CHAPTER – II

REVIEW OF RELATED LITERATURE

“The review of related literature is an instrument 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” (Tirumalaisamy, 1995).

From the review of literature presented it is true that yogic practices and physical exercise bring about desirable changes in the human body. From the review of related literature given above, the following facts were observed. Physical Exercises and Yogic Practices have positive effects on certain Psychological responses like spatial memory and emotional balance and reduces anxiety. Physical Exercises and Yogic Practices improve certain Physical and Physiological fitness of the regular practitioners.

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

The research for reference blanketerial is a time consuming but fruitful phase of the graduate programme. A familiarity with the literature in any problem area helps the students to discover what is already known, what others have attempted to find out, what methods have been promising disappointing, and what problems remain to be solved.
“The literature in any field forms the foundation upon which all future work will be built”. The review of literature are generally used as a basis of inductive reasoning for beating and sympathizing all the relevant literature on a particular topic.

The review of literature is a creative task calling for a deep insight and clear perspective of the overall field. No experienced researcher would think of undertaking a study without acquainting himself with the contribution of previous studies.

A review of related literature is a direction to find out the reality and the beneficial nature and the reliability of a work undertaken, keeping in mind the blanketerials that are available in connection with the topic. A review will give the investigator a vivid idea of what he should do and how he should go about his investigation. **Clarke, D.H. and Clarke, H.H. (1970)** gave the importance of review of related literature as that of before completing a plan for a research understanding, the investigator needs to conduct a literature search in the area of the proposed investigations.

The present chapter covers the available literature pertaining to the studies made on various aspects of assessment of fitness profits. The review of literature has been collected from a number of pertinent studies undertaken by the physical educationists, sports scientists and sports administrators. Considering the purpose of the present study the reviews have been mainly classified into the following aspects.
1. Studies on Physical fitness
2. Studies on Physical Exercises
3. Studies on Circuit training
4. Studies on Yogic Practices

2.1 STUDIES ON PHYSICAL FITNESS

Astorino et. al., (2004) conducted a study on changes in physical fitness parameter during a competitive field hockey season which requires a substantial amount of muscular strength, speed, and cardiovascular endurance. The Division III female field hockey athletes (n =13) completed tests of muscular strength, body composition, and maximal oxygen uptake (VO2 max) during each phase of their season. Muscular strength was assessed using 1 repetition maximum (RM) leg and bench press tests. Body composition was assessed by anthropometry (skinfolds [SKF]), circumferences ([CC]), and bioelectrical impedance analysis (BIA), Incremental treadmill testing was administered to assess VO2 max. VO2 max was unchanged during the season. A higher VO2 max was unchanged during the season. A higher VO2 max (p< 0.05) is shown during and after the season vs before the season. Significant decrease (p<0.05) was seen in upper (10%) and lower body strength (14%) during the season. There were significant lower percent body fat (%BF) from BIA, fat mass (FM) from CC, and body mass index (BMI) was significantly lower (p<0.05) in season and postseason vs preseason. The preseason training was effective in decreasing %BF and increasing VO2 max, yet muscular strength was lost. These data support the superior levels of muscular strength and leanness in these athletes compared with age – blanketched peers.
Cindy and Hurley (1995) selected thirty – one men between the age of 54 and 75 years, were studied to compare the effect of strength and flexibility training (SF), flexibility only training (FO) and no training (inactive control group) on shoulder and hip range of motion. The results indicated that the FO group increased its range of motion in shoulder abduction to a significantly greater extent than the SF group, and none of the changes in range of motion for the SF group was significantly different more than the changes in the control group. The strength and flexibility training alone was for improving joint range of motion in shoulder abduction.

Moorthy, (1982) conducted a study on minimum muscular fitness of school children of age group from 6 to 12 years and compared the influence of selected yogic exercises and physical exercises on them. In that study, 1000 children (571 boys and 429 girls) from II standard to XI standard from three schools in Pune, 90 boys and 90 girls who had failed were randomly selected for experimental purposes. 30 boys and 30 girls were randomly allotted to control group, Experimental group I (physical Exercises) and Experimental Group II (Yogic Exercise) underwent the treatment for a period of six weeks. He concluded that both experimental groups showed significant improvement after six weeks training when compared to control group. The percentage of improvement was seen much greater in yogic group than in physical exercise group.

Gharote, (1983) The physical fitness index of 44 school children were taken into study using Fleischmann battery of basic fitness tests. After three weeks’ training in Yogic physical culture considerable improvement has been shown in leg lifts, shuttle run and balance. Extent flexibility, dynamic flexibility,
softball throw, cable jumps, 600 yard run and pull – ups did not show any improvement. The gain in physical fitness index was lost during non training period of three weeks while extent flexibility, dynamic flexibility soft ball throw, 600 yards run and balance improve thereby indicating delayed effect. When compared to the results obtained for the control group, students having more fat lost it while those having less fat showed a gain even though the average values remained unchanged.

**Boddington et. al., (2004)** worked on a study to establish validity of a 5-m multiple shuttle test using indirect (criterion and construct) and direct measures of performance. The comparisons were made between data from established fitness tests and a 5-m MST with subjects of different playing abilities. Direct validity was determined by comparing values from a 5-m MST with data from a time – motion study of field hockey. For criterion validity, the strongest relationship existed between the 20m MST (42.7 +/- 7.1 ml.kg (-1). Min (-1)) and total distance from the 5-m MST (650.9 +/- 59.2m; r = 0.92). For construct validity, regional representative players covered more distance that club-level players (689.9 +/- 46.6 m vs. 661.1 +/- 31.0m; p< 0.01). For direct validity, the highest correlation was found between total distance from the 5-m MST (706.0 +/- 31.0 m; p<0.01). For direct validity, the highest correlation was found between total distance from the 5-m MST (706.0 +/- 37.5m) and mean displacement during blanketches (61.0 +/-6.0m; r = 0.74). It was concluded that the 5-m MST had both indirect and direct validity for the fitness assessment of field hockey players. The data obtained from the 5-m MST directly relates to the physical fitness of the players during competition.
Santo, (1976) selected 76 college men to study the effects of physical conditioning programmes on cardio respiratory endurance. The subjects were divided into four groups, three of which participated in different physical conditioning programmes and one remained as control group. Three conditioning programmes were (i) Cooper’s aerobic programme (ii) Interval training and (iii) Regular physical education programme. Cardio respiratory endurance was measured by Harvard step test, 12 – minute run / walk test, a three – minute shuttle run and one – minute lateral jump. It was concluded that interval training, aerobic conditioning and regular physical education programme groups improved significantly in cardio respiratory endurance in comparison to control group.

Uppal, (1982) in his study investigated endurance training employing slow continuous running method, which significantly reduces resting systolic and diastolic blood pressure of the secondary school level boys after exercise. No significant change was found out in resting and exercise blood pressure in the case of control group, as it was obviously a reflection of inactivity.

Barathi (2011) analysed the physical fitness components namely leg strength, back strength, speed agility and strength endurance among Kerala and Tamilnadu male football players. To achieve this purpose Kerala University male football players (n=15) and Tamilnadu University Football players (n=15) were selected as randomly as subjects for this research study. The Leg strength was measured by leg lift with dynamometer, back strength was measured by back lift with dynamometer, speed was measured by conducting 50 metre dash, agility was measured by shuttle run and strength endurance was measured by push-ups. The analysis of variance (ANOVA) was used to find out the difference between Kerala
and Tamilnadu Football team players on selected criterion variables. The result reveals that there was a significant different in the selected physical fitness components except leg strength among Kerala and Tamilnadu University Football players. The result also indicates that Tamilnadu players were better than Kerala University players on all selected physical fitness components.

Harvey and Wehr (1965) observed the callisthenic exercise programme advocated for adults by the Presidents Council on Physical fitness. It was tested for its effect on selected components of physical fitness. Nineteen subjects participated in the exercise programme for ten weeks. The training was preceded and followed by measurements relative to the council’s objectives for the programme strength, flexibility, improved general appearance, endurance, coordination and efficiency. Flexibility in males and a segment of the endurance complex in females appeared significant at the 0.05 level of confidence when the differences observed from training to post training were exposed to non parametric tests; but this significance did not appear in any of the other components of physical fitness in isolated instances within a given component.

Fabricius (1964) studied the physical fitness development of fourth grade boys and girls who participated in a regular elementary school physical education curriculum with those who participated in a regular elementary physical education curriculum with the addition of selected calisthenics. Physical fitness was measured by the Oregon motor fitness test. In each class a period of three minutes nine seconds was spent on added calisthenics. The classes met four times per week. The result showed that both groups improved significantly in physical
fitness in the six month period for September 1962 to March 1963. The experimental group having the added calisthenics improved significantly more than the control group.

**Duraisami and Ekambaram (2011)** in their study carried out to the effect of Suryanamaskar and varied asana practices on selected physics fitness components among men college athletes. To achieve the purpose 30 subjects, age ranged between 18 to 21 years were selected from various colleges in Chennai. The subjects (n=30) were randomly assigned to two equal groups of 15 athletes in each. The groups were assigned as experimental group (EG), control group (CG) in an equivalent manner. The pre test was conducted on the selected physical fitness components of both groups. The experiment group practiced in Suryanamaskar and varied asana practices for a period of six weeks. The subjects of the control group were not practices in any yogic practice. The Suryanamaskar and varied asana practices were scheduled at 6.00 pm to 7.00 pm for 3 days in a week. The post-tests were conducted for all athletes on physical fitness components namely flexibility and agility. The collected data from the athletics were statistically analyzed by ‘t’ ratio.

**Ahamed and Sing (2010)** have contributed a research article for comparison of selected physical fitness variables of 18 years old male cricket players. Six hundred boys of 18 years old of Mysore University were selected for physical fitness variables. Mysore district boys were found superior to physical fitness variables in comparison to the boys of other 3 districts like Hassan, Mandya and Chamarajnagar.
James (1992) conducted a study on the “Survey of physical fitness of higher secondary school boys between the age group of sixteen and nineteen years of low, medium and high altitudes in Tamil Nadu”. The purpose of the study was to determine the physical fitness status of school boys from 16 to 19 years of age using the AAHPERD youth fitness test. The investigator had selected three hundred and fifteen boys at random from nine schools at low, medium and high altitudes for the survey. The data collected at different altitudes were analysed by using F-ratio. These was significant difference among the different altitudes groups in all the components to physical fitness tests except in sit ups for abdominal strength.

Koebel et. al., (1992) investigated that the physical fitness testing has endured several evolutionary changes. The most recent trend is to use health-related rather than motor –performance test items. Physical fitness is currently described in terms of cardio respiratory endurance, body composition, muscular strength, muscular endurance and flexibility. The use of criterion – reference standards that specify the acceptable level of fitness conducive to health has been proposed. Physical educators have begun to expand the scope of fitness testing and recognize the need for programmes that teach children to basic concepts of health and fitness and how to influence present and future health status through physical activity. The purpose of this paper is to present an historical account of youth fitness testing, provide insight into the attitudes, problems and controversies that have encompassed this subject and demonstrate how these have influenced the rationale of the tests. Results illustrate current problems areas and provide useful data for future investigators.
Abdulnour (1987) conducted a study to compare the physical fitness of the Kuwait data with those of high school boys and girls in the United States, as indicated by their performance on the AAHPERD youth fitness test. The investigator compared the mean differences in physical fitness among three groups of girls and three groups of boys attending public secondary schools in Kuwait. The fitness tests included pull ups for boys and flexed arm hang for girls, flexed leg sit ups shuttle run, broad jump, 50 yard dash and 600 yard run.

Subblankethi et al. (2011) have conducted a comparative study on the selected physical fitness variables between University and Non University men and women players. To achieve this purpose of the study, only sixty players were selected. Among them, fifteen University men players and fifteen University women players who represented Inter University Tournament in Annamalai University, fifteen non university men players and fifteen non university women players, who did not participate Inter University Tournament in Annamalai University, Chidambaram, Cuddalore District, Tamil Nadu in India with an age group of 20 to 24 years were selected at random. The following physical fitness variables such as strength endurance and cardio respiratory endurance were selected as criterion variables. The data were collected from university and non university men and women players on strength endurance and cardio respiratory endurance by using bend knee sit-ups and cooper’s 12 min run/walk test respectively. The 2 x 2 factorial ANOVA was used to analyze the significant difference, if any among the groups. The 0.05 level of confidence was fixed to test the level of significance which was considered as an appropriate. The results of the study showed that there
was significant difference exist between men and women players irrespective of their group on selected criterion variables and also significant difference found exist between university and non university players irrespective of their gender of selected criterion variables namely strength endurance and cardio respiratory endurance. The results of the study further showed that there was significant difference between university and non university men and women players on selected criterion variables such as strength endurance and cardio respiratory endurance.

Faigenbaum and McFarland (2008) in their article, to evaluate the efficacy of an after-school resistance training programme on improving the physical fitness of middle school-age boys. 22 boys (M = 13.9 yr., SD = 4 yr.) participated in a periodized, multiple-set, 9-wk. (2x/week) resistance training programme. All subjects were pre and post-tested on their 10-repetition maximum squat, 10-repetition maximum bench press, vertical jump, medicine ball toss, flexibility and also percentage of body fat and the progressive aerobic cardiovascular endurance run (PACER). Statistical analysis indicated that subjects significantly improved performance on the squat (19%), bench press (15%), flexibility (10%), vertical jump (5%), medicine ball toss (12%) and the PACER (36%). Although this design minus a control group limits interpretation, this after-school resistance-training programme can improve muscular fitness and cardiovascular fitness in boys and should be replicated with appropriate experimental controls.
Haskell and Kiernan (2000) have suggested that the physical activity and physical fitness are complex entities comparison numerous diverse components that present a challenge in terms of accurate, reliable measurement. Physical activity can be classified by its mechanical (static or dynamic) or metabolic (aerobic or anaerobic) characteristics and its intensity (absolute or relative to the person’s capacity). Habitual physical activity can be assessed by using a variety of questionnaires, diaries or logs and by monitoring body movement or physiologic responses. Selection of a measurement method depends on the purpose of the evaluation, the nature of the study population and the resources available. The various components of physical fitness and be assessed accurately in the laboratory and in many cases, in the field by using a composite of performance tests. Most coaches and high-level athletes would accept as very beneficial a dietary supplement that would increase performance in a competitive event by even 3 per cent; for example, lowering a runner’s time of 3 min, 43s in the 1500 m by 6.7s. To establish that such small changes are caused by the dietary supplement requires carefully conducted research that involves randomized, placebo-controlled, double-blind studies designed to maximize statistical power. Statistical power can be increased by enlarging sample size, selecting tests with high reliability, selecting a potent but safe supplement and maximizing adherence. Failure to design studies with adequate statistical power will produce results that are unreliable and will increase the likelihood that a true effect will be missed.

The American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD) is the principle professional organization representing the disciplines included in the title. Their physical fitness test has been the major
instrument for measuring physical fitness in American school children for over 50 years. In the United States, there has been a change of emphasis over the years from a sports oriented philosophy to one centered around fitness and wellness. This change has been reflected by a change in the AAHPERD test from an emphasis on “performance fitness” to fitness reflecting good health. In 1976, the AAHPERD test included pull-ups (flexed-arm hand for girls), flexed-leg sit-ups, shuttle run, standing long jump, 50-yard dash, and 600 yard run-walk. In the 1980’s, AAHPERD introduced the “Physical Best” test, which included the 1 mile walk/run, skinfold measurement (that is, body fat), sit-ups, pull-ups and sit-and-reach. This new test attempted to measure fitness as it related to health rather than performance. The 1½ mile run test is a field measure of aerobic capacity, the skinfold test estimates body composition, sit-ups estimates muscle strength, and sit-and-reach is a measure of flexibility (Trimmer and Trimmer, 1976).

Kripet (1989) investigated the effectiveness of a six – week strength training programme consisting of squat and plyometric exercises on vertical jump performance, static and dynamic muscular strength and muscular power production in college age adults. Fifteen male and two female college students in an advanced weight training class at the Oregon State University served as subjects for the study. Nine subjects were trained only with combined squat and plyometric exercise. All subjects were trained only with combined squat and plyometric exercise. All subjects were trained twice a week for six weeks. A pre-test and post – test randomized groups design was used in this study. The statistical analysis was conducted using a paired t-test, and a repeated measures analysis of variance (ANOVA). A 0.05 level of significance was selected for
rejection of null hypothesis. The results indicated a significant mean increases from the pre-test to post –test for the vertical power jump within the combined squat and plyometric training. Static strength significantly decreased (P <0.05) from the pre-test level to the post – test level within the squat training groups. Hamstring strength and power significantly differed (P < 0.05) within both training programmes when pre-test and post –test means were compared. However, the researcher found no significant difference, between the gains achieved by two training programmes.

Thankamma Ommen (1981) compared the isometrics, yogic physical culture and combination training on body composition and physical fitness status of high school boys. Results of this study have shown that all the three exercise groups showed a significant increase in toe-touching scores. The inter group differences show that yogic physical culture group is more helpful in developing flexibility than the isometric and combination groups, and in dynamic flexibility. Comparatively yogic exercises were the best in developing dynamic flexibility.

Narayanasamy and Jeyanthy (2011) in their article reveal that the effect of treadmill exercises on selected physical fitness components of middle aged obese people, namely strength endurance and cardio respiratory endurance. To achieve this purpose of the study thirty (men) middle aged people in the village Kattumannarkoil were randomly selected as subjects. They were divided into two equal groups. Each group consisted of fifteen subjects. Group I underwent treadmill exercises for three days per week for twelve weeks. Group II acted as control that did not undergo any special training programme apart from their
regular work in nature. The following variables namely strength endurance and cardio respiratory endurance were selected as criterion variables. All the subjects of two groups were tested on selected dependent variables at prior to and immediately after the training programme. The analysis of covariance (ANCOVA) was used to analyse the significant difference, if any among the groups. The 0.05 level of confidence was fixed as the level of significance to test, the ‘F’ ratio obtained by the analysis of covariance, which was considered as an appropriate. The results of the study revealed that there was a significant difference between treadmill exercise group and control group on selected physical fitness components namely strength endurance and cardio respiratory endurance. Significant improvements on selected criterion variables were also noticed due to treadmill exercise programme.

2.2 STUDIES ON PHYSICAL EXERCISES

Karwande (1981) made a study on the “comparative effect of yogic and physical exercises on anxiety level and mental fatigue of children. This study was carried with sixty male students from VII and VIII standard. The average age of the subjects was 12 years. The test of anxiety level and mental fatigue were taken as criteria measures for the purpose of the study. The test are taken before and after the experimental period of fix weeks. He concluded that anxiety level can be reduced either by training in selected Asanas or related physical exercise and the training in selected Asanas was superior to the training in physical exercise for both variables though the difference was not statistically significant.
Krishnan (1991) conducted a study on the effect of exercises and yogic exercises on physiological variables among schoolboys. In this study 90 students were selected from Thirumayam. Three groups were randomly selected on which one served as control group and other two served as experimental groups with Bharathiym and Yogasana exercises respectively. They were measured for selected physiological variables like pulse rate, breath holding time, cardiovascular efficiency and vital capacity before training as well as immediately after six weeks of training. The significance of the difference among the means of control group, Bharathiym group and Yogasana group, pre test and post test were determined by ‘t’- ratio. Through analysis of variance, Bharathiym and yogic group significantly improved the pulse rate, Breath holding time, cardio vascular efficiency and vital capacity.

Fieldman (1966) has taken 33 college men doing the toe touch test as subjects to ascertain the relative contribution of selected extensibility exercises, arranged with progressive increase, to the flexibility of the hip joint. The subjects performed six tests over a five – week period. The first and sixth tests had no warm – ups, while from the second to fifth tests they had various degrees of warm-ups. Results indicate the tests, which included extensibility exercises allowed the subjects to display greater flexibility.
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Kotzamanidis et al., (2005) investigated that the effect of a combined heavy –resistance and running-speed training programme performed in the same training session on strength, running velocity (RV) and vertical-jump performance (VJ) of soccer players. Thirty- five individuals were divided into 30 groups. The first group (n= 12, COM group) performed a combined resistance and speed training programme at the same training session without speed training. The third group was the control group (n =12, CON group). Three jump tests were used for the evaluation of vertical jump performance: squat jump, countermovement jump and drop jump. The 30 m dash and 1 repetition maximum (1 RM) tests were used for running speed and strength evaluation, respectively. After training, both experimental groups significantly improved their 1RM of all tested exercises. Furthermore, the COM group performed significantly better than the STR and the CON groups in the 30 m dash, squat jump and countermovement jump. It is concluded that the combined resistance and running – speed programme provides better results than the conventional resistance training, regarding the power performance of soccer players.

Karwande (1981) made a study on “comparative effect of yogic and physical exercises on anxiety level and mental fatigue of children. The study was carried with sixty male students from VII and VIII standard. The average age of the subjects was 12 years. The anxiety level and the mental fatigue were taken as criteria measure for the purpose of the study. The tests were taken before and after
the experimental period of six weeks. He concluded that anxiety level can be reduced either by training in selected asana or in related physical exercises. Mental fatigue can be reduced either by training in selected asana or in related physical exercise and the training in selected asana was superior to the training in physical exercise for both variable though the difference was not statistically significant.

**Baquet et al., (2003)** state that the training – induced adaptations in aerobic fitness have been extensively studied in adults and some exercise scientists have recommended similar training programmes for young people. However, the subject of the response to aerobic training of children and adolescents in controversial. The effects of exercise training on prepubertal children are particularly debatable. The latter may be partly explained by different training designs, which make comparisons between studies very probleblanketic.

**Viswalingam (1993)** conducted a study on the comparative effect of aerobic exercises on selected physical and physiological variables between normal and visually handicapped boys. For the purpose of this study he has selected 30 normal boys and 30 visually handicapped boys. The normal boys were tested in connection with physical and physiological variables and were given aerobic exercises for six weeks and the visually handicapped boys were tested and were given the exercises training. To find out the comparative effect between normal and visually handicapped boys in physical and physiological variables, ‘t’ test was employed for significance. These was no significant difference both for normal and visually handicapped boys in breath holding time. There was a significant
difference between the normal and visually handicapped boys in agility, power, strength, pulse rate and vital capacity.

**Uppal (1982)** found that the efficiency of an individual in performing physical activities depends basically on cardio respiratory changes and training results in development of the circulo – respiratory efficiency. As a result of his study, he came to the conclusion that by endurance training, the efficiency of the circulatory and respiratory system is improved. Maximal O\textsubscript{2} uptake is increased. Stroke volume and cardiac output are increased. Ventilatory efficiency is improved, lung volumes become longer and diffusion capacities increased.

**Michael (1960)** conducted study to find out the pulse were and blood pressure changes occurring during a physical training programme, it was concluded that the resting and post exercise systolic blood pressure measurement decreased significantly during training. The changes were significant after 16 weeks while the pulse rate changes indicated conditioning and changed in six weeks. During training these measurements were reversed and made significant change in ten weeks.

**Selvaraju (1991)** conducted a study on effect of circuit training and aerobic exercise on selected physiological variables and motor abilities among school boys. For the purpose on the study ninety subjects were selected randomly between ages eleven to sixteen years. The subjects were divided into three equal groups each group consisting of 30. One was control and the other two were
experimental groups. The investigator selected the variables such as agility, speed, power, breath holding time, vital capacity and pulse rate.

**Feenstra (1988)** conducted a study on comparison of jogging and aerobic fitness exercise in their ability to enhance cardiorespiratory fitness in sedentary young women. For that study selected parameters were compared following a 3 days per week, 12 weeks exercise programme between aerobic fitness exercise (AFF) and jogging (J) variables included VO$_2$ mad, body weight and percentage fat. Percentage of perceived exertion (RPE) were also examined, subjects were 27 females aged 18-30 years. Experimental subjects (N =20) trained at an intensity equal to 70 percent of their heart rate reserve. Initial duration of training was 15 minutes during 1$^{st}$ week, post training to 45 minutes by 2$^{nd}$ week. Post training the AFE and ‘F’ groups evidenced significance improvement in VO$_2$ max expressed in both absolute and relative terms. ANOVA on post training VO$_2$ max between 32 groups revealed a significant changes were noted in body weight percentage fat within or between groups.

**Faigenbaum et al. (2003)** concluded that the strength training has become an accepted method of conditioning in children. However, there is concern among some observers that maximal strength testing may be inappropriate or potentially injurious to children. The purpose of this study was to evaluate the safety and efficacy of 1 repetition maximum (1RM) strength testing in healthy children. Thirtytwo girls and 64 boys between 6.2 and 12.3 years of age (mean age 9.3 x 1.6 years) volunteered to participate in this study. All subjects were screened for medical conditions that could worsen during maximal strength testing. Under close supervision by qualified professionals, each subject performed a 1RM test
on 1 upper-body (standing chest press or seated chest press) and 1 lowerbody (leg press or leg extension) exercise using child-size weight training mechanics. No injuries occurred during the study period and the testing protocol was well tolerated by the subjects. No gender differences were found for any upper or lower-body strength test. These findings demonstrate that healthy children can safely perform 1RM (repetition maximum) strength tests, provided that appropriate procedures are followed.

Radhakrishnan (1993) studies on the effect of super circuit exercise programme on selected physical and physiological variables among college men students. For the purpose of the study, 60 undergraduate students were selected from Thiagarajar College, Madurai as subjects. Their age group ranged from eighteen to twenty. They were again divided into two equal groups on random basis in which one was control group and the other was experimental group. The investigator selected physical variables such as agility, strength and flexibility and physiological variables such as pulse rate, vital capacity and breath holding time. To compare the physical and physiological variables ANACOVA technique was employed. It was found out that super circuit exercise programme brought out significant improvement in agility, strength, flexibility, pulse rate and vital capacity. However, it was also found out that the super circuit exercise programme did not bring and significant improvement on breath holding time.

Kritpet et.al., (1989) conducted a study to determine the effect of 6 weeks strength training programme consisting of squat and plyometric exercises on vertical power jump performance, static and dynamic muscular strength and muscular
power production in college adults. Fifteen male and two female college students in an advanced weight training class at the Oregon state University served as subjects of the study. Nine subjects trained only with squat exercise whereas eight subjects trained with combined squat and plyometric exercises. All subjects trained twice a week for six weeks. A pre-test randomized group design was utilized in this study. The statistical analysis was conducted using a paired ‘t’ test and a repeated measures ANOVA. A.05 level of significance was selected for rejection of null hypothesis (p <.05). The results of the training program indicated a significant meant gain (p<.05) within both training programs. However no difference existed between the gains achieved by the two training programs. The result of the study will assist physical educationist and coaches in designing more effective training program both at college and high school level.

Harold (1986) has taken 33 college men doing the toe touch test as subjects to ascertain the relative contribution of selected extensibility exercises, arranged with progressive increase, to the flexibility of the hip joint. The subjects performed six tests over a five –week period. The first and sixth tests had no warm ups. Results indicate that tests, which included extensibility exercises, allowed the subject to display greater flexibility.

Kobayashi (1969) studied the effects of 8-week rope skipping programme on the cardiovascular fitness of 13 male high school non-athletes. Each boy skipped rope five minutes daily for 35 training sessions. Oxygen consumption and heart rate were determined from a standard treadmill run. As shown by these tests, cardio-respiratory fitness was improved significantly.
In duration study by **Tooshi (1977)** the jogging was two days a week and four days a week. It was demonstrated that four days a week programme was superior to two days a week programme in obtaining significant improvements in working capacity, cardiovascular fitness and body composition.

**Anish Kumar Marais (2006)** conducted the study on effect of aerobic exercise and circuit training on selected motor abilities and physiological variables among high school boys. The study was delimited to fifty high school boys of St. Joseph’s higher secondary school, Thiruvananthapuram, Kerala as subjects at random age group between 13 to 15 years. The Test was tested by standardized test. The selected variables are Motor Ability, 1) Abdominal muscular endurance, 2) Trunk flexibility, 3) agility, 4) endurance of the arm and shoulder gridle, Physiological Variables 1) resting pulse rate, 2) cardio respiratory fitness, 3) cardiovascular fitness. The collected data was analysis of variable of comparing co-related (paired) samples. The study showed that significant improvement in the total physical fitness of high school boys. The influence of regular aerobic exercise and circuit training.

**2.3 STUDIES ON CIRCUIT TRAINING**

**Selvi (1998)** analysed the effect on plyometric, circuit training and XBX plan on selected physical, physiological, haeblanketological and biochemical variables of Tamil Nadu Agricultural University women students. For the purpose of the study ninety women students studying in second and the third year undergraduate course were selected as subjects. The subjects were divided into three groups, each group consisting thirty subjects. Group one underwent a
treatment for polyometric training. Group two followed circuit training and group three followed XBX plan for a period of twelve weeks. After the experimental treatment of twelve weeks, final reading was taken on the above variables. Analayis of co-variance was employed to find out the comparative effect of each training. It was found out that all the physical, and physiological variables were significantly improved through circuit training.

Fincher (1991) In a study to find out the influence of high intensity variation of circuit training program, today college football players were randomized in to experimental and control groups. The experimental group (N=20) participated three days per week on alternate days utilizing a very brief, high – intensity variation of circuit training. The conventional circuit – training program made significant improvement in power, endurance and strength. However, the high intensify program of circuit training produced significantly greater improvement then did the conventional program.

Smith (1980) studied the effects of circuit training on the performance skills of beginners and advance beginner swimmers. Fifty two male and female students and North Carolina central university were subjects. The variable measured for beginner swimmers were breath holding, prove glide, arm stroke and crawel stroke and back stroke. Students were randomly divided in to equal groups the experimental groups engaged in six weeks swimming only. It was found that the circuit training had a significant effect on the performance skills of the experimental beginners based on the red cross progressive swimming test.
Gaurbutt, Boocock (1989) and others studied and considered 3 circuit of 9 exercise to establish the extent to which physiological response during the first circuit can be sustained throughout the training session. Heart rate, blood locate, perceived exertion and VO\(_2\) were obtained on 8 subjects while performing degree circuits. The heart rate and perceived exertion should a significant increase throughout the session. The VO\(_2\) did not vary between circuit, the mean (+SD) value being 27.4 (+6.2) ml Kg\(^{-1}\) min\(^{-1}\). The blood lactate concentrations were 4.3 (+1.1) mm (+20) mm and 5.5 (+1.9) mm for the first, second and third circuits respectively, these difference being non-significant. The pace of work declined systematically during the session whose average duration was 18.5min. The slow rates of performance during the second and third circuit were best predicted by the heart rate (r=0.85, 0.78) and blood lactated (r =0.76, 0.69) the rating of perceived exertion was a poor predictor of performance rate.

Mary Reethammal (1994) conducted a study on Effect on varied frequencies of circuit training on muscular performance of college women. For the purpose of the study ninety girls were selected at random and their age ranged from 16 to 19 years. The subjects were divided into three equal groups of 30 each. One control and two experimental groups. The research selected speed, explosive power, strength and agility as the variables for the study. To compare the statistical data ANACOVA was employed. It was found out that the muscular performance, such as speed, explosive power, muscular strength and agility were significantly improved due to the influence of 3 days and 5 days circuit training among college women.
Ravikumar (1992) conducted a study on effect of circuit training on selected physical and physiological variables. For the purpose of the study sixty boys free form deformities and elements were selected at random. Thirty boys in control groups and thirty boys in circuit training groups. The age of the boys were between 13 to 15. The investigator selected physical variables namely speed, strength, agility and power and two physiological variables namely pulse rate and vital capacity. To compare the selected physical and physiological variables ANACOVA technique was employed. It was found out that all the physical and physiological variables were significantly improved through circuit training. When compared with control group there was no significant improvement in speed.

Raj Mohna (1991) conducted a comparative study on the effects of physical training programme on selected physical and physiological variables among school students. For the purpose of the study seventy five boys in the age group of 13 to 15 years were selected from Kendriya Vidyalaya Coimbatore. The subjects were divided into three equal groups were randomly assigned as swimming, Cycling and control groups. Then investigator selected the variables such as muscular endurance flexibility pulse rate and vital capacity. ANACOVA was used for statistical technique. It was found that the practice of cycling and swimming improved efficiency significantly in physical variables, compared to that of physiological variables such as muscular endurance, flexibility, pulse rate and vital capacity.

Chowdary (1991) did the analysis of circuit training variations on selected biochemical variables on college men athletes. For the purpose of the study 60
male subjects from SR UB SJB Maharani Autonomous College Peddapuram, Andhra Pradesh was selected and their age ranged from 17 to 21. The subjects were divided into three equal groups on twenty each. Two experimental and one control group. The researcher selected blood sugar, cholesterol, pyruvic acid and lactic acid and the variables for the study. To compare the statistical data ANACOVA was adopted. It was found out that there was no effect on blood sugar level because of circuit training. At the same time circuit training had significantly reduced blood cholesterol.

Singh (1991) conducted a study on comparative effectiveness of specific circuit training, weight training and combination training on selected skills among basketball players. For the purpose of the study ninety six male students studying in standard nine of the Kendriya Vidyalaya No.1 Gwalior were selected as subjects. The subjects were divided into four groups. Each group consisting of twenty four subjects. Group I for control group, Group II underwent for specific circuit training group, Group III went for weight training and Group IV went for the combination training group. After the experimental treatment of twelve weeks, final reading was taken. Analysis of co-variance was employed to find out the comparative effect of each training. It was found out that in from shot, side shot, foul shot, speed pass, jump and reach over arm pass for accuracy, push pass and dribble were significantly improved through combination training method.

Alexander (1988) analysed the effect of the circuit training weight training and interval training on cardio respiratory endurance. Fifty one college males from development physical education classes at the University of Maxico were
randomly assigned to one of the three exercises programme. The subjects were trained for a Post-test measures of circulo-respiratory endurance were administered under same experimental conditions. The analysis of variance showed no significant difference in between the three exercise programmes in the measures of circulo respiratory endurance.

**Akilan and Muthusubramanian (2011)** have evaluated the effectiveness of a basketball specific endurance circuit on improving aspects of aerobic capacity of school basketball players. Thirty male high school aged basketball players volunteered to participate in this study. The mean (SD) age, height and body mass were 16.1 x 1.9 years, 1.72 x 0.5 m, 70.3 x 10.5 kg, respectively. The experiment group under went 6 weeks 2 sessions per week of basketball specific endurance training this was carried out on an outdoor courts. This training was carried out during the competitive phase of the high school basketball season. Pre and post aerobic capacity was measured on the field. There was a statistical significance from pre to post testing in the experimental group (p < 0.005) and no statistical significance on control (p < 0.05) group. The mean increase being 1.7 ml/kg/min was found in the experimental group. The basketball specific endurance circuit induced greater improvements in VO2, suggesting it was somewhat effective in improving aerobic fitness during the competitive season.

**Chelly et al. (2009)** investigated that the effects of voluntary maximal leg strength training on peak power output (W peak), vertical jump performance and field performances in junior soccer players. Twenty-two male soccer players participated in this investigation and were divided into 2 groups: A resistance
training group (RTG; age 17 +/- 0.3 years) and a control group (CG; age 17 +/- 0.5 years). Before and after the training sessions (twice a week for 2 months), Wpeak was determined by means of a cycling force-velocity test. Squat jump (SJ), counter movement jump (CMJ) and 5-jump test (5-JT) performances were assessed. Kineblanketics analyses were made using a video camera during a 40 m sprint running test and the following running velocities were calculated. The first step after the start (V (first step)), the first 5 m (V(first 5 metres)) and between the 35 m and 40 m (V (max)). Back half squat exercises were performed to determine 1-repetition maximum (1- RM). Leg and thing muscle volume and mean thigh cross-sectional area (CSA) were assessed by anthropometry. The resistance training group showed improvement in Wpeak (p<0.05), jump performance (SJ, p < 0.05 and 5 JT, p < 0.001), 1-RM (p < 0.001) and all sprint running calculated velocities (p<0.05 for both V (first step) and V (first 5 metres), p<0.01 for V (max)). Both typical force-velocity relationships and mechanical parabolic curves between power and velocity increased after the strength training programme. Leg and thigh muscle volume and CSA of RTG remained unchanged after strength training. Back half squat exercises, including adapted heavy loads and only 2 training sessions per week, improved athletic performance in junior soccer players. These specific dynamic constant external resistance exercises are highly recommended as part of an annual training programme for junior soccer players.

The study was tested the safety and the effects of circuit resistance training (CRT) on peak upper extremity cardiorespiratory endurance and muscle strength in chronic survivors of paraplegia due to spinal cord injury. **Method:** Ten men with chronic neurologically complete paraplegia at the T5-L1 levels participated in
the study. Subjects completed 12 wk of CRT, using a series of alternating isoinertial resistance exercises on a multi-station gym and high-speed, low-resistance arm ergometry. Peak arm ergometry tests, upper extremity isoinertial strength testing, and testing of upper extremity isokinetic strength were all performed before and after training. **Results:** None of the subjects suffered injury from exercise training. Significant increases were observed in peak oxygen consumption (29.7%, p<0.01) time to fatigue (p<0.01 and peak power output during arm testing (p<0.05). Significant increases in isoinertial strength for the training maneuvers ranged from 11.9 to 30 per cent (Ps<0.01). Significant increases in isokinetic strength were experienced for shoulder joint internal rotation, extension, abduction, adduction and horizontal adduction (Ps<0.05). **Conclusion:** Chronic survivors of paraplegia safely improve their upper extremity cardiorespiratory endurance and muscle strength when undergoing a short-term circuit resistance training programme. Gains in fitness and strength exceeded those usually reported after either arm endurance exercise conditioning or strength training in this subject population (Jacobs *et al.*, 2001).

**Murugesan (1990)** conducted a study on effect of hollow sprints and Fartlek training on selected physiological variables. For the purpose of the study ninety male subjects from Muthiah Alagappa Blanketriculation Higher Secondary School, Kottiayur, Sivagangai District were selected. Their age ranging from fourteen to sixteen years. The investigator selected physiological variables such as haemoglobin content, mean arterial blood pressure, pulse rate and breath holding time. To compare the variables ANACOVA technique was employed. It was found that Fartlek training group when compared with hollow sprints group.
Fartlek training group had a significant improvement in haemoglobin content and hollow sprints group had a significant improvement in breath holding time, pulse rate and mean arterial blood pressure of health related and fitness gram, which represent the ingredients for performance related physical fitness. The decrease in body fat percent proved that the obtained result was mainly on the account of the effect of %BX fitness plan.

**Oslem (1987)** studied the effect of a set of circuit training programme on strength and muscular endurance of college age male (N = 42) enrolled in weight training classes participated in the study. Pre and post test for IRM strength absolute muscular endurance and relative muscular endurance were given for the bench press and leg press. Treatment consisted of two work out session per week of seven weeks. In each session students were requested to complete two sets of ten exercises. Both size of an exercise were completed before a student moved to the next activity. A work result ratio of 20 sec was used. Test, re-test procedure and pre and post test means changes were analysed using Pearson’s ‘r’ and independent ‘t’ analysis. Mean changes between pre and post tests for IRM strength in the bench press and leg press and relative muscular endurance in the bench press were significant (P<0.05). No significant changes in relative muscular endurance in the leg press (P<0.05).

**Donaghe (1977)** studied the effects of rope skipping upon motor fitness elements and Badminton achievement of college women. Two beginning classes were utilized in the study. One class included 10 minutes of rope skipping and the other class who served as a control did not. The rope skipping routine started with
rest periods interspersed with skipping. As time progressed the rest periods were gradually shortened until they were eliminated and the vigour and complexity of the skipping increased. Both groups improved significantly on all motor fitness and badminton tests. However, the difference between the groups were not significant. Fitness results achieved from rope skipping not only depend on the length of time skipping is continued and the interspersing of test period between skipping bouts, but also on the rapidity or speed of the rope turns.

Baker (1968) conducted a study to determine the effects of cardiovascular efficiency that results from a programme of rope skipping and jogging. The Harvard step test was administered to ninety two male students in order to determine their level of cardiovascular efficiency. The subjects were than randomly divided into two groups; group I skipped rope 10min. daily for six weeks and group II jogged thirty minutes daily for six weeks. Upon completion of the conditioning programmes the subjects again were administered the Harvard step test and comparisons were made from the pre exercise and post exercise data. The conclusions of this study were that a daily ten minute programme of rope skill will significantly improve cardiovascular efficiency as measured by the Harvard step test. A daily thirty minute programme of jogging will significantly improve cardiovascular efficiency as measured by the Harvard step test and a ten minute daily programme for rope skipping is as efficient as a particular thirty minute daily programme of jogging for improving cardiovascular efficiency as measured by the Harvard step test.
Karthikeyan (2011) analysed the effect of moving circuit training on selected motor fitness variables namely leg strength and back strength. To achieve this purpose of the study, thirty men students studying in the Department of Physical Education and Sports Sciences, Annamalai University, Annamalai Nagar, Tamil Nadu and India were selected as subjects at random. Their age ranged between 18 to 24 years. The selected subjects were divided into two equal groups of fifteen each namely moving circuit training group and control group. The experimental group has undergone twelve weeks of moving circuit training, whereas the control group maintained their daily routine activities and no special training was given. The subjects of the two groups were tested on selected motor fitness variables namely leg strength and back strength using standardized tests namely leg lift with dynamometer and back lift with dynamometer before and after the training period. The collected data were analyzed statistically through analysis of covariance (ANCOVA) to find out the significant difference, if any between the groups. The .05 level of confidence was fixed to test the level of significance which was considered as an appropriate. The results of the study showed that moving circuit training group showed significant improvement on leg strength and back strength compared to control group.

2.4 STUDIES ON YOGIC PRACTICES

Gharote, (1973) conducted a study on the effect of yogic training on physical fitness. He employed fleishman basic fitness test. 17 males and 12 females were his subjects and they were given three weeks training in selected yogic exercises. He found significant increases of 7.74 in fitness index in males and 11.75 in females.
Gharote and Ganguly, (1973) observed that nine weeks practice in yogic culture was helpful to improve general physical fitness level of 49 cadet police who were already conditioned to physical activities. The control group was engaged only in school schedule. The physical fitness of the subjects were judged through (a) Fleishman – basic fitness test (b) Cureton’s flexibility test (c) Skin – fold and (d) Harvard – step test. The improvement was most significant in flexibility.

Santoshi (2010) found that the effects of Pranayama on status of cardio respiratory endurance. Also the study was conducted on 120 male students between the age group of 13 to 17 years. Four groups consisting of 30 students each were formed. This study examined which type of Pranayama group had the maximum effect on the physiological fitness of subjects. Results showed that every type of Pranayamas improved the physiological fitness but training of Ujjayi and Bhashrika Pranayama can collectively provide the best results.

Krishna Kumar (2007) has studied on “Yoga and Physical fitness” determined yoga is all embracing, all inclusive and universal in its application leading to all round development of body, mind and soul. Yoga aims at bringing about an integration of the psycho-physiological processes. Yogic practices are intended to stabilize the psycho physiological mechanism so that there are fewer tendencies towards an imbalance in the face of external and internal stimuli. This unique contribution of yogic exercises and improved various components of physical fitness such as flexibility, speed, balance and cardiovascular fitness.
Govindarajulu, (2003) “Effect of Yoga Practice on Flexibility and Cardio Respiratory Endurance on High School Girls” Sixty (n =60) high school girls (average age 12 years) volunteered for a pre-experimental group design, where the practice of selected yoga practice was given as an intervention to the experimental group ‘A’ (n1 = 30) for a period of eight weeks. The control group ‘B’ (n1 =30) was not allowed to participate in the experimental treatment. The pre – and post tests were conducted on flexibility and cardio respiratory endurance. The results of ANOVA revealed that three was improvement in flexibility and no significant change was evident in the cardio respiratory endurance.

Selvam (2007) has studied the effect of yogic training on selected physical fitness variables. Sixty college girls in the age group of 18 to 21 years of age were selected as subjects, in that, 30 girls acted as control group and 30 girls undergone experimental group for a period of eight weeks. Prior to and at the end of the yogic training the pre test and post test was conducted on speed (50 metre dash), flexibility (Cureton’s flexibility test), agility (shuttle run) and balance. The data collected from the subjects were statistically analysed by ANCOVA. Results of the study revealed that significant mean difference was obtained in speed, flexibility, agility and balance. Yogic training for 8 weeks and contributed for the improvement on speed, flexibility, agility and balance.

To find the effect of yogic practices and physical exercise on muscular endurance and vital capacity. For this purpose forty-five sedentary working women from various faculties (Except from the Department of Physical Education and Sports Sciences) of Annamalai University in the age group of 35 to 45 years
were selected. They were divided into three equal groups. Each group consisted of fifteen subjects, of which, group-1 underwent yogic practices, group-2 underwent physical exercise and group-3 acted as control, who did not participate in any special training. The training period for this study was five days per week for eight weeks. Prior to and after the training period the subjects were tested for Muscular Endurance and Vital Capacity. It was concluded that after the yogic practice and physical exercise periods that both training has improved the Muscular Endurance and Vital Capacity. The analysis of covariance (ANCOVA) was used to find out the significant difference if any, among the experimental groups and control group on selected criterion variables separately. In all the cases, .05 level of confidence was fixed to test the significance, which was considered as appropriate (Elavarasi and Gopinath, 2011).

Limited studies have been carried out regarding the effects of a selected routine of Yogic practices on the improvement of physical fitness. It is accepted by the authorities in physical education that Yogic procedures are the best to contribute to improve the flexibility (Smithless and Cameron, 1962) Yoga and Physical education both strive to attain healthy and fitness through their programmes in which Yogic approach seems to be more sound and effective. Apart from the practices like Yamas and Niyamas, meant for Training and conditioning of attitudes, the nature of so-called physical practices like Asanas, Pranayamas etc., contributed to the emotional training by influencing autonomic nervous system and endocrinal system.

Prasad (1966) evaluated the Yoga System of physical education. The education was made through the use of scientific analysis, seminar discussions,
some experiments and judgement of experts. Rating by the experts indicated that the yoga asanas selected made a very good contribution to flexibility, balance and endurance but it gave only a little contribution to the development of strength.

**Giri (1966)** using a set of Yogic exercises studied the effects of the programme for 6 weeks on the five tests of National physical efficiency. He found a significant improvement among the experimental group in all the five sets as a result of Yogic training. However when the group discontinued the practice of Yogic exercises for the same period of 6 weeks, the effect gained was significantly lost.

**Chakrabarthi (1984)** studied the effects of individual Asana by dividing the volunteers into three groups, each group practicing one of the three important ‘Asanas’ namely Sarvangasana, Sirasasana and Halasana. Each was practiced along with complementary postures in Blanketsyasana, Mayurasana and Pachimotanasana for optimal results. The effect of sarvangasana induced cardio respiratory response and less endocrine and metabolic response. Sirasasana induced less physiological changes and Halasana produced more physical changes and less physiological changes.

**Mall (1989)** found Savasana, a yoga relaxation method to be of great utility in reducing the heart rate, systolic and diastolic pressure of all the four recovery techniques. Nine weeks’ training in yogic physical culture and helpful to improve general physical fitness level of forty-nine cadet police who were already conditioned to physical activities as against the control group of forty-nine engaged only in school schedule as judged through (a) Fleischman basic fitness
test (b) cureton’s flexibility test (c) Skin –fold and Harvard step test. The improvement was most significant in flexibility.

K.Devaraj (2000) conducted a study on the effect of yogic practice on health related physical fitness of visually impaired boys of the age group of 13 to 15 years. He selected 40 persons among which 20 were in the control group. He treated yogic practice on the experimental group. He treated yogic practice on the experimental group for six weeks to find out cardio-vascular endurance, flexibility, biceps and sub-exposal enhancement and made note at pre and post tests. The post test scores proved that there was significant improvement and enhancement among the boys due to the yogic practice.

Moorthy and Videmen (1995) conducted a study on the influence of exercise for the treatment of low back pain. Low back pain is one of the most common ailments of modern man. Twenty two women, aged 25 to 45 years working in administrative office in the University of Jyvaskyla (Finland) were selected as the subjects. They were suffering from non-specific lumbar back pain (LEP). All the subjects were administered spinal disorders, questionnaire, low back symptoms questionnaire, mood variables and selected spinal mobility variables before and after the experiment. The yogic training programme was kept only in the evening one hour every day. After the experimental period it was found out that low back pain was reduced to significant level.

Sankarealingam (1992) made a study on effect of yogic practices on the physical fitness and perceptual motor skills of high school boys in Pudukkottai District and to find out purpose of the study he selected 60 subjects in the age of 15 years. Subjects were divided into two groups. Selected yogic exercises were
given to the experimental group. ANACOVA were used for this study. He came to a conclusion that the yogic exercises had significantly improved physical fitness and perceptual motor leaning of high school boys.

Yellana Sulochana (1992) investigated the effects of selected physical and yogic exercises on cardiovascular efficiency and body fat percentage among polytechnic women. To this study, one hundred and five women students were randomly selected from Govt. Polytechnic for Women, Madurai. The subjects were randomly assigned to three groups of which one served as control group and the other two served as experimental groups. Each group consists of 35 subjects. The treatment was given for a period of six weeks. The final readings of measurements were than recorded at the end of the six weeks after the treatment period. The significance of the differences among the means of physical and yogic exercise groups for the pre-test and post tests mean gains were determined by F-ratio’s through analysis of variance.

Backialakshmi (1991) conducted a study on influence of selected Asanas and aerobic exercises on selected motor fitness and physiological variables among school boys. The purpose of this study was to find out whether Asanas and aerobic exercises had any influential effect on motor fitness and physiological variables. For this purpose he selected ninety subjects from Kendriya Vidyalaya Karaikudi. Subjects were divided into three homogeneous groups based on their initial performance. Group A is control group and group B and C were given treatment for forty minutes daily for five days a week for a period of six weeks. The Scheffe’s post hoc test was used to analyse the mean and the difference between the means of the various groups. Through this statistical technique he
came to a conclusion that asanas and aerobic exercises had significantly improved the motor fitness and physiological variables among school boys.

Yogic practices have been reported to improve the health and fitness of an individual. The study was undertaken on 14 male students of R.P.T.S.Khandala with a view to seeing the immediate effect of Kapalabhati on cardio vascular endurance as measured through Harvard step Test. Significant improvement (P<0.01) was seen in their cardio-vascular endurance after performing one minute of Kapalabhati as compared to the hyperventilation (S.K.Ganguly, 1989).

M.S.Nayer (1975) investigated the effects of yogic exercise on human physical efficiency. The subjects were conducted on 53 cadets on National Defense Academy. The parameters of assessment included ventilation minute volume; rate of respiration, oxygen consumption, pulse rate, blood pressure, mechanical efficiency and maximum oxygen intake. Four additional assessment were made under resting conditions, viz., vital capacity (VC) minimum breathing capacity (M.B.C), forced expiratory volume (FFV 10sec) and breath holding time. All 3 groups showed significant decrease in pulse rate during exercise. The yogic group in addition recorded highly significant increases in breath holding time (From 54 to 106 sec. And VC from 1.98 to 2.89 L/M² body surface area). The remaining two groups recorded only significant increases in VC, ventilation minute volume, rate of respiratory, blood pressure, mechanical efficiency, maximum oxygen intake capacity, and MBC remained unaltered is all 3 groups.

Chinnasamy (1992) conducted a study on effects of Asana and physical exercise on selected physiological and Bio-chemical variables among school boys. In this study ninety male students were randomly selected from Government
Higher Secondary School. The initial scores were measured for the selected variables namely pulse rate, systolic blood pressure, diastolic blood sugar level. The treatment was given for a period of 6 weeks for the experimental group. The significance of the difference among two kinds of exercise group and Asana group for the pre and post test mean gain were determined by F-ratio through analysis of variance. Asana had significantly improved the haemoglobin content, blood sugar pulse rate and blood pressure.

**Chaya et al. (2000)** in their study on the vital role played by yoga i.e. physical fitness, fitness related to health, skill and performance has assumed tremendous importance in recent times. A review, of research papers on yoga practices, physical exercises and its relation to metabolic changes is conducted at Vivekananda Kendra Yoga Research Foundation, Jigani, Bangalore. The goal of the review was to establish a comprehensive literature review and provide a rationale for future research concerning metabolic changes during yoga practice. Computer searches were conducted using medline, pubmed, along with library search and review of published journals and standard textbooks. An elaborate list of energy expenditure pattern of various physical activities is available but little documented for yogic exercises. Reviews are not large and need extensive research coverage. There is lack of replicated studies which will confirm the methods of results. Evidences suggest yoga as a mind/body approach which has very vast application. The life style changes leading to positive energy balance has been the causative factor for many of the metabolic disorders like hypertension, diabetes malites, cardio vascular diseases and obesity and related problems. Yoga, which is a time-tested method, has shown great positive influence on physical, mental, psychological, social and spiritual personalities of a person. With the
above in background various research works have been undertaken to measure the changes that takes place during yoga practices. The measurement of metabolic changes is one of them.

**Paulin Manimegalai (1993)** conducted a study on “Effect of selected yogic and physical exercises on health related physical fitness among Dindigul Anna District School girls of the age group between 13 to 15 years.” In order to conduct the experimental study, ninety students were selected who were poor in their fitness level (from the below average group). They were divided into three groups randomly namely control groups, experimental group I, experimental group II. Each group consisted to thirty subjects. The control group did not undergo any treatment. The training was given for six weeks. All the three groups were tested using the AAHPERD youth fitness test once again.