CHAPTER II
REVIEW OF RELATED LITERATURE

A study of the relevant literature is an essential step to get a complete picture of what has been done and said with regard to the problem under study, such a review brings about a deep insight and a clear perspective of the overall field. The review provides us with an opportunity of gaining right into the methods, measures, subjects and approaches employed by other research workers. Study of related literatures implies locating reading evaluating reports of research as well as reports of casual observation and opinion that are related to the individual planned research project.

Studies on Yogic Training

Madanmohan et.al,35 studied the effect of six weeks yoga training on weight loss following step test, respiratory pressures, hand grip strength and handgrip endurance in young healthy subjects. Out of 46 healthy subjects (30 males and 16 females, aged17–20 yr), 23 motivated subjects (15 male and 8 female) were given yoga training and the remaining 23 subjects served as controls. Weight loss following Harvard step test (an index of sweat loss), maximum inspirit or pressure, maximum expiratory pressure, 40 mm endurance, handgrip strength and handgrip endurance were determined before and after the six week study period. In the yoga group, weight loss in response to Harvard step test was 64±30 g after yoga training as compared to 161±133 g before the training and the difference was significant (n = 15 male subjects<0.01). In contrast, weight loss following step test was not significantly different in the control group at the end of the study period. Yoga training produced a marked increase in respiratory pressures and endurance in 40mm Hg test in both male and female subjects (P<0.05 for all comparisons).In conclusion, the present study demonstrates attenuation of the sweating response to step test by yoga training. Further, yoga training for a short period of six weeks can produce significant improvements in respiratory muscle strength and endurance.

Raghu raj et.al,\textsuperscript{36} conducted study to determine whether breathing through a particular nostril has a lateralized effect on hand grip strength. 130 right hands dominant, school children between 11 and 18 yrs of age were randomly assigned to 5 groups. Each group had a specific yoga practice in addition to the regular program for a 10 days yoga camp. The practices were: (1) right, (2) left, (3) alternate- nostril breathing (4) breath awareness and (5) practice of mudras. Hand grip strength of both hands was assessed initially and at the end of 10 days for all 5 groups. The right, left- and alternate- nostril breathing groups had a significant increase in grip strength of both hands, ranging from 4.1% to 6.5%, at the end of the camp though without any lateralization effect. The breath awareness and mudra groups showed no change. Hence the present results suggest that yoga breathing through a particular nostril, or through alternate nostrils increases hand grip strength of both hands without lateralization.

Tran et.al\textsuperscript{37} studied the effects of hatha yoga practice on the health-related aspects of physical fitness. Ten healthy, untrained volunteers (nine females and one male), selected ranging in age from 18-27 years. The health-related physical fitness variables are muscular strength and endurance, flexibility, cardio respiratory fitness and body composition selected. Subjects were required to attend a minimum of two yoga classes per week for a total of 8 weeks. Each yoga session consisted of 10 minutes of pranayamas (breath-control exercises), 15 minutes of dynamic warm-up exercises, 50 minutes of asanas (yoga postures), and 10 minutes of supine relaxation in savasana (corpse pose). The subjects were evaluated before and after the 8-week training program. Isokinetic muscular strength for elbow extension, elbow flexion, and knee extension increased by 31%, 19%, and 28% respectively, whereas isometric muscular endurance for knee flexion increased 57%. Ankle flexibility, shoulder elevation, trunk extension, and trunk flexion were also increased relatively there was increase in maximal oxygen uptake.


Chen et.al.\textsuperscript{38} studied the effects of yoga exercise intervention on health related physical fitness in school-age asthmatic children. 31 voluntary children (exercise group 16; control group 15) aged 7 to 12 years were purposively sampled from one public elementary school in Taipei County. The yoga exercise program was practiced by the exercise group three times per week for a consecutive 7 week period. Each 60-minute yoga session included 10 minutes of warm-up and breathing exercises, 40 minutes of yoga postures, and 10 minutes of cool down exercises. Fitness scores were assessed at pre-exercise (baseline) and at the seventh and ninth week after intervention completion. A total of 31 subjects (exercise group 16; control group 15) completed follow-up. There was improved BMI, flexibility, muscular strength, and cardiopulmonary fitness after yoga practice among yoga group, where as no changes were noticed among control group subjects.

Venkatareddy et.al.\textsuperscript{39} studied the effect of yoga on weight and fat fold thickness among obese women. 30 obese woman of age 19-53, categorized into two groups, as per body mass index (BMI), were exposed to one-hour practice of asanas and pranayama in the morning for the period of 90 days. A significant reduction in BMI was seen in both groups. In group I (BMI greater than 35) the reduction was greater as compared to group II (BMI 25-35). Lean body mass (LBM), however, did not show significant change in both the groups.

John Walsakom\textsuperscript{40} evaluated the response of selected asanas on balance, flexibility, muscular endurance and reaction time among school boys. Thirty healthy, untrained school boys were selected from kalapet in Pondicherry and their age ranged from 10 to 15 years. The subjects were equally divided into two groups namely control and experimental group. The experimental group underwent selected asanas practice for one hour duration for ten weeks. Balance was measured using by stoke stand, flexibility was measured with the reliable equipment sit and reach box.


Muscular endurance was measured using by bent knee sit ups and reaction time was measured using by nelson hand stick. The results of pre-test and post-test were compared by using Analysis of Covariance (ANCOVA). The results revealed that Balance, flexibility, muscular endurance variables were significantly improved after practice of asanas.

Madanmohan et al.\textsuperscript{41} assessed the effect of yoga training on reaction time, respiratory endurance and muscular strength. Twenty seven male medical students were randomly selected from Jawaharlal institute of postgraduate medical education and research in Pondicherry and their aged from 18 to 21 years. They were given yoga training on 12 weeks of 30 minute for six days. Muscular strength was measured using by hand grip dynamometer. The results of pre-test and post-test were compared by using t ratio test. There was significant improvement on reaction time, respiratory endurance and muscular strength among male students after the intervention.

Sugumar\textsuperscript{42} study was framed find out the effect of yogic practices on body composition among the college men students. Thirty healthy, untrained male subjects were selected from various Departments of Gandhigram Rural Institute, Deemed University, Gandhigram, Dindigual and their age ranged from 18 to 25 years. The subjects were equally divided into two groups namely the control and the experimental group. The experimental group underwent selected asanas and pranayama for five days per week for six weeks. Control group did not undergo any training programme rather than their routine work. Body composition was measured by using BIA method in the three sites. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. Finding of body composition shows significant improvement due to the six weeks yogic practice when compared to the control group.


Bharatha priya and Gopinath\textsuperscript{43} studied the effect of yogic practice on flexibility among school boys. Forty subjects were selected from A.R.R Matriculation higher secondary school and their age ranged from 15 to 17 years. The subjects were divided into two groups namely the control and the experimental group. The experimental group underwent selected asanas and pranayama for five days per week for twelve weeks. Control group did not undergo any training programme rather than their routine work. Flexibility was measured by using sit and reach box. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. Finding of flexibility shows significant improvement due to the twelve weeks yogic practice when compared to the control group.

Komathi and Kalimuthu\textsuperscript{44} study was framed find out the effect of yogic practices on abdominal strength among school boys. Forty subjects were selected from A.R.R Matriculation higher secondary school and their age ranged from 15 to 17 years. The subjects were divided into two groups namely the control and the experimental group. The experimental group underwent selected asanas and pranayama for five days per week for twelve weeks. Control group did not undergo any training programme rather than their routine work. The abdominal strength was measured by using sit ups. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. Finding of abdominal strength shows significant improvement due to the twelve weeks yogic practice when compared to the control group.

Manimakalai and Chitra\textsuperscript{45} studied the effect of yogasanas practice on flexibility among university women. Thirty healthy, untrained female subjects were selected from Annamalai University in various departments and their age ranged from 18 to 25 years. The subjects were divided into two groups namely the control and the experimental group. The experimental group underwent selected asanas for five days per week for eight weeks. Control group did not undergo any training

programme rather than their routine work. Flexibility was measured by using sit and reach box. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. Finding of flexibility shows significant improvement due to the eight weeks yogic practice when compared to the control group.

Rajkumar et.al\textsuperscript{46} found out the effect of yogic practices for weight control for obese men students. Thirty two obese men students were selected from Pavendhar Bharathidasan institute of information technology, Tiruchirapalli and their aged from 17 to 21. The subjects were divided into two groups namely the control and the experimental group. The experimental group underwent selected yogic practices for eight weeks. Control group did not undergo any training programme rather than their routine work. All the two groups were tested on selected criterion variables such as body weight measured using by weighing machine, forearm and thigh circumference measured using by steel measuring tap and body composition measure using by skin fold caliper of biceps and triceps. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. The yogic practices groups significantly improved body weight, forearm and thigh circumference and body composition when compared to the control group.

Selvakumar, Chandrasekar and Pushparaj\textsuperscript{47} conducted the effect of selected yogic practices on cardio vascular endurance of college students. Sixty male subjects were selected from Thiagarajar College, Madurai and their age ranged from 18 to 20 years. The subjects were divided into two groups namely the control and the experimental group. The experimental group underwent selected asanas and pranayama practice weekly five classes for twelve weeks. Control group did not undergo any training programme rather than their routine work. Cardio vascular endurance was measured through field test using by one mile run and walk. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. Finding of cardio

vascular endurance shows significant improvement due to the practices of yoga when compared to the control group.

Sokkanathan and Selvakumar\textsuperscript{48} studied effect of selected yogic practice on muscular endurance of school children. Sixty male subjects were selected from Madurai District Matriculation Higher secondary school, Madurai and their age ranged from 14 to 15 years. The subjects were divided into two groups namely the control and the experimental group. The experimental group underwent selected asanas and pranayama practice weekly five classes for twelve weeks. Control group did not undergo any training programme rather than their routine work. Muscular endurance was measured through field tests using by bent knee sit ups. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. The yogic practices groups significantly improved muscular endurance when compared to the control group.

Sreenimurugan, Selvakumar and Jeyaveerapandian\textsuperscript{49} studied effect of selected yogic practices on body composition of college students. Sixty male subjects were selected from Madurai District College students, Madurai and their age ranged from 18 to 21 years. The subjects were equally divided into two groups namely the control and the experimental group. The experimental group underwent selected asanas and pranayama weekly five classes for twelve weeks. Control group did not undergo any training programme rather than their routine work. Body composition was measured using by skin fold caliper. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. The yogic practices groups significantly improved body composition when compared to the control group.


Sekar babu and Kulothugan\textsuperscript{50} studied the effect of yogic practices on selected physiological variables of men hockey players. Thirty hockey men players were selected from Annamalai University, Chidambaram and their age ranged from 18 to 25 years. The subjects were divided into two groups namely the control and the experimental group. The experimental group underwent forty five minutes selected asanas and pranayama practice five classes per week for eight weeks. Control group did not undergo any training programme rather than their routine work. Cardiorespiratory endurance was measured by using Cooper,s twelve minutes run and walk test, however the breath hold time was measured by the standard stop watch and resting pulse rate measured by using stethoscope. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. The yogic practices groups significantly improved Cardiorespiratory endurance, breath hold time and significantly decreased resting pulse rate when compared to the control group.

Sultana\textsuperscript{51} studied the effects of yoga practice on dominate hand grip strength of female students. Forty female subjects were selected from various Departments in Pondicherry University and their age ranged from 18 to 25 years. The subjects were divided into four groups’ namely Right nostril breathing group (Asanas and Suriya Bhedana), Left nostril (Asanas and Chandra Bhedana), Alternate nostril breathing group (Asanas and Nadisudhi) and control group. The experimental group underwent selected asanas and pranayama practice for ten days. Control group did not undergo any training programme rather than their routine work. Hand grip strength was measured through hand grip dynamometer. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. The yogic practices three groups significantly improved hand grip strength, Alternate nostril breathing group ( Asanas and Nadisudhi) is better improved compared than other groups.


Studies on Aerobic Training

Wang et.al\textsuperscript{52} studied the effects of aquatic exercise on physical fitness (flexibility, strength and aerobic fitness), self-reported physical functioning and pain in adults with osteoarthritis of the hip or knee. Two-group randomized controlled trial with a convenience sample was used. Participants were recruited from community sources and randomly assigned to a 12-weeks aquatic programme and a non-exercise control condition. Data for 38 participants were collected at baseline, week 6, and week 12 during 2003 and 2004. Instruments were a standard plastic goniometer, a hand held dynamometer, the 6-minute walk test, the multidimensional Health Assessment Questionnaire, and a visual analogue scale for pain. Repeated measures analysis of variance showed that aquatic exercise statistically significantly improved knee and hip flexibility, strength and aerobic fitness, but had no effect on self-reported physical functioning and pain.

Takeshima et.al\textsuperscript{53} studied the effect of concurrent aerobic and resistance circuit exercise training on fitness in older adults. Thirty-five volunteers were randomly divided into two groups [programmed accommodating circuit exercise group (PG) 8 men and 10 women, 68.3 (4.9) years, and non-exercise control group 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 programmed accommodating circuit exercise. (Moderate intensity hydraulic-resistance exercise and aerobic movements at 70% of peak heart rate) followed by 10 min cool-down exercise. programmed accommodating circuit exercise increased oxygen uptake. Muscular strength evaluated by a hydraulic-resistance exercise machine increased at low to high resistance dial settings for knee extension, knee flexion, back extension and flexion, chest pull and press shoulder press and pull and leg press Body fat (sum of three skin folds) decreased and high-density lipoprotein cholesterol (HDLC) increased for PG. There were no changes in any variables for control group. These results indicate that programmed accommodating circuit exercise training


incorporating aerobic exercise and hydraulic-resistance exercise elicits significant improvements in cardio respiratory fitness, muscular strength, and body composition.

Sheales,\textsuperscript{54} studied the effect of 13 week aerobic dancing programme on aerobic power, self image of mood status in sedentary women. The exercise group met for 50 min exercise 3 times a week. Body variables were skin fold measurement taken at 10 sites; the variables were assessed on pre-post test basis. It revealed that exercise brought about significant improvement in aerobic power and significant reduction in body fat percentage. The finding of this study suggested that participation in regular aerobic exercise can improve aerobic power and positive impact on mood state and also reduction in fat and stress.

Toy,\textsuperscript{55} studied the effect of aerobic dance training on Vo2 Max and Body Composition in early middle aged Women. Twenty subjects were selected to experimental group (No: 10) and control group (No: 10) for this study. The experimental group underwent twelve weeks aerobic dance training. The control group which was not undergone any training. The selected variables were vo2 max, body weight, and BMI and percentage body fat measure from the study. After twelve weeks of aerobic dance training, a significant reduction was noted in body weight, BMI and percentage body fat, and a significant in vo2 max. This study highlights that systematic aerobic dance training helps to increase the physical and cardio respiratory fitness among middle aged women.

Shenbagavalli and Mary Recthammal\textsuperscript{56} studied the effect of aerobic training on body mass index on sedentary obese men. 30 obese men were selected randomly and divided into two groups 15 subjects in each group. Group I as experimental group and Group II as control group. The experimental group had been in aerobic training programme five days in a week for a period of 8 weeks. The control group did not

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involve in any fitness programme or training programme. Once in 2 weeks the load was increased. The body mass index was selected as variable. The collected data were analyzed by using ‘t’ ratio. From the findings it is quite interesting to know that the sedentary obese men have positive influence upon their body mass index due to the training programme given. The results shown aerobic training helps the subjects to decrease the weight, maintains body mass index and also it helps to increase the heart rate, improve the breathing for a sustained time.

Agro\textsuperscript{57} studied the effect of low impact and high impact aerobic dance exercise on selected fitness measures such as Vo2 max, Sum of skin folds, sit reach flexibility test among college females. Thirty three college females participated in a 10 week training thrice a week for 45 minutes each session. ‘T’ test indicated a significant increase in Vo2 max for the high impact group, whereas no changes were noticed in low impact group. A significant difference was found between the groups in Vo2 max. Both low impact and high impact groups significantly decreased the sum of skin folds but no significantly decreased the sum of skin folds but no significant difference was found between the groups. Flexibility increased significantly in the low impact group but not in the high impact group, although no significant difference was found between the groups.

Koutedakis et al\textsuperscript{58} conducted study to assess effects of three months of aerobic and strength training on selected performance- and fitness-related parameters in modern dance students. The sample consisted of 32 men and women (age 19 +/- 2.2 years) who were randomly assigned into exercise (n = 19) and control (n = 13) groups. Anthropometric and flexibility assessments, treadmill ergometry, strength measurements, and- on a separate day-a dance technique test were conducted pre- and post exercise training in both groups. It is concluded that in modern dance students (a) a 3-month aerobic and strength training program has positive effects on selected dance performance and fitness-related parameters, (b) aerobic capacity and leg strength improvements do not hinder dance performance as studied herein, and (c) the


dance-only approach does not provide enough scope for physical fitness enhancements.

LiCL et.al,\(^{59}\) studied the effects of aerobic exercise intervention with goals of improving health-related physical fitness among selected adults in high-tech Company at Taiwan. This study was conducted as a quasi-experimental design. Among the 54 subjects enrolled in the study, 26 subjects of the volunteers agreed to participate in an aerobic exercise program. The control group was comprised of a similar sample of 28 subjects working at the same company. Subjects in the exercise group participated in a 12-week aerobic exercise program, while subjects in the control group did not participate. The results of analysis of variance with repeated measures of health-related physical fitness showed that the subjects in the exercise group had significantly more improvements in abdominal muscle strength and endurance than the subjects in the control group. This study indicated that one 12-week aerobic exercise program was effective in improving the abdominal muscle strength and endurance among selected adults.

Promoth\(^{60}\) studied the effect of step aerobics training on selected physical and physiological variables of physical education students. Thirty female students were selected, from St. Joseph Physical Education College, Moolamattum in Kerala. Fifteen female students were assigned as experimental group and another 15 female students were assigned as control group. Their age ranged from 20 to 24 years. The experimental group was progressively introduced to the practice of step aerobics. The subjects performed step aerobics apart from their regular physical education workout, five days in a week for a period of sixty minutes. The control groups did not participate any training programme expect their regular workout. Both groups were tested before and after experimental period of twelve weeks with respective standard tests. The data were computed statistically by using “Analysis of Co-Variance” (ANCOVA) to see progressive effects. The results, in general, support the theory that


step aerobics had significant effects on selected physical and physiological variables improved significantly among the experimental group i.e., flexibility, explosive power, BMI, and $\text{Vo}_2\text{max}$ and no significant changes were seen in control group.

Mahendran$^{61}$ studied the effect of 12 weeks aerobic exercises on selected health related physical fitness and physiological variables among adolescents. Thirty healthy, untrained school boys were selected from Sengunthar higher secondary school in Thuraiyur and their age ranged from 12 to 15 years. The subjects were equally divided into two groups namely control and experimental group. The experimental group underwent aerobic exercises training for forty five minutes duration for twelve weeks for weekly five classes. Control group was kept under observation without training. Selected health related variables were, muscular strength was measured using by hand grip dynamometer, muscular endurance was measured using by bent knee sit ups, cardio-respiratory endurance was measured using 12-minutes run/walk, flexibility was measured with the reliable equipment sit and reach box. The body mass index was calculated by measuring the height and body weight of the subjects. The height was measured in meters by using a stadiometer and weight was measured in kilograms by using a weighing machine. The following equation was used to calculate the body mass index (BMI) i.e. $\text{BMI} = \frac{\text{weight in kg}}{\text{height in meter}}^2$. The results of pre-test and post-test were compared by using Analysis of Covariance (ANCOVA). All variables were significantly improved among experimental group.

Pollock et al.$^{62}$ studied the effect of walking on body composition and cardiovascular function of middle aged men. Sixteen sedentary male subjects were trained for 20 weeks four days per week. The vigorous walking was progressively increased in accordance with the tolerance of each individual by the last week. Substantial improvement occurred in maximum oxygen consumption, sub-maximal heart rate and resting diastolic blood pressure and reductions of body weight and

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percent of fat, which indicates that vigorous walking can be effective as an adult training activity.

Zant and Kusma\textsuperscript{63} studied the effect of a community based exercise and health education program to improve cardiovascular fitness and body composition. Twenty five subjects were participated in 12 weeks aerobic training programme. Resting Heart Rate, blood pressure, body composition (skin folds), and maximal exercise capacity were measured before and after training. Data was analyzed by ANOVA. There were significant reductions in Resting Heart Rate, blood pressure, body composition percent of body fat and increased maximal exercise workload. These results indicate that a community based exercise and health education program result in beneficial changes in fitness and body composition.

Robert Boling\textsuperscript{64} and others conducted a study on the effects of aerobic training on competition anxiety and Selected Physiological Variables in Tae Kwon Do Athletes. The athletes ages ranging from 18-21 years and they participated in the training program three times a week for a five-week period. The control group went through the conventional Tae Kwon Do training program consisting of stretching and forms Kata’s. The experimental group went through aerobic exercise practice session along with their conventional Tae Kwon Do practice. Pre- and post-test data for each subject were obtained for a sub-maximal cycle ergometer test, wet spirometer test for vital capacity, and for a sports competition anxiety test. Dependent tests were used to compare means within groups. Analysis of covariance was used to compare means between groups. The experimental group improved significantly in aerobic capacity, vital capacity, exercise heart rate, and exercise blood pressure.

Zant and Kusma\textsuperscript{65} studied the effectiveness of a community based exercise and health education program to improve cardiovascular (CV) fitness and body composition on 25 subjects. Subjects participated in a supervised aerobic training


\textsuperscript{64} Robert Boling, et. al., “Effects of Aerobic Training on Competition Anxiety and Selected Physiological Variables in Tae Kwon Do Athletes”, \textit{Research Quarterly for Exercise and Sport, Abstracts of Completed Research Supplement} Vol.64” (March 1993),p. 23

programme for 12 weeks. Resting Heart Rate (RHR) blood pressure (BP), weight, body composition (skin folds), and maximal exercise capacity (cycle) were measured before and after training. Data was analysed via ANOVA. There was significant (P<0.05) reductions in systolic BP, RHR, 5 minutes post exercise HR, weight, sum of 6 skin folds percent of body fat and fat weight. Subjects significantly increased maximal exercise workload. These results indicate that a community based exercise and health education program result in beneficial changes in fitness and body composition.

Aranga Panbilnathan and Kulothungan\textsuperscript{66} studied effect of different intensity aerobic exercise on body composition variables among middle aged men. Sixty male subjects were selected randomly divided four groups and each group consists of fifteen subjects each. The age ranged from 35 to 45. Group I underwent as low intensity aerobic exercise, group II underwent moderate intensity aerobic exercise, group III underwent high intensity aerobic exercise and group IV acted as control group. The experimental groups underwent their intensity aerobic exercise programme three days per week for twelve weeks. Control group did not undergo any training programme rather than their routine work. The body composition are percentage body fat and lean body mass were measured by using skin fold caliper. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. The results shows that high intensity aerobic exercises were significantly better than low and moderate aerobic exercises in percentage body fat. The moderate and high intensity aerobic exercises significantly influenced lean body mass of middle age men.

Nagaraj, Subramaniam and Jayasivarajan\textsuperscript{67} studied effect of stretching exercises and aerobic exercises on flexibility of school boys. For this study sixty school boys were selected at random from Velankanni Matriculation Higher secondary school, Puducherry and their age ranged from 14 -17years. The selected subjects divided in to four groups each group consist of fifteen subjects. Group I


underwent stretching exercises, group II underwent aerobics exercises, group III underwent combined exercises (stretching and aerobics exercises) and group IV is control group. The three experimental groups were subjected to the training programme for 10 weeks for three days per week. Control group did not undergo any training programme rather than their routine work. Flexibility was measured by using sit and reach box. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. The result shows that combined exercises (stretching and aerobics exercises) were significantly better than stretching exercises, aerobics exercises in flexibility.

Ashok & Rupiner studied to examine the distribution of Subcutaneous fat in young adult physically active males (N=50) and females (N=50) aged from 18-24 years, before and after a 90 days conditioning programme consisting of exercises targeted to improve flexibility, Strength and Cardio respiratory endurance. The data was significantly analyzed by using ANOVA and Scheffe Post hoc tests were used to derive the result. The result shows that the distribution pattern of subcutaneous fat in the form Skin fold thickness in males was sub scapular (maximal) followed by calf, triceps suprailiac, biceps (minimal). The subcutaneous Skin fold thickness from the observed body sites significantly decreased (except Sub scapular in females) with the progression of a conditioning programme but it could not change the preconditioning distribution pattern of subcutaneous fat in both males & females. Whereas the Body fat Percentage significantly decreased (before 23.87 ± 3.20 & after 20.86 ± 2.41) and LBM% significantly increased (before 76.00 ± 3.20 after 79.14 ± 2.80) only in females after conditioning programme. These findings indicate that a conditioning programme on the one hand lowers the total body fat by mobilizing and using the subcutaneous fat and on the other hand increase lean body mass (LBM) both in males & females.

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Studies on Yogic and Aerobic Training

Ravikumar\textsuperscript{69} conducted a study to find out the effect of selected yogic practices and aerobic exercises on somato type components and its relationship with health related physical fitness and biochemical variables. Forty-five college male students were selected randomly from in the Government boys’ hostel, lawspet, Puducherry. Their age ranges from 18 to 25 years. They were divided into three groups namely control group, yogic group and aerobic group. The training period the yogic group and the aerobic group underwent fourteen weeks of training on their respective program. The yogic group was trained on asanas and pranayama. The aerobic group was trained on aerobic exercises with rhythmic music with various types of aerobic type movements. The progressive load method was used up to fourteen weeks for the respective groups. The training was given during for 5 days a week. The data pertaining to pre test and post test of experimental variables were derived through the following methods. Health related physical fitness components such muscular strength and endurance, muscular flexibility, cardiovascular endurance & body composition significantly improved after yogic group and aerobic exercise group than the control group.

Preetha\textsuperscript{70} conducted a study to find out the effect of selected yogasanas and aerobic exercises on selected physical, physiological and psychological variables among women students of Pondicherry University. Samples were selected randomly aged between 20 to 25 years and was divided into equally three groups Control and two experimental groups. Experimental group I underwent aerobic exercises, experimental group II underwent yogasana practice the both group the training session were held five days in a week for a period of twelve weeks .Control group did not undergo any training. Prior to and at the end of training period all subject were tested for selected physical, physiological and psychological variables. Aerobic exercises & yoga practice group showed significant improvement on selected


\textsuperscript{70} O. Preetha, “Effect of Selected Yogasanas and Aerobic Exercises on Selected Physical, Physiological and Psychological Variables in University Women Students,” (Unpublished M.phil Thesis, Pondicherry University, Pondicherry, September 2006).
physical, physiological and psychological variables like weight, flexibility, and balance among experimental group than the control group.

Sakthignanavel\textsuperscript{71} studied the effect of pranayama and aerobic exercises on physical and mental performance among males. The present investigation was undertaken to study the effect of pranayama with aerobic exercises on muscular endurance, vital capacity and cardio respiratory endurance. Thirty normal male volunteers had undergone a 12 weeks training course of pranayama (n1=10), aerobic exercise (n2 =10) and pranayama with aerobic exercises (n3=10). The suitable parameters were assessed before and after the training. The results shown that the pranayama group marked as higher degree in vital capacity (p<0.05). The aerobic group shows greater cardio respiratory endurance and muscular endurance than the other groups (p<0.05). The combined pranayama aerobic group shown a greater improvement in all aspects than the other three groups (p<0.05).

Sakthinanavel\textsuperscript{72} studied the effect of continuous running, yogic pranayama, and combination of continuous running and yogic pranayama exercise on cardio-respiratory endurance, selected physiological and psychological variables among male students of indira nagar at Pondicherry. Sixty school students were randomly assigned to four groups’. Group I performed continuous running. Group II performed pranayama. Group III performed, the combined continuous running and pranayama group. Group IV acted as the control group and was not involved in any specific training. subject in each group were trained with respective programmers for a of fourteen weeks, four times a week, each training session lasted for 30 minutes. Prior to and at the end of training period all subject were tested for cardio-respiratory endurance, selected physiological and psychological variables. Only combined continuous running & yogic pranayama group showed significant improvement on cardio-respiratory endurance & psychological variables & some of the physiological

Variables expect cardiac variables like systolic pressure, diastolic pressure, mean pressure, pulse pressure, & rate pressure product.

Madhan kumar\textsuperscript{73} conducted a study to find out the effect of 12 weeks jogging and asanas on selected physical variables among obese men. Thirty subjects from Cheyyar town, Tamil Nadu state was randomly selected and their age ranged from 18-25 years. The subjects were divided into three groups, one control and two experimental groups. The two experimental groups were subjected to a training programme for 12 weeks. Jogging was administrated to group I (n=10) and asanas was administrated to group II (n=10) and group III (n=10) served as a control group. Test was conducted for physical variables namely agility, muscular strength and flexibility prior and after the 12 weeks training programme the data was collected and analysed statistically by Analysis of covariance and to find out the significant difference at 0.01 level of confidence. The result reveals there was significant difference among the three groups. It is finally concluded that the jogging group found to be significant than the asanas group on agility, muscular strength but asanas group found to be significant than the jogging group on flexibility.

Chidambara Raja\textsuperscript{74} studied the effect of yogic practice and physical fitness on flexibility, anxiety and blood pressure. Forty five subjects working women in various faculties of Annamalai University in the age group of 35 to 40 years were selected. They were divided into three equal groups each group consisted of fifteen subjects. Group I underwent yoga practice, group II underwent physical exercise and group III acted as control group who did not participate in any special training. The training period for this study was five days in a week for eight weeks. Flexibility was measured using by sit and reach test, anxiety was measured by Taylor’s Manifest Anxiety scale and blood pressure was measured using sphygmanometer. Prior to and after the training period the subjects were tested flexibility, anxiety and blood pressure (systolic and diastolic). The data were computed statistically by using


“Analysis of Co- Variance” (ANCOVA). All the variables were significantly improved among experimental group than the control group.

Punithavathi\textsuperscript{75} study was carried out to investigate the effects of aerobic exercises and yogic practices on selected physical, physiological and biochemical variables among school girls. 45 girls were selected from St. Joseph of Cluny Hr. Sec. School, Pondicherry. The age group of the subjects ranged between 14 to 18 years. The subjects were divided into three groups and each group consisted of fifteen subjects. The two experimental groups underwent two different training programmes namely aerobic exercises and yogic practices and the third group acted as control group which was not subjected to any training. The subjects selected were from three categories viz. Control group, aerobic experimental group and yogic experimental group, and the data on the selected variables were collected before and after the training period. The pretest and post test data collected from control, aerobic and yogic experimental groups were statistically analyzed to find out the significance of the variables such as speed, muscular endurance, cardio respiratory endurance, resting pulse rate, breath holding time, respiratory rate, protein and lactic acid, by the use of analysis of covariance (ANCOVA). After eliminating the influencing of pre test, the adjusted post test means of experimental groups and control group were tested for significance by using ANCOVA.

Neethi and Chidambara Raja\textsuperscript{76} studied effect of yogic practices and physical exercises on muscular strength self - concept and blood pressure. Forty five healthy, untrained female subjects were selected from various Departments of Annamalai University and their age ranged from 18 to 25 years. The selected subjects were equally divided into three groups. Group I underwent yoga practices, group II underwent two experimental groups and group III as a control group. The experimental groups underwent their training programma five days per week for eight weeks. Control group did not undergo any training programme rather than their routine work. Muscular strength was measured by sit ups test, self concept was


measured with the help of Muktha Rani Rasthogi’s self-concept and blood pressure was measured by using sphygmomanometer. Prior to and after end of practice period all subjects were tested. The results of pre-test and post-test were compared with using Analysis of Co-variance. The yogic practices group and physical exercises group on muscular strength, self-concept significantly improved when compared with the control group. Blood pressure has also decreased in yogic practices group and physical exercises group when compared with the control group.

**Studies on Training and Detraining**

Testerman\(^{77}\) conducted a study on training and detraining effect on selected physiological fitness in adult black women. Pre, post and detraining post measurements were made on body weight, heart rate, blood pressure, and sum of skin fold and predicted max Vo2. The study was conducted in 4 stages 2 training stages and detraining. Training was either by walking, jogging or aerobic dance, 3 times per week, over 11 to 12 weeks. One detraining period was for 10 weeks, a second period for 15 weeks. Data were analyzed by factorial ANOVA, Predicted max vo2 was significantly increased after and was either maintained or reduced back to pre training levels through detraining. Skin fold thickness were significantly reduced following training and after detraining both systolic and diastolic blood pressure underwent no changes from training through the detraining period.

Vaithianathan\(^{78}\) studied the effects prior to and after training on selected physical and physiological variables. 70 physically fit and untrained boys were randomly assigned to one of the two groups: Group I (experimental group) performed circuit training five days a week for a period of 12 weeks; Group II (control group) were restricted to participate in any of the training programme. Prior to and at the end of training period all subjects were tested for muscular strength, muscular endurance, cardio-respiratory endurance, blood pressure, vital capacity and respiratory rate Data were analyzed by factorial ANOVA. The results of the study indicated that circuit training improved the efficiency significantly in physical fitness variables such as


muscular strength, muscular endurance and cardio-respiratory endurance and also physiological variables such as blood pressure, vital capacity and respiratory rate.

Jaya sivarajan\textsuperscript{79} studied the effect of plyometric training and detraining on speed and explosive power among school boys. Thirty healthy untrained school boys were selected from karaikal region and their age ranged from 12 to 15 years. The subjects were equally divided into two groups namely control and experimental group. The experimental group underwent plyometric training for one hour duration for twelve weeks for weekly three classes. Control group did not undergo any training. Speed was measured using by 50meter dash and explosive power was measured using by standing board jump. The results of pre-test, post-test and detraining were compared by using Data were analyzed by factorial ANOVA The impact plyometric training significantly improved the speed, explosive power among school boys in the post test.

Swaminathan\textsuperscript{80} studied the effects of maximal power and plyometric trainings detraining and retraining on selected strength and power parameters. Forty five healthy male subjects were selected from sports hostel boys in Tiruchirapalli, Tamil Nadu and they were aged 15 to 17. The selected subjects were divided into three equal groups of fifteen subjects each at random. Group I underwent maximal power training, Group II underwent plyometric training and Group III acted as control. The experimental groups underwent their respective programmes for three days per week for twelve weeks. Control group which did not undergo any training programme. All the subjects of the three groups were tested on selected criterion variables such as leg strength, back strength, strength endurance and elastic power in terms of vertical distance and explosive power in terms of horizontal distance. Data were analyzed by factorial ANOVA. The results shown there was significant improvement in the strength and power parameters among sports hostel boys.


Karthikeyan\textsuperscript{81} studied the effects of isolated, complex weight, plyometric trainings detraining and retraining on selected strength and power parameters among male subjects. Sixty healthy male subjects were selected from department of physical education and sports sciences at Annamalai University, Annamalai Nager, Tamil Nadu and they were aged 18 to 22. The selected subjects were divided into four equal groups of fifteen subjects each at random. Group I underwent maximal weight training, Group II underwent plyometric training and Group III underwent maximal weight training and plyometric training, Group IV acted as control. The experimental groups underwent their respective programmes for three days per week for twelve weeks. Control group did not undergo any training programme. All the subjects of the four groups were tested on selected criterion variables such as leg strength, back strength, strength endurance, an aerobic power and explosive power after the training programmes as pre and post tests respectively, at every ten days of detraining programme for forty days (four cessations) and four weeks of retraining programme. The collected data were statistically analysis factorial ANOVA. The study results concluded that there was significant improvement on selected strength and power parameters among experimental group than the control group.

Muthuelukavam\textsuperscript{82} studied the effect of different intensity circuit training and detraining on selected biomotor abilities and physiological parameters among university male students. Forty five male subjects were selected from department of physical education and sports sciences at Annamalai University, Annamalai Nager, Tamil Nadu and they were aged 18 to 20. The selected subjects were divided into three equal groups of fifteen subjects each at random. Group I underwent moderate intensity circuit training, Group II underwent high intensity circuit training and Group III acted as control. The experimental groups underwent their respective programmes for ten weeks. Control group did not undergo any training programme. after the training programmes as pre and post tests respectively, at every ten days of detraining programme for forty days (four cessations) and four weeks of retraining programme. The collected data were statistically analysis factorial ANOVA. The study results concluded that there was significant improvement on selected strength and power parameters among experimental group than the control group.

\textsuperscript{81} P. Karthikeyan, “Effects of Isolated, Complex Weight, Plyometric Trainings Detraining and Retraining on Selected Strength and Power Parameters Among Male Subjects.” \textit{(Unpublished Doctoral Thesis, Annamalai University, Annamalainager, 2003)}.

\textsuperscript{82} Muthuelukavam, “Effect of Different Intensity Circuit Training and Detraining on Selected Biomotor Abilities and Physiological Parameters among University Male Students.” \textit{(Unpublished Doctoral Thesis, Annamalai University, Annamalainager, December 2006)}.
concluded that there was significant improvement on selected biomotor abilities and physiological parameters among experimental group than the control group.

Margarent Neval Fringer\textsuperscript{83} determined the changes in selected physiological parameters in the subsequent period of detraining. The forty four female college students were selected and their age between 17 - 28 years. The subjects underwent bicycle ergo meter twice a week during ten weeks conditioning period. At the end of the training period she concluded that selected physiological variables were enhanced by the training program and the ten weeks inactivity period produced significantly greater loss in physiological variables.

Wise Blessed Singh\textsuperscript{84} studied the effect of concurrent strength and endurance training and detraining on selected bio-motor abilities. Thirty men students participated in this study. They were selected from bachelor of physical education in Annamalai University their age 18 to 22 years. The selected subjects were equally divided into two groups control and experimental. The experimental group performed both the strength and endurance training three days per week on alternative days for twelve weeks. Control group did not undergo any training programme rather than their routine work. The dependent variables selected were assessed by standard test and procedure. The data were collected prior to and immediately after twelve weeks of training and also during detraining period once in ten days for thirty days analyzed by using factorial ANOVA with last factor repeated measures.

\textsuperscript{83} Margarent Neval Fringer, “Changes in Selected Cardio Respiratory Parameters during Period of Conditioning and Reconditioning in Young Adult Females”, \textit{Dissertation Abstracts International} (July 1972), p. 181

Summary of the Literature

The review of literature helped the investigator to spot out relevant topics and variables. Further the literature helped the investigator to frame the suitable hypothesis leading to the problems. The latest literature also helped the investigator to support his finding with regard to the problem. Further the literature collected in the study also helped the research scholar to summarize his study.

The reviews were presented under the four sections such as yogic training (17), aerobic training (17), yogic and aerobic training (8) and general training and detraining (8). All the research studies presented in the section proved that the yogic and aerobic training programme contribute significantly for better development of dependent variables. The research studies reviewed were collected from journals available in the websites and some university libraries.

It is also observed from the reviews of literature that no research studies have been conducted in relation to yogic and aerobic training followed by detraining on health related physical fitness variables. This motivated the researcher to select this study.