein (HDL)
and HDL2 cholesterol increased with walking and decreased with detraining but no between group changes (analysis of variance, p. 0.05) were found in other lipid and lipoprotein variables. These finding suggest that regular brisk walking can improve endurance fitness and increase HDL cholesterol concentration in sedentary women.

Bell and Bassey. (1994) Compared the oxygen uptake and heart rate in various styles of dance and in a graded step test in ten healthy women aged [mean (SD)] 34 (5) years. Dance was choreographed into progressively more energetic sequences typical of community classes, and videotaped. Oxygen uptake was assessed using a respirometer carried in a back-pack. Each of the two tests (dance and step) took 15-20 min and measurements were made in randomized balanced order on the same day. The mean oxygen costs of dance ranged from 1.29 l.min\(^{-1}\) for low impact style to 1.83 l.min\(^{-1}\) for high impact style with arm work; mean heart rates were 135 and 174 beats.min\(^{-1}\) respectively. Low impact dance raised heart rates above 60% of predicted maximum and so would provide training; during high impact dance recorded heart rates sometimes exceeded recommended safe limits. The addition of arm work significantly increased heart rates in both high and low impact dance but when oxygen pulses for each style of dance were compared no significant differences attributable to arm work were found. Moreover calculated differences between oxygen uptakes in stepping and dance at the same heart rates (those recorded during dance) were not significant for any of the four styles. Analysis of variance confirmed that neither arm work nor impact
contributed significantly to the differences, so there was no evidence that these forms of dance change the normal relation between heart rate and oxygen uptake found in dynamic activities with large muscle groups such as stepping.

**Prink, et. al., (1995)** Evaluated the acute effects of walking performed of fairly light (50%VO2 max) and moderate (70%VO2max) intensities on serum lipids and lipoproteins in a group of premenopausal and a group of postmenopausal women, postmenopausal women were 34.5± 1.1 years of age, had 22.8± 1.7% body fat and a 2.47± 0.08. min.1 VO2 max. Postmenopausal women were 54.8± 2.5 years of age had 37.9± 0.9% body fat and a 2.06± 0.15 1min-1 VO2 max. All subjects walked on a motor driven treadmill at each respective intensity of exercise for a total duration sufficient to expend 350 Kcal of energy. Dependent variables included total cholesterol (TC) high density lipoprotein cholesterol (HDL-C) and its sub fractions HDL2-Cand HDL3-C, low density lipoprotein cholesterol (LDL-C) and Triglycerides (TG). Blood samples were obtained at baseline (pre-exercise) immediately post-exercise (IPE) and 24 hours and 48 hours post-exercise. A repeated measure design was employed controlling for died, menstrual cycle periodicity, natural menopause and plasma volume shifts. A 2 × 4 ANOVA was used to test for differences among means for each group separately. Significant (P<0.05) time exercise intensity interactions were found for TC and LDL-C for the premenopausal women. This non-parallel change across exercise intensity condition created significant differences at IPE for both TC and LDL-C. Furthermore, an IPE increase in TG (P<0.05) was observed. For the
premenopausal women, a significant (P<0.5) time exercise intensity interaction was noted for LDL-C. Non-parallel changes across intensity level at IPE were responsible for this interaction. A 19.8% increase HDL2-C (P<0.05) at IPE was also noted. No other differences were found for either group. These findings indicated that a single bout of walking has the potential to acutely affect the blood lipid profile of premenopausal as well as premenopausal women. Immediately following a walk performed at 70% VO2 max reduction in LDI-C was noted for both groups of women while the 50% VO2 max condition increased HDL2-C only in the post menopausal women.

Bonettle, et., al. (1995) Assessed the plasma levels of lipoprotein (a), total cholesterol triglycerides. HDL cholesterol, LDL cholesterol apoprotein A1 and apoprotein B in 10 healthy untrained volunteers subjected to a bicycle ergometric exercise equal to 50% of individuals VO2 max followed by increasing loads until muscular exhaustion. Blood samples were taken before the exercise, immediately afterwards and then at 12 hourly intervals for a 72 hours period. Subsequently, the same parameters were evaluated for 8 long-distance runners during the XXIII New York Marathon, with blood samples being taken before and after the race and then after one month of detraining. After the exercise, lipoprotein (a) in untrained subjects began to decrease significantly from the 24th hour on and remained lower than base line levels up till the 72nd hour. After detraining, lipoprotein (a) in marathon runners increased significantly both with respect to basal values and especially to post-race values. Modifications of the other metabolic parameters evaluated in both
tests were negligible and predictable. In the two groups of subjects examined, no correlation was found between lipoprotein (a) and the anthropometrical data and metabolic parameters considered.

**Nummela .A, et.,al., (1996)** Investigated the effects of sprint training on the anaerobic performance characteristics in well-trained sprint runners employing the maximal anaerobic running test (MART). Another purpose was to study the applicability of MART in the prescription of sprint training. Nine male sprint runners performed the MART before and after a 10-week intensive training period. The MART consisted of n.20-s runs on a treadmill with a 100-s recovery between the runs. Initial power, expressed as O2 demand (74 ml.kg-1.min-1), was increased by 6 ml.kg-1.min-1 for each consecutive run until exhaustion. Blood lactate concentration was measured at rest and after each run. Maximal power (Pmax), power at 10 mM (P10mM) and 3 mM (P3mM) blood lactate levels, and peak blood lactate concentration (peak BLa) were determined from the blood lactate vs O2 demand curve. The Pmax increased from 118.6 +/- 6.0 to 122.6 +/- 4.9 ml kg-1.min-1 (P = 0.009) during the training period and the changes of Pmax correlated positively with the volume of bounding exercises (r = 0.64; p = 0.032). The volume of extensive interval training correlated positively with the changes of P3mM (r = 0.62; p = 0.040) and negatively with the changes of P[10mM-3mM] (r = -0.68; p = 0.016) and peak BLa (r = -0.69; p = 0.019) during the particular training period. A positive correlation was also found between the changes of CMJrest and the volume of bounding and strength training (r = 0.60; p = 0.044). The present results
suggested that sprint training induces an adaptive increase in the maximal anaerobic running power in well-trained male sprint runners. Furthermore, correlation analysis revealed that individual changes in P3mM, peak BLa, Pmax and CMJrest were related to the volume of specific training methods. Therefore we could conclude that the results of the MART could provide guidance in prescribing training for sprint running.

**Morrow Jensen and Peace. (1996)** Divided 11 subjects into either DWR (female = 3, males = 3) or land-based (female = 2, male = 3) exercise groups. Subjects trained three days a week for 35 minutes a session at 80% of HRmax as determined by mode specific VO2max tests. Additionally, subjects performed a timed 2.4-k run. Both training groups significantly improved in VO2max (p < 0.01). DWR training also decreased run time (p = 0.06). No mode specific differences between the two training methods (land vs. water) were observed indicating that DWR can improve VO2max in a similar fashion as land-based exercise.

**Wilber, et., al., (1996)** Exercised aerobically trained subjects 5 days a week, alternating high intensity shorter workouts (90-100% VO2max for 30 minutes) with moderately intense longer sessions (70-75% VO2max for 60 minutes). Similarly, Bushman ,et.,al., . (1997) employed a training regimen consisting of DWR 5-6 days a week integrating two long and short interval days, one long run and an easy recovery run. These training schedules not only reflect actual training routines of these competitive athletes but more importantly insure adequate exercise intensity for the maintenance
VO2max. Only one published training study investigated the effects of DWR with older adults (mean age of controls 57.5 ± 2.3 yr, mean age of experimental group = 63.1 ± 1.6 yr). In this investigation Long, et al. (1996) reported significant VO2max improvements in a group of 35 sedentary older women after a 10-week DWR program.

Williford, et al. (1998) Determined the effects of 10 weeks of aerobic dance training on plasma lipids and lipoprotein levels, cardio respiratory function and body composition in the healthy, untrained females (mean age 23 years). A control group of eight untrained females (mean age 23 years) underwent the same evaluation procedures as the training group. Fasting blood samples, collected pre and post – training, were assayed for triglycerides (TG), total cholesterol (T.C), high density lipoprotein cholesterol (HDLC), maximal oxygen uptake (VO2 max) was determined from a maximal tread-mill test and body composition was determined by hydrostatic weighting Methods. Triglycerides, TC, HDL-C, LDL-C, CHOL/HDLC and LDL/HDLC did not significantly change for either the control or experimental groups. Changes in the experimental group were significantly greater (p<05) then in the control group for VO2 max (12% Vs2%) and time on a continuous grade incremental treadmill test (11%Vs2%). Body composition did not change significantly in either group. It was concluded that 10 weeks of aerobic dance training can significantly improve cardio-vascular fitness independent of changes in serum lipids, lipoproteins or body composition.
Mccord, et al., (1998) Examined the effect of a 12 week program of low impact aerobic dance conditioning on VO2 max, sub maximal heart rates and body composition of college aged women, sixteen women exercised three Times per week for approximately 45 minutes per session at 75-85% of their heart rate reserve. VO2 max was measured by indirect calorimeter using a tread-mill protocol. Submaximal heart rates were measured by electrocardiography, and body fat was assessed by hydro static weight. All testing was conducted within one week pre and post training. Training session consisted of a 5-10 minutes warm up, 30-35 minute low impact aerobic dance segment and a 5 minute cool down. Post test results revealed a small (7%), but significant increase in VO2 max, sub maximal heart rates at minutes 2-3, 3-4 and 4-5 of the graded exercise test decreased significantly. Body fat decreased from 25+-6.8% to 21+-6.3% with no post training change in body weight. It was concluded that low impact aerobic dance is as effective as other endurance training regimens in improving cardio-vascular fitness and decreasing body fat.

Levy .W.C, et., al., (1998) Studied the Heart rate variability (HRV) (SD of the RR interval), an index of parasympathetic tone, was measured at rest and during exercise in 13 healthy older men (age 60 to 82 years) and 11 healthy young men (age 24 to 32 years) before and after 6 months of aerobic exercise training. Before exercise training, the older subjects had a 47% lower HRV at rest compared with the young subjects (31 +/- 5 ms vs 58 +/- 4 ms, p = 0.0002). During peak exercise, the older subjects had less parasympathetic withdrawal than the young subjects (-45% vs -84%, p = 0.0001). Six months of
intensive aerobic exercise training increased maximum oxygen consumption by 21% in the older group and 17% in the young group (analysis of variance: overall training effect, p = 0.0001; training effect in young vs old, p = NS). Training decreased the heart rate at rest in both the older (-9 beats/min) and the young groups (-5 beats/min, before vs after, p = 0.0001). Exercise training increased HRV at rest (p = 0.009) by 68% in the older subjects (31 +/- 5 ms to 52 +/- 8 ms) and by 17% in the young subjects (58 +/- 4 ms to 68 +/- 6 ms). Exercise training increases parasympathetic tone at rest in both the healthy older and young men, which may contribute to the reduction in mortality associated with regular exercise.

Darby. (1998) Investigated the physiological responses to aerobic dance exercise of varied impact (high, low step (less arm moments Vs, more arm movement) and condense (124 V.S. 138 beats. Min-1) experienced, female aerobic dancers (n=16) performed activities that combined the levels of impact and step for 3 trials of 8-min each. Dependent variables included heart rate, percentage of maximal heart rate, oxygen consumption, percentage of maximal oxygen consumption and respiratory exchange ratio. Repeated measure analyses of variance: dictated a significant impact X step interaction whereby oxygen consumption was greater for the high impact –less are movement activity (Jog) while the low impact –more arm movement activity (power jack) was greater for heart rate. The interaction of aerobic dance characteristics (eg. impact, are movement) that may alter physiological responses to aerobic dance exercise should be identified in future aerobic dance routines and studies.
Billat V.L, et al., (1999) Studied between inefficient training and overtraining, an appropriate training stimulus (in terms of intensity and duration) has to be determined in accordance with individual capacities. Interval training at the minimal velocity associated with VO2max (vVO2max) allows an athlete to run for as long as possible at VO2max. Nevertheless, we don't know the influence of a defined increase in training volume at vVO2max on aerobic performance, noradrenaline, and heart rate. Eight subjects performed 4 wk of normal training (NT) with one session per week at vVO2max, i.e., five repetitions run at 50% of the time limit at vVO2max, with recovery of the same duration at 60% vVO2max. They then performed 4 wk of overload training (OT) with three interval training sessions at vVO2max. Normal training significantly improved their velocity associated with VO2max (20.5+/−0.7 vs 21.1+/−0.8 km x h(−1), P = 0.02). As a result of improved running economy (50.6+/−3.5 vs 47.5+/−2.4 mL x min(−1) x kg(−1), P = 0.02), VO2max was not significantly different (71.6+/−4.8 vs 72.7+/−4.8 mL x min(−1) x kg(−1)). Time to exhaustion at vVO2max was not significantly different (301+/−56 vs 283+/−41 s) as was performance (i.e., distance limit run at vVO2max: 2052.2+/−331 vs 1986.2+/−252.9 m). Heart rate at 14 km x h(−1) decreased significantly after NT (162+/−16 vs 155+/−18 bpm, P < 0.01). Lactate threshold remained the same after normal training (84.1+/−4.8% vVO2max). Overload training changed neither the performance nor the factors concerning performance. However, the submaximal heart rate measured at 14 km x h(−1)
decreased after overload training (155+/-18 vs 150+/-15 bpm). The maximal heart rate was not significantly different after NT and OT (199+/-9.5, 198+/-11, 194+/-10.4, P = 0.1). Resting plasma norepinephrine (venous blood sample measured by high pressure liquid chromatography), was unchanged (2.6 vs 2.4 nm x L(-1), P = 0.8). However, plasma norepinephrine measured at the end of the vVO2max test increased significantly (11.1 vs 26.0 nm x L(-1), P = 0.002). Performance and aerobic factors associated with the performance were not altered by the 4 wk of intensive training at vVO2max despite the increase of plasma noradrenaline.

Romijn. (2000) Studied eight endurance – trained women at rest and during exercise at 25, 65 and 85 % at maximum oxygen uptake. The rate of appearance (RA) of tree fifty acids (FFA) was determined by infusion of (2H2) palpitates and fat oxidation rates were determined by indirect calorimeter. Glucose kinetics were assessed with (6,6-2H2) glucose. Glucose Ra increased in relation to exercise intensity. In constant, whereas FFA RA was significantly increased to the same extent in low and moderate-intensity exercise during high intensity exercise. FFA RA was reduced comp red with the other exercise values. Carbohydrate oxidation increased progressively with exercise intensity, whereas the highest rate of oxidation was during exercises at 65% of maximum oxygen uptake after correction for differences in lean body mass, there were no differences between their results and previously reported data in endurance trained men studied under the same conditions. Except for slight differences in glucose metabolism during low-intensity exercise we conclude that the patterns
of changes in substrate kinetics during moderate and high intensity exercise are similar in trained men and women.

Arthur Leon and Otto Sanchez. (2000) Studied on Response of blood lipids to exercise training alone or combined with dietary intervention. The purpose of this study is to review the effects of aerobic exercise training (AET) on blood lipids and assess dose-response relationships and diet interactions. The authors reviewed papers published over the past three decades pertaining to intervention trials on the effects of $12\text{ wk of AET}$ on blood lipids and lipoprotein outcomes in adult men and women. Included were studies with simultaneous dietary and AET interventions, if they had appropriate comparison groups. Studies were classified by the participants’ relative weights expressed as mean BMIs. Information was extracted on baseline characteristics of study subjects, including age, sex, and relative baseline cholesterol levels; details on the training programs; and the responses to training of body weight, $V\text{O}2\text{max}$, and blood total cholesterol (TC) and low-density lipoprotein-cholesterol (LDL-C), high-density lipoprotein-cholesterol (HDL-C), and triglyceride (TG). Results: We identified 51 studies, 28 of which were randomized controlled trials. AET was generally performed at a moderate to hard intensity, with weekly energy expenditures ranging from 2,090 to 20,000 kJ. A marked inconsistency was observed in responsiveness of blood lipids. The most commonly observed change was an increase in HDL-C (with reductions in TC, LDL-C, and TG less frequently observed). Insufficient data are available to establish dose-response relationships between exercise intensity
and volume with lipid changes. The increase in HDL-C with AET was inversely associated with its baseline level (r = 20.462), but no significant associations were found with age, sex, weekly volume of exercise, or with exercise-induced changes in body weight or $V\cdot O_2$ max. Conclusion: Moderate-to hard-intensity AET inconsistently results in an improvement in the blood lipid profile, with the data insufficient to establish dose-response relationships.

Decombaz, et al., (2000) Studied on Effect of diet on the replenishment of intramyocellular lipids after exercise. The aim of this work was to use sequential MRS measurements of IMCL and glycogen to explore the role of three levels of dietary fat on the replenishment of these energy stores after exercise. Following 2h of exercise, two subjects (S1, S2) were fed one of three diets (15 %, 40 % or 70 % fat energy), each on a separate occasion. IMCL and glycogen were measured by MRS in the tibialis anterior muscle before, after exercise, and at 10 and at 32h of recovery. Results Initial IMCL concentration (mmol · kg⁻¹ : 3.0 in S1 and 1.8 in S2) was reduced to 70 % after exercise. The rate of replenishment was minimal with the low-fat (mmol · kg⁻¹ · 24h⁻¹ : 0.7 and 0.0) and much higher with both higher fat diets (mmol · kg⁻¹ · 24h⁻¹ : 3.1 and 3.2 in S1, 0.7 and 0.9 in S2). Glycogen and IMCL replenishments were inversely correlated. IMCL and glycogen can vary acutely in response to diet after exercise. Studies are needed to determine if such variations occur within the range of ordinary diets and to clarify the functional significance of IMCL in differently active individuals.
Laukkanen, et al., (2001) Measured heart rate during floor and step aerobic classes at three intensity levels. A group of 20 female occasional exercisers [mean age 33 (SD 8) years, mean body mass index 21 (SD 2) kg.m-2 volunteered to participate in six aerobic classes (three floor classes, three step classes) and in a laboratory test as members of one of two groups according to their pre-study regular participation in aerobics classes. Subjects in group A had participated four or more times a week and those of group B less than twice a week. The characteristics of the groups were as follows: group A, n = 10, mean maximal oxygen uptake (VO2max) 38.7 (SD 3.6) ml.kg-1.min-1, mean maximal heart rate (HRmax) 183 (SD 8) beats.min-1; group B, n = 10, VO2max 36.1 (SD 3.6) ml.kg-1.min-1, HRmax 178 (SD 7) beats.min-1. Each class consisted of a warm-up, a 20 min period of structured aerobic exercise (cardiophase) and a cool-down. The cardiophase was planned and guided as light, (rate of perceived exertion, RPE 11-12), moderate (RPE 13-14) or heavy (RPE 15-17) by an experienced instructor. The mean heart rates during the light classes were 72 (step) and 74 (floor) %HRmax in group A and 75 (step) and 79 (floor) %HRmax in group B; during the moderate classes, 84 (step) and 80 (floor) %HRmax in group A and 82 (step) and 83 (floor) %HRmax in group B, and during the heavy classes 89 (step and floor) %HRmax in group A and 88 (step) and 92 (floor) %HRmax in group B. Differences in heart rate and %HRmax were not statistically significant between the groups. However, differences in heart rate and %HRmax between the intensities (light vs moderate, moderate vs heavy and light vs heavy) were significant within both
groups (all, P < 0.01). Based on the results, we conclude that intensity management during the aerobics classes was generally successful regardless of the participants' prior participation in aerobics.

Green, et al., (2001) Compared the exercise intensity of a combined aerobic and resistance exercise circuit training session with the exercise intensity of continuous aerobic exercise in patients with chronic heart failure (CHF). Peak oxygen consumption (VO2peak) and muscular strength (1 repetition maximum) were assessed in six CHF patients (age 62 +/- 3 years). Heart rate, rate of perceived exertion (RPE), blood pressures, ambulatory oxygen consumption (VO2), and ventilator data were measured during two types of exercise: continuous cycling on a bicycle ergometer (aerobic [AER] session) and combined AER and resistance exercise (circuit training [CIR] session). RESULTS: There were no significant differences in VO2, RPE, heart rate, or hemodynamic responses (rate pressure product, diastolic blood pressure, or mean arterial pressure) during exercise, between the two sessions. Systolic blood pressure was significantly lower during CIR (P < 0.05). Minute ventilation and tidal volume were significantly higher (P < 0.0001 and P < 0.01, respectively) and respiratory frequency significantly lower (P < 0.005) during CIR. During CIR, RPE significantly correlated with VO2 (P < 0.01), whereas heart rate did not. Conversely, during the AER session HR correlated with VO2 (P < 0.01), but RPE did not. Circuit training is a well-tolerated form of exercise training for CHF patients that is associated with similar oxygen and hemodynamic demand to aerobic exercise. Results suggest that RPE may be a
better method of prescribing and monitoring exercise intensity during CIR, with heart rate the preferred measure of intensity during aerobic exercise.

**Baldari and Guidetti. (2001)** Examined the fitness level of a rhythmic gymnasts group and a young female classical dancers group. Aerobic power (Vo2 max); individual retaliatory (IVT) and aerobic thresholds (IAT) were assessed in 12 elite rhythmic gymnasts. Eight elite ballet dancers and 12 sedentary female subjects in the same age range (13-16 yrs). The Vo2 max, IVT and IAT were assessed during continues incremental running treadmill test. At IVT and IAT the Vo2 max expressed in ml x kg (-1) X min (-1) was significantly different between the three groups of subjects. The highest values were found in gymnasts (30.8t/-2.6 for IVT and 43.8 t/- 3.5 for IAT) followed by the values of dancers (21.7 +/- 2.8 for IVT and 30.5 t/- 3.1 for IAT) and controls (15.6 +/-2.0 for IVT and 20.6 +/- 1.7 for IAT) when the Vo2 max was expressed in percent of Vo2 max, the Values at IAT were significantly different between all groups (gymnasts : 84.9 t/- 0.7 : dancers 64.0t/- 4.1 : controls 59.7 t/- 2.4) while at IVT no difference was found between dancers and controls (45.6+/- 4.1 and 45.2+/-16 respectively) At maximum effort Vo2 was significantly higher both in gymnasts and dancers (51.7t/- 4.4 and 47.5+/-3.0 max kg (-1) min (-1) respectively), than in controls (34.5 t/-2.5 ml X kg (-1) X min (-1), although Vo2 max was similar between gymnasts and dancers, Vo2 values at NT and IAT were able to discriminate the higher level of fitness in gymnasts with respect to dancers.
Park, et. al., (2001) Conducted a study that the effects of aerobic dance on Respiratory circulatory function. Blood components six women college students were chosen for this study did aerobic dance for 4 weeks four times a week. The study aimed at developing a basic data for enhancing physical fitness by revealing the effects of aerobic dance on both respiratory function and blood components. The results obtained from the study after the four week dance were body weight of the subjects decreased by 0.8 kg maximum oxygen uptake averaged an increase of 0.13 % min, oxygen intake in aerobic threshold recorded a growth of 0.22 /min, and as for blood components, T-cholesterol showed a significant deduction, wherever HDC-C marked a meaningful enlargement.

Grier, et., al., (2002) Examined the metabolic and cardiovascular responses of aerobic dance bench stepping (ADBS) at commonly used cadences and bench heights. 30 women (19-47 years of age) performed a graded maximal treadmill test and four 8-minute sub maximal ADBS routines. Subjects followed identical videotape sequences of basic ADBS movements at cadences of 125 and 130 beats. min(-1) at bench heights of 6 and 8 in. Physiological measurements were taken during each minute of each test. Mean values calculated from the last 3 minutes were used for data analysis. Although there were no physiological differences between ADBS at the 2 cadences, there were significant physiological differences between ADBS at the 2 bench heights. On average, a 2-in. increase in bench height, increased heart rate, VO2, and rating of perceived exertion by 10 beats .min(-1), 3.09 ml.kg (-1) min(-1),
and 1.53, respectively. In conclusion, it appears that bench height is more of a factor than cadence in increasing metabolic cost of ADBS. From this study provide information about the energy cost of ADBS at the common bench heights and cadences used in this study and, therefore, may be used to help aerobic participants select the proper bench height and cadence combination to control body weight and develop cardio respiratory fitness safely and effectively.

Grant, et., al., (2002) Compared the pay physiological responses and ratings of perceived exertion to aerobic dance and walking sessions completed at a self selected pace. Six women and six men with a sample mean (SD) age of 68 (7) years completed aerobic dance and walking serious in random order. A treadmill test was performed by each subject from which peak oxygen uptake (VO(2)) and maximum heart rates (HR max) were determined. During the aerobic dance and walking session heart rate and vo (2) were measured Continuously throughout. Rate of perceived exertion (RPF) was measured every three minutes throughout the session. RESALTS The sample means (SD) for % peak. Vo (2) were 67 (17)% for the aerobic dance session and 52 (10)% for the walking serious, and the % HR max sample means (SD) were 74(12)% for the aerobic dance serious and 60 (8)% for walking session. The Sample mean (SD) (RPF) for the aerobic dance serious was 11(2), and for the walking session it was 10(2) % peak, Vo(2), % HR max, and RPF were significantly higher for aerobic dance than for walking. However, both the aerobic dance walking session were of adequate intensity to the poor aerobic fitness is most
subjects. Further investigations into the relation between RPE and speak. Vo (2) in a field setting over representative exercise time periods would be useful.

**Buyukyazi .G, et., al., (2003)** Studied the effects of two different eight-week aerobic training programs consisting of continuous (CR) or extensive interval running (IR) on serum growth (GH) and cortisol hormones in 33 male basketball players aged 15-16 were assessed. The CR group ran 4.8 km and the IR group ran 4 x 1.2 km, using equal work-to-rest ratio, three times per week. Aerobic power scores of all subjects and anaerobic power marks of the training subjects increased (p<0.01). Upon exertion, though serum GH levels increased in both exercise groups (p<0.01) prior to and following training; cortisol levels increased only in the IR group prior to training, and in both exercise groups following training (p<0.05). Following the eight week period, resting cortisol levels rose in the training (p<0.05) and control (p<0.01) groups. To conclude, an 8-week training program consisting of continuous or extensive interval running has been effective on acute GH and cortisol secretion in 15-16 year-old male athletes.

**Lesley. J. White. (2003)** Studied Intramyocellular Lipid Changes in Men and Women during Aerobic Exercise: A H-Magnetic Resonance Spectroscopy Study. This study was designed to compare intramyocellular lipid (IMCL) changes during 60 min of submaximal exercise in men and women. Eighteen moderately active (18–38 yr) men (n = 9) and women (n = 9) were recruited. Maximum oxygen consumption (VO2max) and body composition
were used to match subjects for aerobic fitness and body composition. Subjects performed cycle ergometry for 1 h at 65% of VO2max. Expired gases were collected throughout exercise to determine caloric expenditure and substrate use. Blood samples were collected before and after exercise to evaluate markers of lipid metabolism. Pre- and postexercise proton spectra were acquired from the vastus lateralis using a 3-T whole-body imaging system. Spectra were acquired from an 18-mm³ region of interest (echo time = 45 msec; repetition time = 2000 msec) for IMCL evaluation. IMCL decreased significantly with exercise (11.5–28.5% for men and 17.1–21.7% for women) (P < 0.05); however, there were no significant differences between men and women. Although changes were found for many plasma variables [free fatty acids, glycerol, and norepinephrine (P < 0.05)], group differences were only evident for norepinephrine. In conclusion, a significant decrease in IMCL was observed during 60 min of cycling in matched men and women.

**Daniel .G. Carey. (2003) Studied Can Aerobic And Anaerobic Power Be Measured In A 60-Second Maximal Test?** The primary objective of this study was to assess the efficacy of measuring both aerobic and anaerobic power in a 60-second, maximal effort test. It was hypothesized that oxygen consumption increases rapidly during maximal effort and maximal oxygen consumption (VO2 max) may be reached in one minute. Fifteen United States Cycling Federation competitive cyclists performed the following tests: 1) practice 60-second maximal exertion test; 2) standard incremental workload VO2 max test; 3) Wingate anaerobic power test (WAT); 4) VO2 measured
during 60-second maximal exertion test (60-SEC); and 5) VO2 measured during 75-second maximal exertion test (75-SEC). All tests were performed on an electrically-braked cycle ergometer. Hydrostatic weighing was performed to determine percent body fat. Peak oxygen consumption values for the 60-SEC (53.4 ml· kg⁻¹· min⁻¹, 92% VO2 max), and 75-SEC (52.6 ml· kg⁻¹· min⁻¹, 91% VO2 max) tests were significantly lower than VO2 max (58.1 ml· kg⁻¹· min⁻¹). During the 75-SEC test, there was no significant difference in percentage VO2max from 30 seconds to 75 seconds, demonstrating a plateau effect. There were no significant differences in peak power or relative peak power between the Wingate, 60-SEC, and 75 SEC tests while, as expected, mean power, relative mean power, and fatigue index were significantly different between these tests. Power measures were highly correlated among all three tests. It was concluded that VO2 max was not attained during either the 60-SEC nor 75-SEC tests. Furthermore, high correlations in power output for WAT, 60-SEC, and 75-SEC precludes the necessity for anaerobic tests longer than the 30-second WAT.

Peter G. Weyand. (2004) Studied Energetics of high-speed running: integrating classical theory and contemporary observations. Despite the dynamic, physiological conditions involved, we have demonstrated that high-speed running performance can be understood in terms of the E˙ an-max and E˙ aer-max of individual runners and the common time courses of their respective fractional availabilities. The dependence of skeletal muscle on the same basic metabolic pathways allows the empirical framework provided here
to be useful for numerous purposes. Previously, we have used our exponential time constant, $k3$, to develop a new technique for assessing performance and determining the $E \dot{\alpha} n$ and $E \dot{\alpha} r$ maxima of individual performers (8). Additionally, our empirical framework could be used to analyze the relationship between metabolism and muscular performance in other modes of exercise or conceivably within individual muscle cells and tissues. Such investigations could determine whether skeletal muscle fatigue during whole-body exercise has the intrinsic, general, and quantifiable metabolic basis suggested by our findings.

**Benelli et al., (2004)** Conducted a study on Physiological responses to fitness activities: A comparison between land-based and water aerobics exercise. This study compared the heart rate (HR) and blood lactate (BL) responses in young healthy women performing the same routine of aerobics exercise in 3 different conditions: on land, in shallow water (0.8 m), and in deep water (1.4 m). The average age and body mass index (BMI) of the group were 27.4 years and 22.6 kg·m$^{-2}$, respectively. The highest HR and BL values were reached during land aerobics (median HR values were 138.0 and 161.5 b·min$^{-1}$, and lactate values were 3.10 and 5.65 mmol·L$^{-1}$ at slow and at faster pace, respectively). These parameters were progressively reduced going from shallow water (121.5 and 154.0 b·min$^{-1}$, 1.75 and 3.15 mmol·L$^{-1}$) to deep water (97.5 and 113.5 b·min$^{-1}$, 1.70 and 1.75 mmol·L$^{-1}$). The HR measured as percentage of maximum HR varied from 48.43% to 77.53% depending on the water depth and the pace. These data indicate that exercise in water
significantly reduces HR and BL production compared with the same exercise performed on land.

**Takeshima, et., al., (2004)** Determined the physiological effects of a programmed accommodating circuit exercise (PACE) program consisting of aerobic exercise and hydraulic-resistance exercise (HRE) on fitness in older adults. Thirty-five volunteers were randomly divided into two groups [PACE group (PG) 8 men and 10 women, 68.3 (4.9) years, and non-exercise control group (CG) 7 men and 10 women, 68.0 (3.4) years). The PG participated in a 12-week, 3 days per week supervised program consisting of 10 min warm-up and 30 min of PACE (moderate intensity HRE and aerobic movements at 70% of peak heart rate) followed by 10 min cool-down exercise. PACE increased (P<0.05) oxygen uptake (V(O2)) at lactate threshold [PG, pre 0.79 (0.20) l min(-1), post 1.02 (0.22) l min(-1), 29%; CG, pre 0.87 (0.14) l min(-1), post 0.85 (0.15) l min(-1), -2%] and at peak V(O2) [PG, pre 1.36 (0.24) l min(-1), post 1.56 (0.28) l min(-1), 15%; CG, pre 1.32 (0.29) l min(-1), post 1.37 (0.37) l min(-1), 4%] in PG measured using an incremental cycle ergometer. Muscular strength evaluated by a HRE machine increased at low to high resistance dial settings for knee extension (9-52%), knee flexion (14-76%), back extension (18-92%) and flexion (50-70%), chest pull (6-28%) and press (3-17%), shoulder press (18-31%) and pull (26-85%), and leg press (21%). Body fat (sum of three skinfolds) decreased (16%), and high-density lipoprotein cholesterol (HDLC) increased (10.9 mg dl(-1)) for PG. There were no changes in any variables for CG. These results indicate that PACE training
incorporating aerobic exercise and HRE elicits significant improvements in cardiorespiratory fitness, muscular strength, body composition, and HDLC for older adults. Therefore, PACE training is an effective well-rounded exercise program that can be utilized as a means to improve health-related components of fitness in older adults.

Myen, et., al., (2004) Examined whether the work load expressed in oxygen uptake and heart rate, during dance class and rehearsal prepared the dancer for performance. Previous research on the demands of class and performance has been affected by equipment limitations and could only provide limited insight into the physiological demands placed on the dancer. The present study noted that dance performance had significantly greater mean oxygen uptake and heart rate than noted in both class and rehearsal, heart rates were rarely within the aerobic training gone (60-90% H R max, where HR max is the maximum heart rate) Dance performance, placed a greater demand on the aerobic and an aerobic glycoltic energy system than seen during class and rehearsal which placed a greater emphasis on the adenosine tri phosphate creative phosphate system practical implications suggest the need to supplement training within dance companies to overcome this deficit in training demand.

La Torre, et., al.,(2005) Determined the cardiovascular responses during aerobic step dance using an overload strategy not yet investigated: appendicular overload. Ten healthy and moderately trained women (mean+/-SD: age 27+-3.4 years, height 167.8+-4.6 cm, body mass 55.7+-4.7 kg, body mass index
19.8+/−1.6, VO2max44.4+/−6.1 mLxkg−1xmin−1) performed an incremental treadmill test to determine VO2peak, the VO2-heart rate (HR) and rating of perceived exertion (RPE)-HR relationships. Within 1 week from the laboratory test, the subjects performed two identical aerobic step dance routines: one using a track suit with loads placed in pockets close to the legs and arms and another without overload. The appendicular overload (10% of body mass) significantly increased the exercise intensity from 84.5% to 89.8% of HRmax corresponding to 68.9% and 78.3% of VO2peak, respectively (P<0.01). Similarly, RPE increased from 12.1 to 15.7 (P<0.001). The estimated VO2 and the caloric expenditure rose from 30.3 to 34.7 mLxkg−1xmin−1 and from 251 to 288 kcal, respectively. This study shows that the use of appendicular overload significantly increases the energy cost of aerobic step session similarly to other overload strategies already reported in the literature.

Mosher. (2005) Compared the effects of two different methods of step bench training on cardio respiratory fitness body composition and lipoprotein concentration in college-aged females subjects were assigned to one of three group that is a traditional continuous step, an interval step group, or a non-exercise control group. The traditional continuous step and the IS groups participated in three 50 minute serious for 12 weeks. The traditional continuous step session included a warm up, 30-35 min of continuous bench stepping 10-15 min of callisthenic exercise and a 5 min cool-down. The interval step group session included a 5-7 min warm-up 35-40 min of alternating intervals of bench stepping and non step aerobic dance, and a 5-7 min cool-down. Target heart
were maintained within 70-85% of maximal heart rate. Results showed increase in HDC-C concentrations in the interval step group (P<0.05). Decrease in percent body fat were evident in both dance groups (P<0.05) and cardiovascular fitness increased in both groups (P<0.01). No changes were evident in the control group. In college women, 12 weeks of interval step or traditional continuous step training improved cardio respiratory fitness and body composition. In addition, interval step training appears to have a greater effect on HDL-C concentrations than continuous step training.

**Rousanoglou and Boudolos. (2005)** Designed to investigate G.R.F. and heart rate (HR) Exhibited by AD instructors of body genders during a simulated AD instruction, from the perspective of accepted occupational workloads. Fourteen females and 14 males instructors performed a 35 min AD exercise programmer. (Warm-up low impact (C1) interval – in high impact (HI) interval – cool down) Four GPF measurement were taken during LI and HI time intervals respectively. HR was recorded throughout the whole experimental procedure and was synchronized to GPF measurement. All GPF and HR values were significantly increased in HI exercise (P<0.05) with a non significant (P>0.05) time effect for GPF. In both LI and HI exercises. Females demonstrated significantly higher vertical but lower lateral GPF (P<0.05) and significantly shorter excludes of movement (P<0.05) while in HI exercise that had significant longer flight times (P<0.005). for both genders, HR was kept at 70% during LI and HI interval respectively, with females showing a trend, through non-significant or higher HA values. The gender Specificity of the
significant vertical and lateral GPF Pattern differences, may Possibly be associated with the significant anthropometric differences of male and female AD instructors. HR (max-scale) and RHR exceeded the accepted occupational levels rising to training States levels. We suggest that AD instructors take up Such intrusions methods which allow them to minimize the magnitude or the rate of GRF, as well as HR levels developed in the course of their working hour.

**Wyen and Redding. (2005)** Conducted a Story to monitor the Physiological parametres of a Nurnberg of dance during a 12 weeks rehearsal Period and an 8 week performance. Schedule seventeen dancers (8 men and 9 women) from 2 companies under took the multistage dance specific aerobic fitness text before the rehearsal period, before the performance period, and after the performance period. Heart rate data were collected throughout the test: the mean heart rate during stage 5 and blood lactate levels were measured at the end of the test. No significant changes in heart rate or lactate parameters were noted between the prerehearsal and performance tests were shown in both parameters’ (P<0.01 and P<0.01) which suggests an increase in the subjects aerobic capacities during the performance period implications from the present study suggests that dancers are not adequately physiologically prepared to perform to the same degree to will their skills are homed the study suggests that supplemental training required to bridge this physical gap and better prepare the dame for performance.
Gillian Burgess, et. al., (2005) Studied on Effects of a 6-week aerobic dance intervention on body image and physical self-perceptions in adolescent girls. Research examining the impact of physical activity on body image dissatisfaction and physical self-perceptions has been both limited and equivocal. The current research investigated the effects of 6-week aerobic dance on these variables with 50 British schoolgirls aged 13–14 years. A cross-over design was used with two equivalent groups taught normal physical education and aerobic dance in a different order. The Body Attitude Questionnaire (BAQ) and Children and Youth Physical Self-Perception Profile (CY-PSPP) were administered as pre, mid and post-test to each participant in each group before the first intervention, at the change over and after 12 weeks. The results of this study revealed that participation in 6 weeks of aerobic dance significantly reduced body image dissatisfaction (Attractiveness, Feeling Fat, Salience and Strength and Fitness) and enhanced physical self-perceptions (Body Attractiveness and Physical Self-Worth), although these improvements were not sustained.

Anne.F, et. al., (2006) Investigated whether measures of obesity are associated with periodontitis. Design A case-control study. Setting A nationally representative sample using data from the Third National Health and Nutrition Examination Survey. The sample included 2452 nonsmokers, aged 13 to 21 years, who received a periodontal examination and had complete information for age, sex, and smoking habits. Main Exposures Skinfold thickness, weight, and waist circumference were examined as independent
variables in logistic regression models. Final models were adjusted for sex, race/ethnicity, poverty index ratio, last dental visit, and self-reported calcium intake. Main Outcome Measures Cases were subjects with the presence of 1 or more periodontal sites with both a loss of tissue attachment of 3 mm and a probing depth of 3 mm (n = 111). Subjects who did not meet these criteria were classified as controls (n = 2341). Results Total body weight and waist circumference were associated with periodontitis, but the association varied by age. Adolescents aged 13 to 16 years were not at increased risk of chronic periodontitis, while adolescents aged 17 to 21 years had an increased risk per 1-kg increase in body weight (adjusted odds ratio, 1.06 [95% confidence interval, 1.01-1.09]). Similarly, adolescents aged 13 to 16 years were not at increased risk for periodontal disease, while adolescents aged 17 to 21 years were at an increased risk of periodontal disease per 1-cm increase in waist circumference (adjusted odds ratio, 1.05 [95% confidence interval, 1.01-1.08]). Conclusion Periodontitis may follow patterns similar to other chronic conditions that originate early in life and are related to central adiposity.

Rixon, et al., (2006) Estimated energy expenditure by heart rate for 28 women participating in 4 modes of aerobic dance Body Combat (i.e. TAEBO) Pump; step; and RPM (i.e. spinning) Conpood to 2 running speeds. In conclusion, RPM, Body combat and step aerobics were equally as effective as jogging between 8.05 and 8.37 km.h (-1), and they met American college of sports medicine guidelines for weight mollification and maintenance. Additionally heart rate assessment provided a Quantitative method for essential energy expenditure and effective of different aerobic programmes.
Radmila Kostic, et., al., (2006) Studied on changes in the cardiovascular fitness and body composition of women under the influence of the aerobic dance. The effects of aerobic dance were investigated on the cardiovascular fitness and body composition of 46 women aged 20 to 25. The experimental group was made up 26 female subjects, and the control group numbered 20 subjects. The experimental program of the aerobic dance lasted for a period of three months, with sixty-minute training sessions three times a week. The aerobic dance part of each workout lasted for 40 minutes, and involved high, low and moderate impact segments. The cardiovascular fitness was evaluated by means of the following parameters: resting heart rate, heart rate under strain, systolic arterial blood pressure (mmHg), diastolic arterial blood pressure (mmHg), the absolute value of maximal oxygen uptake (l/min) and the relative value of maximal oxygen uptake (ml/kg/min). Body composition was evaluated by means of the following measurements: body height (cm), body weight (cm), average thorax volume (cm), girth (cm), back skinfold (mm), abdominal skinfold (mm). The basic descriptive statistics coefficients were calculated for all the data from the initial and final measuring, along with the Student t-test and multivariate and univariate covariance analysis (MANCOVA and ANCOVA). There is a statistically significant difference in the variables for cardiovascular fitness and body composition between the initial and final measuring in the experimental group and between the experimental and control group at the final measuring. This study confirmed previous conclusions about significant positive influence of the aerobic dance trainings on the changes in the cardiovascular endurance and body composition parameters in young adult women.
George E. Billman and Monica Kukielka. (2006) Studied Effects of endurance exercise training on heart rate variability and susceptibility to sudden cardiac death: protection is not due to enhanced cardiac vagal regulation. The present study demonstrates that exercise training improves cardiac autonomic function such that cardiac vagal regulation is maintained even when the heart is stressed by either exercise or acute myocardial ischemia in animals with healed infarctions. Furthermore, exercise training completely suppressed ventricular fibrillation induced by myocardial ischemia. However, because atropine retreatment did not reintroduce lethal arrhythmias in these dogs, the exercise-induced protection from ventricular fibrillation did not result solely from enhanced cardiac vagal regulation. The mechanisms by which exercise training improved cardiac vagal regulation and prevented ventricular fibrillation remain to be determined.

Jan Helgerud. (2006) Studied Aerobic High-Intensity Intervals Improve V’O₂max More Than Moderate Training. The present study compared the effects of aerobic endurance training at different intensities and with different methods matched for total work and frequency. Responses in maximal oxygen uptake (V’O₂max), stroke volume of the heart (SV), blood volume, lactate threshold (LT), and running economy (CR) were examined. Methods: Forty healthy, non-smoking, moderately trained male subjects were randomly assigned to one of four groups: 1) long slow distance (70% maximal heart rate; HRmax); 2) lactate threshold (85% HRmax); 3) 15/15 interval running (15 s of running at 90–95% HRmax followed by 15 s of active resting
at 70% HRmax); and 4) 4–4 min of interval running (4 min of running at 90–95% HRmax followed by 3 min of active resting at 70% HRmax). All four training protocols resulted in similar total oxygen consumption and were performed 3 dIwkj1 for 8 wk. Results: High-intensity aerobic interval training resulted in significantly increased V˙ O2max compared with long slow distance and lactate-threshold training intensities (P G 0.01). The percentage increases for the 15/15 and 4–4 min groups were 5.5 and 7.2%, respectively, reflecting increases in V˙ O2max from 60.5 to 64.4 mLkgj1minj1 and 55.5 to 60.4 mLkgj1minj1. SV increased significantly by approximately 10% after interval training (P G 0.05). Conclusions: High–aerobic intensity endurance interval training is significantly more effective than performing the same total work at either lactate threshold or at 70% HRmax, in improving V˙ O2max. The changes in V˙ O2max correspond with changes in SV, indicating a close link between the two.

Impellizzeri. F .M. (2006) Studied Physiological and performance effects of generic versus specific aerobic training in soccer players. The aim of this study was to compare the effects of specific (small-sided games) vs. generic (running) aerobic interval training on physical fitness and objective measures of match performance in soccer. Forty junior players were randomly assigned to either generic (n=20) or specific (n=20) interval training consisting of 4 bouts of 4 min at 90–95 % of maximum heart rate with 3 min active rest periods, completed twice a week. The following outcomes were measured at baseline (Pre), after 4 weeks of pre-season training (Mid), and after a further 8
weeks of training during the regular season (Post): maximum oxygen uptake, lactate threshold (Tlac), running economy at Tlac, a soccer-specific endurance test (Ekblom's circuit), and indices of physical performance during soccer matches (total distance and time spent standing, walking, and at low- and high-intensity running speed). Training load, as quantified by heart rate and rating of perceived exertion, was recorded during all training sessions and was similar between groups. There were significant improvements in aerobic fitness and match performance in both groups of soccer players, especially in response to the first 4 weeks of pre-season training. However, no significant differences between specific and generic aerobic interval training were found in any of the measured variables including soccer specific tests. The results of this study showed that both small-sided games and running are equally effective modes of aerobic interval training in junior soccer players.

**Baillie Wyon and Head. (2007)** Studied the physiological effects of performance in Highland-dance competition to consider whether the traditional methods used during class and rehearsal provide an appropriate training stimulus toward this performance. Nine championship standard, female Highland dancers (age 14.2 +/- 1.47 years) had their heart rate and blood lactate concentrations measured before and after 3 dances during a championship competition. Heart rate was also measured during the same 3 dances in rehearsal and during class. Repeated-measures analysis of variance showed significant differences in pre-dance lactate concentrations between the first dance (Highland Fling, 1.4 +/- 0.3 mM/L), the second dance (Sword
dance, 2.3 +/- 0.8 mM/L), and the third dance (Sean Truibhas, 3.5 +/- 1.8 mM/L; F2,16 = 11.72, P < .01. This, coupled with a significant rise in lactate concentration during the dances (F1,8 = 76.75, P < .001), resulted in a final post dance lactate concentration of 7.3 +/- 2.96 mM/L. Heart-rate data during competition, rehearsal, and class (195.0 +/- 6.5, 172.6 +/- 5.4, and 151.9 +/- 7.4 beats/min, respectively) showed significant differences between all 3 (F2,16 = 107.1, P < .001); these are comparable to research on other dance forms. Given the disparity between the anaerobic predominance of competition and the aerobic predominance during class, it is suggested that the class does not provide an appropriate training stimulus as preparation for competitive performance in Highland dance.

**Millar. P. J. et., al., (2009)** Made a research on sprint interval training involves short bouts of high-intensity exercise and has produced training responses similar to those of endurance training. The effects of multiple supramaximal exercise bouts on neurocardiac modulation have not been examined. Therefore, we investigated the recovery of heart rate (HR) variability and nonlinear HR dynamics in 10 young (20.1 +/- 1.2 years) healthy males following single (1) and multiple (4) Wingate tests. HR variability was assessed with time and frequency domain measures, whereas nonlinear HR dynamics were determined by assessing the complexity (sample entropy) and fractal nature (detrended fluctuation analysis) of the HR time series. Responses were determined at pre-exercise baseline and at 3 time points during recovery from exercise: Post1 (5-20 min), Post2 (45-60 min), and Post3 (105-120 min).
Following a single Wingate test, all temporal and spectral HR measures had returned to baseline by 1 h of recovery. In contrast, these measures were different from baseline at 2 h following multiple Wingate tests. Fractal HR properties were altered (p < 0.05) at Post1 following a single Wingate test and at Post1 and Post2 following multiple Wingate tests. HR complexity was reduced (p < 0.001) throughout the 2-h recovery following both exercise conditions. In conclusion, Wingate tests result in alterations in cardiac autonomic control, with multiple Wingate tests resulting in larger, more prolonged alterations. Based on the results of the single Wingate test, nonlinear measures, such as HR complexity, may be more sensitive in detecting subtle alterations in neurocardiac behaviour, compared with traditional measures of HR variability.

Furuichi, Y., et., al., (2009) Investigated the effects of intensive interval training during 20-day of unloading on local muscle oxygenation kinetics evaluated by near infrared spectroscopy technique (NIRS). Eleven adult men completed 20-day unloading and were divided into two groups; the control (CON) group and training (TR) group. The TR group engaged in exercise training sessions that consisted of one-legged submaximal cycle exercise using the unloaded leg at 60 approximately 80% of VO(2peak) with intermittent rest periods, 25 min/day every other day. All subjects performed isometric knee extension exercise at 50% of their maximum voluntary contraction force before and after unloading. NIRS Delta[deoxy-Hb/Mb] signal was recorded from m. vastus lateralis and was fitted to an exponential equation in order to determine
the kinetics parameters. The time constant (tau) of the % Delta[deoxy-Hb/Mb] was unchanged in the TR group, while it significantly increased in the CON group after unloading (pre, 5.0+/1.0; post, 7.4+/1.0 s). It is concluded that 20-day unloading increased the tau, suggesting deterioration of capacity for oxidative phosphorylation and oxygen utilization in a skeletal muscle. Additionally, the preservation of tau in the TR group suggested that intensive interval training could have an impact on the maintenance of muscle oxidative metabolism during unloading.

Andersson J.P., et., al., (2009) Made an investigation on the concentration of the protein S100B in serum is used as a brain damage marker in various conditions. We wanted to investigate whether a voluntary, prolonged apnea in trained breath-hold divers resulted in an increase of S100B in serum. Nine trained breath-hold divers performed a protocol mimicking the procedures they use during breath-hold training and competition, including extensive preapneic hyperventilation and glossopharyngeal insufflation, in order to perform a maximum-duration apnea, i.e., "static apnea" (average: 335 s, range: 281-403 s). Arterial blood samples were collected and cardiovascular variables recorded. Arterial partial pressures of O(2) and CO(2) (Pa(O(2)) and Pa(CO(2))) were 128 Torr and 20 Torr, respectively, at the start of apnea. The degree of asphyxia at the end of apnea was considerable, with Pa(O(2)) and Pa(CO(2)) reaching 28 Torr and 45 Torr, respectively. The concentration of S100B in serum transiently increased from 0.066 microg/l at the start of apnea to 0.083 microg/l after the apnea (P < 0.05). The increase in S100B is attributed
to the asphyxia or to other physiological responses to apnea, for example, increased blood pressure, and probably indicates a temporary opening of the blood-brain barrier. It is not possible to conclude that the observed increase in S100B levels in serum after a maximal-duration apnea reflects a serious injury to the brain, although the results raise concerns considering negative long-term effects. At the least, the results indicate that prolonged, voluntary apnea affects the integrity of the central nervous system and do not preclude cumulative effects.

Rector .R.S, et.,al., (2009) Studied on Weight-bearing endurance activity and resistance exercise are recommended to help preserve bone health during adulthood. However, the effects of resistance training relative to those of weight-bearing endurance activity often are confounded by body weight and composition. The purpose of this study was to determine the effects of long-term running, cycling, and resistance training on whole-body and regional bone mineral density (BMD), adjusting for body weight and composition. Cyclists (CYCLE; n = 19), runners (RUN; n = 10), and resistance trained men (RT; n = 13) ages 19-45 years participated in this cross-sectional study. Current and lifetime bone loading was calculated using ground-reaction force values of the reported physical activities. Whole-body and regional BMD and body composition were assessed using dual X-ray absorptiometry. Bone turnover markers and hormones were measured in fasting serum samples. The RT athletes had significantly greater body weight, lean body mass (LBM), and fat mass than CYCLE and RUN athletes; percent body fat did not differ among
groups. Unadjusted BMD at all sites was significantly greater in the RT compared with CYCLE and RUN. After adjusting for LBM, RUN had significantly greater spine BMD than CYCLE. Subjects' LBM was a significant predictor of BMD in RT and CYCLE but not in RUN, suggesting that high-impact activity may override the benefits of LBM on BMD. Current bone loading was positively associated with serum osteocalcin concentrations (r = 0.480, p = 0.002). In conclusion, the results of the present study demonstrate that long-term running and resistance training increase BMD compared with cycling. However, it seems that high-impact activities, such as running, have a greater positive effect on BMD than resistance training.

Lucia Mikusovaa, et., al., (2009) Studied on Biochemical aspects of exercise in prevention of overweight and obesity. Regular physical activity is an important component of healthy lifestyle providing many beneficial effects such as improving physical fitness, enhancing muscular strength, increasing endurance, promoting well-being and protecting against cardiovascular diseases, cancer or diabetes. Not lesser important is the role of exercise in the prevention and treatment of overweight and obesity. An important element in etiology of obesity seems to be inability to oxidize lipids. The authors reviewed factors influencing fat oxidation during physical activity such as exercise intensity aimed to enhance its effect on overweight or obese people. Many studies support the use of exercise as an ideal weight loss strategy, mainly in combination with dietary restriction. Some exercise programs fail to prove significant weight loss changes what may be caused by low adherence to the
training. New, interesting, non-stereotype and individualized exercise programs such as dance should be found to improve adherence to the regular physical activity and consequently to promote general health.

Dheeraj Sangwan. (2009) Studied on physical fitness and physiological variables of School athletes of Haryana. The Present study was considered with various physiological variables so as compile the physiological characteristics of public and government school athletes selected from Haryana under physiological variables like Blood Pressure (Diastolic) Blood Pressure (Systolic) Pulse Rate Breath Holding and Respiratory Rate. The related physiological variables were considered to the public and government school athletes of Haryana. The study concentrates on the above mentioned physiological variables along with various physical fitness components as, the physical fitness is very important consideration while selecting the public and Government school athletes. The American Alliance for Physical, Health Education, Recreation & Dance (AAPHERED) was provided the following test items to measure the total physical fitness of the individual. The research scholar decided to take the physical fitness and physiological variables to assess the relationship and comparative study on Haryana School Athletes.

Konrad Witek . (2009) Studied on changes in serum lipid profile of elite volleyball players in the competition period. To assess the changes in serum lipid profile of volleyball players in various phases of competition period characterised by creatine kinase activity. A group of 14 Polish elite volleyball players aged 23 - 34 years were examined 3 times during the
competition period lasting 10 weeks. Total cholesterol (TC), LDL, HDL, triacylglycerols (TG) and creatine kinase (CK) activity were determined in serum. Body fat content was determined from 4 skinfolds by Durnin’s method. Creatine kinase activity was very high throughout the study period although significantly decreased in relation to the first examination; TC, LDL, TC/HDL and LDL/HDL gradually increased while HDL decreased. Nevertheless, the values of TC, HDL, LDL and LDL/HDL were within normal limits in all subjects throughout the study. The changes in lipid profile may be regarded as transitory and of no significant impact on the risk of cardiovascular diseases as in all cases they were within physiological ranges.

**Byron .R. McKay, et., al. (2010)** Studied effect of short-term high-intensity interval training vs. continuous training on O2 uptake kinetics, muscle deoxygenation, and exercise performance. This study demonstrated that V˙O2p kinetics was faster during moderate-intensity exercise after only 2 days of training, regardless of the type of exercise training program (HIT or END). The _V˙O2p_ kinetics was progressively reduced throughout training. The extent to which _V˙O2p_ kinetics was reduced is influenced by the initial training status of the individual, with individuals who have slower initial kinetics responding to the training with a greater magnitude. Both short-term HIT and END protocols showed similar training-induced adaptations with respect to exercise performance, _V˙O2p_ kinetics, HR kinetics, measured lactate threshold, and estimated lactate threshold, with no differences occurring between training programs. The time course of HHb (reflecting fractional O2 extraction) was not
changed with training, despite a speeding of $V^\prime\ O_2p$ kinetics, suggesting that local muscle (microvascular) O2 delivery was faster and remained “matched” to muscle O2 utilization during the transition to exercise after training. These results suggest that $V^\prime\ O_2p$ kinetics (and muscle O2 utilization kinetics) is influenced similarly by both training programs and that the early adaptation begins as early as after 2 training days.

Richards .J.C, et., al., (2010) Studied the sprint interval training (SIT) and traditional endurance training elicit similar physiological adaptations. From the perspective of metabolic function, superior glucose regulation is a common characteristic of endurance-trained adults. Accordingly, we have investigated the hypothesis that short-term SIT will increase insulin sensitivity in sedentary/recreationally active humans. Thirty one healthy adults were randomly assigned to one of three conditions: (1) SIT (n = 12): six sessions of repeated (4-7) 30 s bouts of very high-intensity cycle ergometer exercise over 14 days; (2) sedentary control (n = 10); (3) single-bout SIT (n = 9): one session of 4 x 30 s cycle ergometer sprints. Insulin sensitivity was determined (hyperinsulinaemic euglycaemic clamp) prior to and 72 h following each intervention. Compared with baseline, and sedentary and single-bout controls, SIT increased insulin sensitivity (glucose infusion rate: 6.3 +/- 0.6 vs. 8.0 +/- 0.8 mg kg(1) min(1); mean +/- s.e.m.; P = 0.04). In a separate study, we investigated the effect of SIT on the thermogenic response to beta-adrenergic receptor (beta-AR) stimulation, an important determinant of energy balance. Compared with baseline, and sedentary and single-bout control groups, SIT did
not affect resting energy expenditure (EE: ventilated hood technique; 6274 +/- 226 vs. 6079 +/- 297 kJ day(1); P = 0.51) or the thermogenic response to isoproterenol (6, 12 and 24 ng (kg fat-free mass)(1) min(1): %EE 11 +/- 2, 14 +/- 3, 23 +/- 2 vs. 11 +/- 1, 16 +/- 2, 25 +/- 3; P = 0.79). Combined data from both studies revealed no effect of SIT on fasted circulating concentrations of glucose, insulin, adiponectin, pigment epithelial-derived factor, non-esterified fatty acids or noradrenaline (all P > 0.05). Sixteen minutes of high-intensity exercise over 14 days augments insulin sensitivity but does not affect the thermogenic response to beta-AR stimulation.

Walter A.A, et., al., (2010) Evaluated the effects of cycle ergometry high-intensity interval training (HIIT) with and without beta-alanine supplementation on maximal oxygen consumption rate (VO2 peak), cycle ergometer workload at the ventilator threshold (VT W), and body composition. Forty-four women (mean +/- SD age = 21.8 +/- 3.7 years; height = 166.5 +/- 6.6 cm; body mass (BM) = 65.9 +/- 10.8 kg; VO2 peak = 31.5 +/- 6.2 ml x kg(-1) x min(-1)) were randomly assigned to 1 of 3 groups: beta-alanine (BA, n = 14) 1.5 g + 15 g dextrose powder; placebo (PL, n = 19) 16.5 g dextrose powder; or control (CON, n = 11). Testing was conducted at baseline (week 0), after 3 weeks (week 4), and after 6 weeks (week 8). VO2 peak (ml x kg(-1) x min(-1)) and VT W were measured with a metabolic cart during graded exercise tests on a corival cycle ergometer, and body composition (percent fat = % fat and fat-free mass = FFM) were determined by air displacement plethysmography. High-intensity interval training was performed on a corival
cycle ergometer 3 times per week with 5 2-minute work intervals and 1-minute passive recovery with undulating intensities (90-110% of the workload recorded at VO2 peak) during each training session. VO2 peak increased (p < or = 0.05) in the BA and PL groups at weeks 4 and 8, but did not change (p > 0.05) for the CON group. VT W increased (p < or = 0.05) for all groups at weeks 4 and 8. Body mass increased (p < or = 0.05) only for the BA group at weeks 4 and 8, whereas %fat decreased (p < or = 0.05) and FFM increased (p < or = 0.05) at weeks 4 and 8 for all groups (BA, PL, and CON). Although it is unclear why beta-alanine supplementation increased BM, there was no additive effects for increasing VO2 peak beyond the PL. Overall, these results suggested that HIIT may be an effective and time-efficient method of training to improve maximal oxygen uptake.

Okuneye Rafiu, et. al., (2010) Studied on the effects of a Six-Week Aerobic Dance Programme on Selected Fitness Components and Waist-Hip-Ratio in Adult Males. This study examined the effects of a six-week low-impact aerobic dance on selected fitness components (trunk flexibility, leg power and abdominal muscle endurance) and waist-hip-ratio (WHR) in adult males. A total of fifteen (15) Lagos State University male undergraduates (age range: 19-28 years) from the Faculty of Education volunteered to take part in the study. The one-group pre-test - post-test quasi-experimental research design was employed. Both pre-test and post-test measurements were taken from each participant under the same conditions. Participants were all exposed to a low-impact aerobic dance for a duration of six weeks. While the
descriptive statistics of mean, range and standard deviation were used to describe the data; inferences were drawn using the Students paired T-test. Results revealed that a six-week low – impact aerobic dance programme can significantly reduce the waist-hip-ratios, improve trunk flexibility, leg power and abdominal endurance/strength in male undergraduate students.

George Abraham. (2010) Studied on Analysis of anthropometry, body composition and performance variables of young Indian athletes in southern region. The purpose of this study was to analyze the anthropometry and body composition associated with performance of university level male track and field athletes of South India. This study was conducted on 93 track and field athletes from South India, comprised of 22 sprinters (100 & 200 mts), mean age 19.5 years, height 172.1 cm and weight 68.2 kg, 20 middle distance runners (800 & 1500 mts), mean age 19 yrs, height 166.8 cm and weight 62.5 kg, 16 long distance runners (5000 & 10000 mts), mean age 18.7 years, height 167.2 cm and weight 62.1 kg, 20 throwers, (shot, discus & hammer throw), mean age 19 years, height 170.8 cm and weight 72.6 kg and jumpers (High, long & triple jump), mean age 18.3 years, height 169.9 cm and weight 64.1 kg. Besides height and weight, six skin folds (triceps, chest, subscapular, abdomen, suprailiac & calf), two bicondylar breadths (humerus & femur) and two girths (biceps & calf) were measured. Somatotype evaluations were made according to Carter and Heath (1990) method. BMI was calculated as body mass divided by square of height (kg/m2). The somatochart indicated that sprinters and middle distance runners are ectomorphic mesomorphs, long distance runners
are mesomorph ectomorphs while throwers are endomorphic mesomorphs. The jumpers fell into the somatotype category of balanced mesomorphs. Among all groups body fat percent is lowest in sprinters (6.23±0.83%) and highest in throwers (7.38±0.85%). This was reflected in their endomorphic components which is lowest in sprinters (2.53±0.45) and highest in throwers (3.39±0.65). Ectomorphic component is highly marked in long distance runners (3.56±0.65) while mesomophy was highest in sprinters (4.31±0.91). Throwers have significantly higher values of skin folds than other groups. Compared to their overseas counterparts, the athletes of both track and field events in the present study exhibited greater endomorphic values. The present data will serve as a reference standard for the anthropometry and body composition of south Indian track and field athletes.

Parameswari.G. and Elayaraja. (2010) Studied on effects of intensive and extensive interval trainings on selected physiological parameters. The aim of the present study was to evaluate the effects of intensive and extensive interval training on selected physiological parameters. Forty five men students age between 18 and 24 were randomly selected and they were divided into three equal groups (n = 15) namely intensive interval training group (IITG), extensive interval training group (EITG) and control group (CG). The IITG and EITG group were underwent their respective training programme for three days per week for twelve weeks in which the CG did not participate any special training programme apart from their regular physical education activities as per their curriculum. Physiological variables namely cardio respiratory endurance
and breath holding time were selected as criterion variables. All the subjects of three groups were tested on selected dependent variables at prior to and immediately after the training programme. Statistical Analysis: The analysis of covariance (ANCOVA) was used to analyze the significant difference, if any among the groups. Since, three groups were compared, whenever the obtained ‘f’ ratio for adjusted post test was found to be significant, the Scheffé S test was used to find out the paired mean differences, if any. Result: The result showed that there was a significant mean difference exists among intensive interval training group (IITG), extensive interval training group (EITG) and control group (CG) on cardio respiratory endurance and breath holding time. However, the improvement on cardio respiratory endurance and breath holding time were greater in EITG than in IITG.

Bouchla .A, et., al., (2011) Studied sought to evaluate the additional effects of strength training on muscle strength and body composition in chf patients participating in an interval training program. Twenty consecutive, stable CHF patients participated in a rehabilitation program. Subjects were randomly assigned to aerobic (n = 10) or combined aerobic plus strength training group (n = 10). Aerobic group performed interval training on cycle ergometers. Strength training incorporated exercises for various muscle groups, including quadriceps, hamstrings, biceps brachii, and the deltoids. Both regimes were of the same duration. Body composition was evaluated by whole-body dual energy x-ray absorptiometry and quadriceps strength by the sum of the 2-repetition maximum (2-RM) test for each leg. Peak oxygen uptake
(\text{VO}(2\text{peak})) and peak work load (W(\text{peak})) as well as oxygen uptake (\text{VO}(2\text{AT})) and workload at anaerobic threshold (W(\text{AT})) were evaluated by a symptom limited cardiopulmonary exercise testing. RESULTS: Concerning leg lean mass, no significant within-subjects or between-groups changes were observed (P > .05). Both groups improved in 2-RM test (P < .05), while a significant difference was observed between groups (P < .05). \text{VO}(2\text{peak}) and \text{VO}(2\text{AT}) and W(\text{peak}) and W(\text{AT}) were equally improved between training groups (P < .05). Combined aerobic interval and strength training induces a greater benefit than interval training alone on muscle strength in CHF patients. Adaptations other than hypertrophy, such as muscle fiber type alterations and/or neuromuscular adjustments, may account for these results.

\textbf{Evrim, et., al., (2011)} Studied on The Effects of Aerobic Dance Exercise on Body Composition Changes Associated with Weight Change in Sedentary Women. The purpose of this study was to assess the effects of aerobic dance exercise on body composition in sedentary overweight women. In this study, Total 55 adult sedentary women participated as volunteers. The age, height and weight averages of the subjects exercise and control group were respectively 35,10±9,12 years, 1,60±5,22 m and 68,55±6,73 kg (n=29) and 30,27±10,85 years, 1,59±5,53 cm and 61,25±8,38 kg (n=26). Body composition (via skinfolds caliper), waist hip ratio, waist circumference were measured and body fat percentage, Basal Metabolic Rate and Lean Body Mass were calculated at sedentary women. The measurements were taken twice as before and after aerobic-dance exercise being applied an 8-week series of one
hour exercise three days per week. The control group did not participate in any physical activity during the six-week period. There were significant differences between pretest and posttest for weight, body mass index, waist circumference, waist hip ratio, metabolic and body composition parameters in exercise group (p<0,05). Besides there were significantly decreased body weight, Lean Body Mass, Basal Metabolic Rate and fat percentage (p<0,05). Furthermore, there were not significant differences between pretest and posttest for waist circumference, waist hip ratio, body composition parameters, Lean Body Mass, Basal Metabolic Rate, body weight and body fat percentage in control group(p>0,05). As a result, it can be said that aerobic dance exercise at a moderate intensity and duration can improve physical fitness and can decrease body fat percentage, Lean Body Mass and Basal Metabolic Rate during weight loss.

Jonathan .D. Bartlett. (2011) Studied High-intensity interval running is perceived to be more enjoyable than moderate-intensity continuous exercise: Implications for exercise adherence. The aim of this study was to objectively quantify ratings of perceived enjoyment using the Physical Activity Enjoyment Scale following high-intensity interval running versus moderate-intensity continuous running. Eight recreationally active men performed two running protocols consisting of high-intensity interval running (663 min at 90% \_V O2max interspersed with 663 min active recovery at 50% \_V O2max with a 7-min warm-up and cool down at 70% \_V O2max) or 50 min moderate intensity continuous running at 70% \_V O2max. Ratings of perceived enjoyment after
exercise were higher (P<0.05) following interval running compared with continuous running (88±6 vs. 61±12) despite higher (P<0.05) ratings of perceived exertion (14±1 vs. 13±1). There was no difference (P>0.05) in average heart rate (88±3 vs. 87±3% maximum heart rate), average $\text{VO}_2$ (71±6 vs. 73±4% $\text{VO}_2$max), total $\text{VO}_2$ (162±16 vs. 166±27 L) or energy expenditure (811±83 vs. 832±136 kcal) between protocols. The greater enjoyment associated with high-intensity interval running may be relevant for improving exercise adherence, since running is a low-cost exercise intervention requiring no exercise equipment and similar relative exercise intensities have previously induced health benefits in patient populations.

**Fatemeh Islami, Zynalabedin Fallah. (2012)** Studied on The Effect of a Progressive Run Training Program on Lipid and Lipoprotein Profiles in High School Girls. The purpose of this study was to investigate the effect of a progressive run training program on lipid and lipoprotein profiles in high school girls. 37 healthy untrained female students were randomly selected as the participants from among the high school girls in Bandar Gaz city. The subjects were randomly assigned into two groups; an experimental group (n=18) with age 15.22±0.22 yr, height 159.81±1.5 cm, weight 58.13±2.86 kg; and a control group (n=19) with age 14.94±0.19 yr, height 159.17±1.4 cm, and weight 53.02±2.06 kg. Rockport walking test was used to calculate every participant's maximal oxygen consumption both before and after the training program. The training intensity was determined via monitoring maximum heart rate. The experimental group participated in the training (progressive run) for 4
weeks, 4 days a week, 31 minutes per session during the first week, 35 minutes per session during the second and third weeks, and 50 minutes per session during the fourth week at the intensity of 40, 50, 60, 70 and 80 percent maximum heart rate. Fasting Blood samples were taken from every participant before and after training to examine the concentration of lipid and plasma lipoproteins. The results showed that the training program has significantly increased VO2Max and high-density lipoprotein-cholesterol (HDL-C) (P<0.05) and significantly decreased the concentration of triglyceride (TG) and very low-density lipoprotein-cholesterol (VLDL-C) in the participants. The increase in total cholesterol (TC) and low-density lipoprotein-cholesterol (LDL-C) were insignificant in either group. Despite the control group, LDL/HDL and TC/HDL ratios decreased in the experimental group though the decrease was not significant at the level of α=0.05. Therefore, it may be concluded that the progressive run training program for 4 weeks positively affected the lipid and lipoprotein profiles and increased cardiovascular fitness in the participants.

Satish Sharma and Dalwinder Singh. (2012) Studied Effect of Intensive Interval Training on Red Blood Corpuscles and Cardiovascular Endurance. The purpose of the present study was to investigate the effect of intensive interval training on the nature of red blood corpuscles count and cardiovascular endurance. Interval training stresses not only the energy system but the muscular system also. To fulfil the objectives of the study, fifty students from the Department of Physical Education, Lovely Professional University, Punjab were selected to act as subjects. They were divided into two groups of
twenty five each i.e. control and experimental group. Data was collected prior and after twelve weeks of training. Comparison of pre-test and post-test training data was done with the application of t-test. Statistically insignificant difference was found between the pre and post-test count of RBC’s whereas statistically significant difference was observed between pre-test and post-test data of cardiovascular endurance after twelve weeks of intensive interval training.

2.2 Conclusion

From the above studies it is clear that there are many studies on Physical fitness with other related variables, but very rare studies are found on Interval Running, Aerobic dance. Hence the researcher undertook the present study.

The next chapter methodology is about the detailed information of the variables used the study, population and sample, tools used for the collection of the data and statistical technique applied for the investigation.