Chapter II

REVIEW OF RELATED LITERATURE

The review of literature is instrumental in the selection of the topic, formulation of hypothesis and deductive reasoning leading to the problem. It helps to get a clear idea and supports the findings with regard to the problem under study. The researcher come across several books, periodicals and journals and published thesis, while searching for relevant facts and findings that are related to the present study, such as those are given below for better understanding and to justify the study.

A study of the relevant literature is an essential step to get a full practice of what has been done and said with regard to the problem under study. Such a review brings about a deep insight and a clean perspective of the overall field.

If one fails to build upon the foundation of knowledge provided by the review of literature, the researcher might miss some work already done on the same topic.

This chapter gives an account of the review of the related literature through which the researcher has traversed to establish the relevance and necessity of the present study. The review of the literature has been classified under the following headings.
1. Studies related to Aerobic dance & Classical dance
2. Studies related to Physical Variables
3. Studies related to Physiological Variables
4. Studies related to Psychological Variables
5. Studies related to Bio-chemical Variables

**Studies related to Aerobic Dance & Classical Dance**

*Burgess, Grogan and Burwitz (2006)* investigated the effects of 6-week aerobic dance on these variables with 50 British school girls aged 13-14 years. A cross-over design was used to the 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.

*Jaywant, P.J. (2013)* conducted a study on the effect of aerobic dance on the body fat distribution and cardiovascular endurance on middle aged women. Dance aerobics is a popular means of exercise in the urban population. This study evaluates the effects of
Dance Aerobics on cardiovascular endurance and body fat percentage on middle aged women. To ensure uniformity in the findings, Cooper Protocol, a standardized protocol for dance aerobics was followed, ensuring optimal exercise intensity and minimal musculo tendinous damage. 120 middle aged women divided in two groups were examined for VO2 max and body fat percentage. Group I comprised 60 women who were engaged in regular aerobic dance sessions for 6 months. Group II did not engage in any exertional physical activity. Unpaired ‘t’ test was used. P=0.001 considered significant. Aerobic dancers exhibited i) no significant difference in VO2 max (p=0.00201) ii) lower fat percentage (p=0.01462), indicating aerobics is highly effective in weight loss, but effects on cardiovascular endurance are not pronounced. Increasing intensity of existing protocol to achieve increased VO2 max may hasten musculo tendinous damage. This should be considered before an individual selects aerobic dancing as fitness activity.

Kin Jsier, et al., (2001) examined the effect of 8 weeks of step aerobics and aerobic dancing on blood lipids and lipoproteins. He conducted two months of physical fitness programme. Participants: Forty –five sedentary female college student volunteers randomly assigned to one of the three groups as step aerobics (n=15), aerobic dancing (n=15) and the control group (n=15). The step aerobics and aerobic dancing groups participated in sessions of 45 min per day, 3
days per week for 8 weeks with 50-70% of their heart rate reserve. Total cholesterol (TC), Triglycerides (TG), Low- Density Lipoprotein cholesterol (LDLC), the ratio of total cholesterol to high density lipoprotein cholesterol (TCHDL -C).

**RESULTS:** At the end of the 8 weeks period, a significant difference has been found between the step aerobics group and the control group and between the aerobic dancing group and the control group in TC levels ($F [2, 44] =8.33; P < 0.01$). A significant difference in HDL-C levels ($F [2, 44] =3.65, P < 0.05$) and TC: HDL-C ratio ($F [2, 44] =11, 56, P < 0.01$) has been found only between the step aerobics group and the control group. These results indicate that step aerobics training is an effective training mode for modifying lipid and lipoprotein profiles of female college-aged students.

**Kravitz, et al., (1993)** conducted a study on step aerobics, which was a modification of aerobic dance using stepping bench ranging height from 10.2-30.5 cms. A study was conducted to examine the physiological effects of eight weeks of step training with (N=12) and without (N=12) adding weights. The main effects of step training resulted in significant (P<.05) overall improvements in VO2 max (38.29 + 1.05 to 41.32 +0.95ml.Kg-1/min-1). Arm flexion strength (30.73+1.83 to 35.08 + 1.73N/m) Forearm flexion strength (26.89+1.13 to 29.29 + 1.14 N/M) and Forearm extension strength (28.13 +1.26 to 31.07 + 1.38 N/m).
Sasa Pantelic, et al., (2007) researched on the effects of a recreational aerobic exercise model on the functional abilities of women. This research included 59 women aged from 22 to 25, and 29 of which made up the experimental group, and 30, the control group. The effects of a recreational aerobic exercise model on the indicators and functional abilities were studied. The experimental model of the recreational aerobic exercise model was analyzed evaluated three times a week, over a period of three months, and the duration of each individual exercise was 60 minutes. The duration of the aerobic part was 35 minutes. The functional abilities were evaluated by means of the following parameters: (1) resting heart rate (the number of heart beats per minute); (2) systolic blood pressure (mmHg); (3) diastolic blood pressure (mmHg); (4) absolute oxygen uptake (l/min); (5) relative oxygen uptake (ml/kg/min). The basic descriptive statistic parameters were calculated for all of the results, and the difference between the initial and final measurements was determined by a canonical-discriminant analysis. The multivariate analysis of covariance (MANCOVA) and the univariate analysis of covariance (ANCOVA) were used to determine the achieved effects of the exercise. A statistically significant difference was found between the initial and final measurements regarding to the applied variables for the evaluation of functional abilities of the subjects belonging to the experimental group, while there were no statistically significant
differences found in the case of the subjects belonging to the control group. The results from the final measurement also indicated that the evaluated recreational aerobic exercise model had a positive effect on the functional abilities of the female subjects belonging to the experimental group \( (p = .00) \). This research supports the existing conclusions about the positive effects of recreational aerobic exercise, on the condition that it is evaluated with the appropriate intensity, length and duration.

**Tsimaras, et al., (2010)** conducted a study on the effects of a traditional dance training program on aerobic capacity and muscle strength of adults with hearing loss. Twenty-three adults with hearing loss were separated into 2 groups. Thirteen subjects (6 men, 7 women, mean age, 25.7 ± 3.9 years) constituting the intervention group, whereas 10 subjects (5 men, 5 women, mean age, 26.4 ± 5.9 years) forming the control group. Pre training and post training treadmill tests were performed to determine heart rate (HR peak), peak minute ventilation \(_{VE} \) peak), peak oxygen consumption \(_{VO2} \) peak, absolute and relative), and time to exhaust (min). Peak torque of hamstring and quadriceps muscles at angular velocities of 60\(^{\circ}\)/s, 180\(^{\circ}\)/s, and 300\(^{\circ}\)/s was also measured. The intervention group followed a 12-week traditional dance training program, whereas the control group received no training during this period. Repeated measures of multiple analyses of variance were used to test mean
differences between the values of both groups. A paired t-test was used to compare the values within each group prior and after program participation. A significance level of 0.05 was used for all tests. Following the 12-week training program, significant improvements in peak physiological parameters was seen in the intervention group for peak minute ventilation, peak oxygen consumption (both absolute and relative), time to exhaustion, and peak torque values between the 2 measurements (initial and final). No significant improvements in peak physiological parameters and peak torque were noticed in the control group. In conclusion, adults with hearing loss can improve their physical fitness levels with the application of a systematic and well-designed traditional dance training program.

Koutedakis Yiannis and Athanasios Jamurtas (2004) evaluated on the dancer as a performing athlete for physiological considerations. The physical demands placed on dancers from current choreography and performance schedules make their physiology and fitness just as important as skill development. However, even at the height of their professional careers, dancers’ aerobic power, muscular strength, muscular balance, bone and joint integrity are the ‘Achilles heels’ of the dance-only on selection and training system. This partly reflects the unfounded view, shared by sections of the dance world, that any exercise training that is not directly related to dance would diminish dancers’ aesthetic appearances. Given that performing dance
itself elicits only limited stimuli for positive fitness adaptations, it is not surprising that professional dancers often demonstrate values similar to those obtained from healthy sedentary individuals of comparable age in key fitness-related parameters. In contrast, recent data on male and female dancers revealed that supplementary exercise training can lead to improvements of such fitness parameters and reduce incidents of dance injuries, without interfering with the key artistic and aesthetic requirements. It seems, however, that strict selection and training regimes have succeeded in transforming dance to an activity practised by individuals who have selectively developed different flexibility characteristics compared with athletes. Body weight targets are normally met by low energy intakes, by female dance students and professional baller as reported to low consume below 70% and 80% of the recommended daily allowance of energy intake, respectively, while the female athlete ‘triad’ of disordered eating, amenorrhea and osteoporosis is now well recognized and is seen just commonly in dancers. An awareness of these factors will assist dancers and their teachers to improve training techniques, to employ effective injury prevention strategies and to determine better physical conditioning. However, any change in the traditional training regimes must be approached cautiously to ensure that the aesthetic content of the dance is not affected by new training techniques. Since physiological aspects of performing dance have been viewed primarily
in the context of ballet, further scientific research on all forms of
dance is required.

Studies related to Physical Variables

Amusa1, et al., (2011) conducted a study on health-related
physical fitness among rural primary school children in Tshannda,
South Africa. The socio-economic transformation in South Africa over
the previous decade may have created a less active lifestyle and a
decline in fitness among South African children. This study seeks to
present the data on the health-related physical fitness of the
Tshannda rural school children in grades 1 to 7 and to evaluate age
and gender differences in physical fitness among the Tshannda
children of which information is not yet available. The stature, body
mass and skinfolds of the children were measured and the Euro fit
test battery was used to assess the children’s physical and
performance fitness. Percentage body fats, fat mass and fat-free mass
were calculated. There was a progressive increase and improvement in
the performance values from grade level one to seven. In the physical
performance tests which require moving the body, power, and
strength, the boys generally performed higher than the girls. Girls
were superior to boys in the tests of flexibility. Body fat was higher in
girls than in boys on all grades and increases the advancement in
grades. The physical performance of sample measures increase the
grade levels and the boys have higher values than girls as well as
performing better in activities requiring physical exertion and expenditure of energy. In contrast, analysis the girls shows superiority in flexibility measures and accumulate more body fat than the boys. Physical fitness of these rural school children seems to be low, thus confirming the world wide decline in fitness levels of children.

Davis, et al., (2007) tested the effect of aerobic exercise training on executive function for overweight children. Executive function includes skills which are important for planning, organizing, problem solving, concentration, resisting impulses, and using strategies to achieve goals. The children in the high volume activity group (40 minutes per day, 5 days/week for 15 weeks) had significant improvement on an executive function test compared with the control group (no physical activity). Those in the low volume group (20 minutes per day, 5 days/week for 15 weeks) showed about half of that improvement. The researchers also performed brain scans and found that the children who were exercising appeared to have more neural activity in the frontal areas of their brain, an important area for executive function.

Kraemer et al. (2001) conducted a study on resistance training combined with bench-step aerobics which enhances women’s health profile. Thirty-five healthy, active women were randomly assigned to one of four groups that either a) performed 25 min of BSA
only (SA25); b) performed a combination of 25 min of BSA and a multiple-set upper and lower body resistance exercise program (SAR); c) performed 40 min of BSA only (SA 40; or d) served as a control group, only performing activities of daily living. Direct assessments for body composition, aerobic fitness, muscular strength, endurance, power, and cross sectional area were performed 1 wk before and after 12 wk of training. All training groups significantly improved peak VO (2) (3.7 to 5.3 mL O (2).kg (-1).min (-1), with the greatest improvement observed in the SAR group (P 0.05). Significant reductions in pre exercise heart rates (8-9 bpm) and body fat percent (5--6%) were observed in all training groups after training. Significant reductions in resting diastolic blood pressure was observed for the SAR and SA40 groups (6.7 and 5.8 mm Hg, respectively). Muscular strength and endurance improved significantly in the SAR group (21 and 11% respectively). All groups developed increased lower body power (11--14%), but the SAR group significantly improved upper body power (32%). Thigh muscle cross-sectional areas measured via magnetic resonance imaging (MRI) increased primarily for the SAR group. BSA is an exercise modality effective for improving physical fitness and body composition in healthy women. The addition to resistance exercise it enhances the total fitness profile by improving muscular performances, muscle morphology, and cardiovascular fitness greater by performing BSA alone. Therefore, the inclusion of both modalities
in an exercise program is most effective for improving total body fitness and woman's health profile.

Lewis (2005) had conducted a study to determine the effects of a home exercise program of combined aerobic and strength training fitness on a 10.5-year-old girl with Down syndrome (DS). Measurements included cardiovascular variables, strength, body composition, flexibility, and skill. The subject participated in a home exercise program: 30 to 60 minutes of moderate to high-intensity exercise, five to six days per week for six weeks. The cardiovascular variables monitored were heart rate, respiration rate, and oxygen consumption during a sub maximal treadmill stress test. Other measures included 10-repetition maximal strength of selected muscle groups, body mass index, flexibility, Gross Motor Scales of the Bruininks-Oseretsky Test of Motor Proficiency, and anaerobic muscle power. Improvements in sub maximal heart and respiration rates, aerobic performance, muscle strength and endurance, gross motor skills, and anaerobic power was observed for this subject. Body weight and flexibility was unchanged.

Obert, P. et al. (2001) had conducted a study on the effect of a 13 week aerobic training programme on the maximal power developed during a force velocity test in pre pubertal boys and girls. Boys and girls (10 – 11 yr), participating in physical activities, served as subjects. One group (M=9, F=8) participated in an extra one hour
aerobic training session twice a week for 13 weeks, while others (M=8; F=8) served as controls. A force velocity test (anaerobic test) was performed on a friction-loaded cycle ergometer. Experimental training consisting of one set of interval runs (intensity = 90 + % of HR max) and a continuous run (intensity = 75-80% of HR max). Maximal power increased significantly in the trained group even when muscle mass change was accounted for. The increase was due to mainly in force production because velocity was not altered. No changes were noted in the control group. It was concluded that aerobic training in prepubertal children actually altered the anaerobic performance factors of force and power production. Aerobic training in children influences anaerobic performances.

Sanja Mandaric (2001) studied on the effects of programmed exercising in music of female pupils. The research was done on the sample of 95 female seventh grade pupils at primary school "Jovan Jovanović Zmaj" in Kanjića. They were divided into three groups (two experimental groups and one control group). Especially programmed teaching of aerobic exercises in music according to "step" and "high-low" aerobics (which was the experimental factor) was conducted in experimental groups, while Physical Education Curriculum regulated by the Ministry of Education of Serbia was conducted in the control group. The effects of programmed exercise to music were followed in the following areas: the area of variables of
morphological characteristics (seven variables); the area of functional abilities (three variables) and the area of motor abilities (sixteen variables). The results of the research showed that programmed exercising in music according to the models of "step" and "high-low" aerobics had increased the improvement of morphological characteristics, functional and motor abilities of the seventh grade primary school female pupils, in comparison to the pupils from the control group. The greatest improvement in both models of aerobic exercise was noticed in the maximal oxygen uptake and variables from the area of general coordination and coordination in rhythm. Gained results of the research indicate that aerobic exercising in music and physical education teaching can be applied in practice, in order to increase exercises precisely and fulfill the aims and tasks of physical education.

Tsourlou, et al., (2006) examined the effectiveness of a 24-week aquatic training (AT) program, which included both aerobic and resistance components, on muscle strength (isometric and dynamic), flexibility, and functional mobility in healthy women over 60 years of age. Twenty-two subjects were assigned randomly to either an AT (n = 12) or a control (C, n = 10) group. Volunteers participated in a supervised shallow-water exercise program for 60 minutes a day, 3 days a week; the exercise program consisted of a 10-minute warm-up and stretching, 25 minutes of endurance-type exercise (dancing) at
80% of heart rate (HR) (max), 20 minutes of upper- and lower-body resistance exercises with specialized water-resistance equipment, and a 5-minute cool down. Maximal isometric torque of knee extensors (KEXT) and knee flexors (KFLEX) were evaluated by a Cybex Norm dynamometer, grip strength (HGR) was evaluated using a Jammer hydraulic dynamometer, and dynamic strength was evaluated via the 3 repetition maximum (3RM) test for chest press, knee extension, lateral pull down, and leg press. Jumping performance was evaluated using the squat jump (SJ), functional mobility with the timed up-and-go (TUG) test, and trunk flexion with the sit-and-reach test. Body composition was measured using the bio electrical impedance method. The AT induced significant improvements in KEXT (10.5%) and KFLEX (13.4%) peak torque, HGR strength (13%), 3RM (25.7-29.4%), SJ (24.6%), sit-and-reach (11.6%), and TUG (19.8%) performance. The AT group demonstrated a significant increase in lean body mass (3.4%). No significant changes in these variables were observed in C group. The results indicate that AT, with both aerobic and resistance components, is an alternative training method for the improvement in neuromuscular and functional fitness performance in healthy elderly women.

Viskić, et al., (2007) analyzed the impact of special programmed physical education including dance, aerobics and rhythmic gymnastics on the development of motor and functional
abilities and morphological characteristics on female fourth-grade high-schoolers in Zagreb. A total sample of 220 high-schoolers aged 16-18 years were divided into two groups: experimental group of 115 students attending the program composed of dance structures and aerobics, and control group of 105 students attending classic program of physical education. A set of 3 morphological variables, 6 motor variables and one functional variable was applied in both groups on three occasions during an academic year (initial, transient and final measurements). Two-factor analysis of variance (MANOVA repeated measure design) showed the experimental program; significantly influencing the development of coordination/agility and specific rhythm coordination, functional aerobic ability, repetitive and explosive strength and flexibility, along with significant reduction of over weight and adipose tissue. Study results clearly indicate that the existing programs of physical education should be revised and replaced by more appropriate ones.

Studies Related to Physiological Variables

**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 predance lactate concentrations between the first dance (Highland Fling, 1.4 +/-0.3 m M/L), the second dance (Sword dance, 2.3 +/- 0.8 m M/L), and the third dance (Sean Truibhas, 3.5 +/- 1.8 m M/L; F2,16 = 11.72, P < .01. This, couple with a significant rise in lactate concentration during the dances (F1, 8 = 76.75, P< .001), results in final post dance lactate concentration of 7.3 +/- 2.96 m M/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 on preparing for competitive performance in Highland dance.

Bethany E. Martyn-Stevens (A-F), (2012) conducted a study on the effects of a dance season on the physiological profile of collegiate female modern dancers. A collegiate modern dancer is a unique athlete because in addition to the physical demands of dance, she also has the artistic demands of creating and performing
for a season of showcases, or in some cases, multiple showcases. In preparing for her dance season in addition to her academic schedule, a collegiate modern dancer’s training includes rigorous daily technique classes and rehearsals which may alter her fitness level across time. To determine the effects of a dance season on the physiological profile of collegiate female modern dancers. Eighteen collegiate female modern dancers were measured for relative anaerobic power, fatigue index, upper body and lower body strength, aerobic capacity and body composition at both pre and post dance season. At post season, there were significant improvements in relative anaerobic power (pre 7.43 ± 1.01 W/kg, post 8.00 ± 0.78 W/kg), body weight (pre 57.80 ± 5.10, post 58.72 ± 5.08), and body composition (pre 18.60 ± 2.03 %, post 17.78 ± 2.49 %), and a significant increase in fatigue index (pre 33.38 ± 9.72 %, post 38.91 ± 7.49 %). There were no significant changes in relative upper and lower body strength or aerobic capacity. The demands of a collegiate dance season resulted in improved power and lean mass but greater anaerobic fatigue in these female modern dancers.

Eckerson and Anderson (2004) examined the physiological response to water aerobics. Heart rate (HR) and oxygen uptake (VO2) measured during water aerobics was compared to maximal values obtained during an incremental treadmill test to assess the energy demand and potential cardio respiratory training effects of EA. Sixteen
college age females served as subjects (mean +/- SD = 20.4 +/- 1.6 years). WA elicited a mean HR of 162 b.min \(^{-1}\) and a mean VO2 of 18.4 ml.kg\(^{-1}\) which represented 74\% of HR reverse, 82 \% of maximal HR, and 48 \% of VO2 max. Average caloric expenditure was 5.7 kcl.min\(^{-1}\). HR for WA consistent with guidelines established by the American College Of Sports Medicine for developing and maintaining CR fitness in healthy adults. However, the VO2 fell just below the recommended minimum threshold level. It was concluded that WA may provide an attractive alternative to traditional modes of exercise for improving CR fitness, however, HR measures may over estimate the metabolic intensity of the exercise.

García, et al., (2007) studied the Lipid and metabolic profiles in adolescents who are affected more by physical fitness than physical activity (AVENA) study. To determine whether the level of physical activity or physical fitness (I.e, aerobic) capacity and muscle strength) in Spanish adolescents influences lipid and metabolic profiles. From a total of 2859 Spanish adolescents (age 13.0-18.5 years) taking part in the AVENA (Alimentación y Valoración del Estado Nutricional en Adolescentes) study, 460 (248 male, 212 female) were randomly selected for blood analysis. Their level of physical activity was determined by questionnaire. Aerobic capacity was assessed using the Course-Navette test. Muscle strength was evaluated using manual dynamometry, the long jump test, and the flexed arm hang test. A
lipid-metabolic cardio vascular risk index was derived from the levels of triglycerides, low-density lipoprotein cholesterol (LDLC), high-density lipoprotein cholesterol (HDLC), and glucose. No relationship was found between the level of physical activity and lipid-metabolic index in either sex. In contrast, there was an inverse relationship between the lipid-metabolic index and aerobic capacity in males (P=.003) after adjustment for physical activity level and muscle strength. In females, a favorable lipid metabolic index was as found with greater muscle strength (P=.048) after adjustment in aerobic capacity. These results indicate that, in adolescents, physical fitness, and not physical activity, is related to lipid and metabolic cardiovascular risk. Higher aerobic capacity in males and greater muscle strength in females were as found with lower lipid and metabolic risk factors for cardiovascular disease.

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 (VO2 max) 38.7 (SD 3.6) ml.kg-1.min-1, mean maximal heart rate (HR max) 183 (SD 8) beats.min-1; group B, n = 10, VO2 max 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 (cardio phase) and a cool-down. The cardio phase 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) % HR max in group A and 75 (step) and 79 (floor) % HR max in group B; during the moderate classes, 84 (step) and 80 (floor) % HR max in group A and 82 (step) and 83 (floor) % HR max in group B, and during the heavy classes 89 (step and floor) % HR max in group A and 88 (step) and 92 (floor) % HR max in group B. Differences in heart rate and % HR max was not statistically significant between the groups. However, differences in heart rate and % HR max between the intensities (light vs moderate, moderate vs heavy and light vs heavy) were significant with in 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.

Savvas, et al., (2008) investigated the adaptations of a water-based training program as well as the detraining and retraining effects on physiological parameters in patients with coronary artery
disease (CAD). Methods: Twenty-one patients were separated in an exercise group (n = 11) and a control group (n = 10). The exercise group followed three periods: training, detraining and retraining. Each period lasted 4 months. During the training and the retraining periods, the patients performed four sessions of water exercise (not swimming) per week. Results: The water-based program was well accepted and no adverse effects were observed. The exercise group improved (p < 0.05) their stress-test time (+11.8%), VO2 peak (+8.4%) and total body strength (+12.2%) after the training period; detraining tended to reverse these positive adaptations Resumption of training increased the beneficial effects obtained after the initial training period (exercise stress: +4.5%; VO2 peak: +6.6%; total strength: +7.0%). The patients in the control group did not show any significant alterations Throughout the study. Conclusion: Water-based exercise is safe and induces positive physiological and muscular adaptations in low-risk patients with CAD.

Selvalakshmi (2007) conducted a study on effect of varied aerobic training program on obese women working in it companies for the purpose of the study aerobic refers to a variety of exercise that stimulate heart and lung activity for a time period sufficiently long to produce beneficial changes in the body (Cooper, 1970). Aerobic is a system of exercises designed to promote the supply and use of oxygen in the body. In this study, the investigator is interested to carry out
the experiment on two randomized groups of obese women working in IT companies and their effects on cardio respiratory functions. For this study, the obese women were grouped into three namely, control, floor aerobic and step aerobic group. The collected data on the cardio respiratory parameters prior to and after 12 weeks of varied aerobics training were statistically analyzed using Analysis of covariance (ANCOVA) as recommended by Clarke and Clarke (1972) Best and Khan (1986). And result on vital capacity showed significant improvement due to varied aerobic exercises, where as no significant improvement in resting heart rate.

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, VO2 max 44.4 +/- 6.1 m L x kg -1 x min -1) performed an incremental treadmill test to determine VO2 peak, 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 tracksuit with loads placed in pockets close to the legs and arms and another with out overload. The appendicular overload (10 % of body mass) significantly increased the exercise intensity from 84.5% to 89.8% of HR max corresponding to
68.9 % and 78.3 % of VO2 peak, 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 mL x kg⁻¹ x min⁻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.

**Volpe SL, et al., (2008)** investigated the effect of diet alone (D), exercise alone (E), and a combination of diet and exercise (DE) on body weight body composition, energy intake, blood pressure, serum lipid and leptin levels, and fitness levels in mildly obese sedentary women and men. The three interventions were compared in a randomized longitudinal study design. The exercise programs were supervised for six months, after which participants in E and DE were provided with exercise equipment to take home. 90 adult overweight women and men (age: 44.2 +/- 7.2 years; BMI = 30.5 +/- 2.7 kg/m²). Body weight, body composition, waist and hip circumferences, blood pressure, serum lipid levels, and fitness levels were evaluated at 0, 3, 6, 9, and 12 months. Serum leptin concentrations were measured at 0 and 6 months only. At 6 and 9 months in women, and 9 months in men, DE demonstrated a significant loss of body weight compared to both D and E (p < 0.05). Serum leptin levels significantly decreased from baseline to 6 months in women in D (p = 0.05) and DE
(p = 0.0003) and men in E (p = 0.038). At one year, no significant differences existed among groups in any of the measures. A combination of diet and exercise resulted in a significant decrease in body weight in women and men; but this decrease was not maintained at one year follow-up. Serum leptin concentrations showed significant within-group decreases, but were not different among groups. A supervised diet and exercise program is effective for weight loss; however, once intensive participant-investigator and participant-participant contact is discontinued, weight regain ensures.

**Studies Related to Psychological Variables**

Anies (1998) studied the effect of exercise on mood states of sedentary females. 66 female students of All Saints College, Trivandrum participated in this study. Mood states was first induced by POMS questionnaire and responses were collected prior to the training programme and the same questionnaire was administered after the exercise programme of a total of 12 sessions extending over a period of 4 weeks having 3 sessions per week with a duration of 45 minutes. A mood state was measured using POMS questionnaire before and after exercise. Results showed significant difference between pretest and posttest where the sedentary female have positive influence upon their mood states due to the exercise programme given.
Barnow, S., et al., (2009) reported that the cognitive theory of personality disorders hypothesizes that the emotional day’s regulation and interpersonal problems in individuals with borderline personality disorder (BPD) are, at least partially, caused by dysfunctional cognitive schemas. These schemas lead to biased evaluation of environmental and interpersonal stimuli. This study examined the interpersonal evaluations of individuals with BPD, depressive and healthy control participants with the thin-slice judgments paradigm. Participants were asked to evaluate six persons in six film clips, which showed these persons for 10s, during which these persons entered a room and took a seat. Interpersonal style of the BPD group was investigated with the Inventory of Interpersonal Problems (IIP-C) questionnaire. Individuals with BPD judged the persons as being more negative and aggressive and less positive than the healthy participants, and more aggressive than the depressive individuals. In addition, individuals with BPD reported more extreme interpersonal behavior relative to the controls. The findings indicate an Aggressive evaluation bias and elevated levels of interpersonal problems in individuals with BPD as suggested in the cognitive theory.

Berger and Motl (2000) conducted a study on recent 25 years reviews of related research literature to the effect of exercise on Profile of Mood States (POMS). They concluded that there is
unequivocal support for the mood enhancing effects of exercise, specifically on improved vigor and reduced tension, depression, anger, confusion and fatigue. With respect to exercise intensity, the authors recommend that unless a participant prefers low or high exercise intensity, optimal conditions for mood changes occur at a moderate intensity level. In summary, exercise, in particular moderate intensity aerobic exercise, reduced negative mood and improved positive mood state.

Kercher A, and Rapee RM.(2009) study evaluates a pathway for depressive risk that integrates cognitive diathesis-stress and stress generation theories, following Hank in and Abramson's (2001, Journal of Clinical Child and Adolescent Psychology, 31(4), 491-504) elaborated cognitive-diathesis transactional stress model. In this model, young adolescents with initial depressive symptoms were hypothesised to experience later stressors that were at least partly dependent on their behaviour. The interaction of cognitive vulnerability, a tendency to make depressogenic attributions and to ruminate, with these dependent stressors was then hypothesised to predict depressive symptoms after 6 months. This model was supported in a sample of 756 young adolescents, with cognitive style and dependent stressors partly mediating the relationship between initial and subsequent depressive symptoms. Cognitive vulnerability was also linked with an increased likelihood of dependent stressors.
Mullen R, Lane A, and Hanton S. (2009) examined the intensity and direction of the competitive state anxiety response in collegiate athletes as a function of four different coping styles: high-anxious, defensive high-anxious, low-anxious and repressors. Specifically, the study predicted that repressors would interpret competitive state anxiety symptoms as more facilitative compared to high-anxious, defensive high-anxious, and low-anxious performers. Separate Multivariate Analyses of Variance (MANOVA) were performed on the intensity and direction sub scales of the modified Competitive State Anxiety Inventory-2 (CSAI-2). A significant main effect was identified for trait worry revealing that low trait anxious athletes reported lower intensities of cognitive and somatic anxiety and higher self-confidence and interpreted these as more facilitative than high trait anxious athletes. The prediction that performers with a repressive coping style would interpret state anxiety symptoms as more facilitative than performers with non-repressive coping styles was not supported.

Stine-Morrow EA, et al., (2008) studied on cognitive training have suggested that the effects of experience are narrow in augmenting or maintaining cognitive abilities, while correlational studies report a wide range of benefits of an engaged life style, including increased longevity, resistance to dementia, and enhanced cognitive flexibility. The latter class of evidence is ambiguous because
it is possible that it is simply the case that those with relatively better cognitive vitality seek out and maintain a wider range of activities. The authors report data from a field experiment in which older adults were randomly assigned to participate in a program intended to operationalize an engaged life style, built on a team-based competition in ill-defined problem solving. Relative to controls experimental participants showed positive change in a composite measure of fluid ability from pretest to posttest. This study, thus, provides experimental evidence for the pro position that engagement, in the absence of specific ability training, can mitigate age-related cognitive declines in fluid ability.

**Stratton (1990)** conducted a study to examine changes in mood states of college cross country runners across a competitive season. Also compared the mood state profiles of the men’s team and the women’s team. The POMS questionnaire was administered to the athletes every other week on Wednesday afternoon prior to practice throughout the season. Significant variations were identified for both the teams. Result reveals that the fatigue score for the females was higher than that for the males.

**VanderGucht, E., et al., (2009)** examined depressogenic psychological processes and reward responsivity in relation to different mood episodes (mania, depression, remission) and bipolar symptomatology. One hundred and seven individuals with bipolar
disorder (34 in a manic/hypomaniac or mixed affective state; 30 in a depressed state and 43 who were euthymic) and 41 healthy controls were interviewed with Structured Clinical Interview for DSM-IV and completed a battery of self-rated and experimental measures assessing negative cognitive styles, coping response to negative affect, self-esteem stability and reward responsiveness. Individuals in all episodes differed from controls on most depression-related and reward responsivity measures. However, correlation analyses revealed clear relationships between negative cognitive styles and depressive symptoms, and reward responsivity and manic symptoms. Separate psychological processes are implicated in depression and mania, but cognitive vulnerability to depression is evident even in patients who are euthymic.

Von Guenthner S. and Hammermeister J. (2007) explored the relationship between wellness and athletic performance, this study assessed the link between wellness, as defined by a high score on five wellness dimensions of emotional, social, spiritual, intellectual, and physical well-being, with psychological variables thought to be related to athletic performance as measured by athletes’ self-report of specific athletic coping skills. 142 collegiate athletes completed a survey composed of the Optimal Living Profile to measure wellness dimensions and the Athletic Coping Skills Inventory to measure specific psychological variables. Analysis indicated that athletes
scoring higher on the dimensions of wellness also scored significantly higher on athletic coping skills. Specifically, male athletes who scored higher on wellness also reported higher scores on coach ability, concentration, goal setting/mental preparation, and peaking under pressure, and female athletes who scored higher on wellness also reported higher scores in coping with adversity, coach ability, concentration, goal setting/mental preparation, and freedom from worry. Various dimensions of wellness seem related to better performance by involving the athletic coping skills of inter collegiate athletes. Implications for coaches and sport psychologists are also discussed.

Wininger (2002) examined the anxiolytic (anxiety reducing) effects of exercise for elderly women engaging in a single bout of aqua aerobics. Volunteers (N=29) completed questionnaires immediately before and after participating in an aqua aerobics class. The average age of participants was 66.4yr. A brief form of Spiel berger’s State Anxiety Inventory and a questionnaire on demographic items were administered prior to engagement in exercise, and the brief form of the State Anxiety Inventory was administered again immediately after the exercise session. There was a significant difference on a t test between participants' ratings of anxiety before exercise (M = 16.8) compared to after exercise (M= 13.9); participants' ratings of state
anxiety were somewhat lower after exercising. Weaknesses of the present study and suggestions for research are presented.

Studies Related to Biochemical Variables

Katzel, et al., (1997) documented the sequential effects of aerobic exercise training and weight loss on risk factors for coronary disease in healthy, obese, middle aged men and older men. The effects of sequential interventions of 9 month of aerobic exercise training (AEX) followed by weight loss (WL) with continued AEX (AEX+WL) in cardiac risk factors in 21 obese middle aged and older men were examined. The results indicated that AEX increases VO2 max of these men by 14% (p<0.001) with no significant change in weight. Also AEX did not improve BP or oral glucose tolerance and had no significant effect on lipid concentrations. During the AEX + WL intervention, 21 men lost 8.1 + 0.6 kg compared with AEX, AEX + WL group decreased glucose and insulin responses during the oral glucose tolerance test by 8% (p<0.05) and 30 % (p<0.01) respectively. AEX + WL reduced plasma triglycerides by 17 % (p<0.05) and LDL-C by 8 % (p<0.01) and increases HDL-C by 11 % (p < 0.01). The sequential interventions resulted in a 20 % decreased in the LDL –C /HDL-C ratio. The results denoted that AEX + WL had a more substantial impact than AEX alone on glucose tolerance and lipoprotein concentrations.

Kristiansen, et al., (2000) subjected eight untrained subjects to endurance training with one thigh for three weeks using a
knee-extensor ergometer. They were then subjected to two-legged glycogen depleting exercise and were given carbohydrate free meal there after to keep muscle glycogen concentration low. The next morning, dynamic knee extensions with both the thighs simultaneously at 60, 80 and until exhaustion at 100 per cent of each thigh peak work load was performed. Glucose uptake was similar in both thighs during exercise at 60 per cent of the thigh peak work load. At the end of 80 and 100 percent of peak work load, glucose uptake was on an average 33 and 22 percent higher, respectively, in trained compared with untrained muscle. Training increased the muscle content of glucose transporters (GLUT-4) by 66 per cent. At exhaustion, glucose extraction correlated significantly with total muscle GLUT-4 protein. Thus, when working at a high load with low glycogen concentrations, muscle glucose uptake was significantly higher in trained than in untrained muscle. This may be due to the higher GLUT-4 protein concentration in trained muscle.

Leaksonen, et al., (2000) conducted a study on the potential importance of favourable changes in the lipid profile produced by aerobic exercise; training-induced lipid profile changes in are their osclerosis-prone type 1 diabetes mellitus (DM) have not there fore been adequately addressed. We assessed the effect of a 12 to 16 week-aerobic (Untrained, N=29) groups after baseline measurements. Training consisted of 30-60 min. moderate intensity
running 3-5 times a week for 12 -16 weeks. For the 42 men finishing the study, peak oxygen consumption (VO2 peak) increased significantly only in the trained group. Total and low density lipoprotein (LDL)/apoA-1 ratio increased in the trained group. HDL and apoA-1 increased in both the groups. The exercise programme brought about improvements in the HDL/LDL and apoA-1/ apo B ratio and apo B and triglyceride levels when comparing the relative (%) changes in the trained versus control group. In the trained group, men with HDL/LDL ratios below the group median at baseline showed even more favorable changes in their lipid profile than those with higher initial HDL / LDL ratios. Body mass index, % body fat and hemoglobin A 1 c did not change during the training period in either group. Endurance training improved the lipid profile in already physically active type 1 diabetic men, independently of effects on body composition or glycemic control. The most favorable changes were in patients with low base line HDFL/ LDL ratios, like the group with the greatest benefit to be gained by such changes.

Leon and Sanchez (2001) determined the effects of aerobics exercise training (AET) on blood lipids and assess dose-response relationships and diet interactions. We reviewed papers published over the past three decades pertaining to intervention trials on the effects of > or = 12 weeks of AET on blood lipids and lipoprotein outcomes in adult men and women. Including 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 programmes; and the responses to training body weight, VO2 (Max), and blood total cholesterol (TC) and low density lipoprotein-cholesterol (LDL-C), high density lipoprotein cholesterol (HDL-C) and triglyceride (TG) of the identified 51 studies, 28 were randomized controlled trials and AET was generally performed as a moderate to hard intensity, with weekly energy expenditures ranging from 2090 to >20,000kJ. A marked inconsistency was observed in the 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 failed 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 = 0.462, but no significant associations were found with age, sex, weekly volume of exercise, or with exercise-induced changes in body weight or VO2 (Max). Conclusions: Moderate to hard – intensity AET in consistently results in an improvement in the blood lipid profile, with the data insufficient to establish dose-response relationships.
Le Mura and Duvillard (2005) say the purpose of this study was to evaluate the effects of various modes of training on the time-course of changes in lipoprotein-lipid profiles in the blood. Cardiovascular fitness and body composition after 16 weeks of training and 6 weeks of detraining in young women. A group of 48 sedentary but healthy women (mean age 20.4 (SD1) years) were matched and randomly placed into a control group (CG, n=12), an aerobic training (XTG, n=12). The ATG, RTG and XTG trained for 16 weeks and were monitored for changes in blood concentrations of lipoprotein-lipids, cardiovascular fitness, body composition, and dietary composition throughout a 16 week period of training and 6 weeks of detraining. The ATG significantly reduced blood concentrations of triglycerides (TRI) (p<0.05) and significantly increased blood concentrations of high-density lipoprotein-cholesterol (HDL-C) after 16 weeks of training. The correlation between percentage fat and HDL-C was 0.63 (p<0.05), which explained 40% of the variation in HDL-C, while the correlation between maximal oxygen uptake (Vo2 max) and HDL-C was 0.48 (P<0.05), which explained 23% of the variation in HDL-C. The ATG increased percentage body fat by 13% (P<0.05) after 16 weeks. Each of the alterations in the ATG had disappeared after the 6 week detraining period. The concentration of total cholesterol (TC), TRI, HDL-C and low density lipoprotein-cholesterol in the blood did not change during the study in RTG, XTG
and CG. The RTG increased upper and lower body strength by 29% (P<0.001) and 38% respectively. The 6 week detraining strength values obtained in RTG were significantly greater than those obtained at baseline. The RTG, XTG and CG did not demonstrate any significant changes in either VO$_2$ max, or body composition during the training and detraining periods. The results of this study suggest that aerobic-type exercise improves lipoprotein-lipid profiles, cardio respiratory fitness and body composition in healthy, young women, while resistance training significantly improved upper and lower body strength only.

Taralov, et al., (2000) found that the physical activity had a beneficial effect on the serum lipid profile in adolescent and mature human. For this study 876 highly trained athletes (559 boys and 317 girls) with their mean age, weight and duration of training, 14.01 years, 56.24 kg, and 3.52 years respectively were used. The control group consisted of 357 untrained subjects (171 boys and 186 girls) with mean age and weight 14.58 years and 57.75 kg, respectively. The athletes were divided into seven subgroups according to the sport practiced with 105 athletes, 107 swimmers, 233 rowers and 225 wrestlers, boxers and judos, 47 weight lifters, 92 from members of various team sports and 67 from other sports. Venous blood samples were drawn from the cubital vein and the concentrations of serum total cholesterol, HDL-cholesterol and triglycerides were measured.
The results of the study indicated that a) trained pubescents had lower serum total cholesterol than untrained boys and girls of the same age; b) trained pubescent boys had lower serum total cholesterol than trained pubescent girls; c) the level of serum triglycerides was not relevant to the type of physical exercise in pubescence; d) long-term sport practicing was not able to decrease serum HDL-cholesterol levels in both sexes; e) sport affected serum total cholesterol to a greater degree than sex in pubescence.

Wilund and Ferrell (2005) sought to determine if a cholesterol ester transfer protein (CETP) gene locus variation contributes to the variability in the responses of plasma high-density lipoprotein-cholesterol (HDL-C) and its sub fractions to endurance exercise training. Middle-to older-aged men and women with at least 1 lipoprotein-lipid risk factor underwent 6 months of endurance exercise training while on a low-fat diet. Plasma lipid levels were measured by nuclear magnetic resonance (NMR). Initial age, body composition, lipoprotein-lipid profiles, and VO(2)max did not differ between the 2 CETP genotype groups (B1B1, n=16; B1B2, n=14). With exercise training VO(2)max increased, and body weight, total body fat, and computed tomographic (CT) intra-abdominal visceral fat decreased similarly in both CETP genotype groups. Plasma total cholesterol and low density lipoprotein-cholesterol (LDL-C) levels did not change significantly with training in either genotype group.
HDL(2NMR)-C levels increased with exercise training in CETP B1B1 (P<0.05), but did not change with training in CETP B1B1 persons and HDL(4NMR)-C levels tended to increase with training somewhat more in CETP B1B2 individuals, but these differences were not significant. HDL (5NMR)-C levels increased similarly with exercise training in the 2 groups. The integrated HDL (3-5NMR)-C levels increased with exercise training in CETP B1B1 (P<0.05), but did not change in CETP B1B1 genotype individuals. A polipoptotein E (APO E) or lipoprotein lipase (LPL) P vull genotype did not associate with HDL-C sub fraction changes with training. Thus, CETP genotype may contribute to the inter individual differences in plasma HDL-C sub fraction changes occurring with endurance exercise training in sedentary middle-to older-aged men and women.