

## CHAPTER - II

### REVIEW OF RELATED LITERATURE

The phrase "review of literature" consists of two words "review and literature". In the research methodology the term literature refers to the knowledge of a particular area of any discipline, which includes theoretical, practical and its research studies.

The word Review means the study of the relevant literature to get a clear idea of what has been done with regard to the problem under this study. Such review brings in deep and clear perspective to the overall field.

A serious and scholarly attempt has been made to go through the related literature in books periodicals, journals and websites. The following review provides a rational foundation for the present study.

#### 2.1 YOGIC PRACTICES

**Bari Shaikh and Saheb (2013)** presented a study to find out the effect of yoga exercises for the development of physical fitness among college students. The sample for the present study consisted of 40 college girls out of which 20 were experimental group and 20 were control group. Yoga exercises were given to experimental group on alternate days i.e. three sessions per week and control group were given the general training of physical exercises for eight weeks. To assess physical fitness, 50 meters run, shuttle run and 600 yard run was conducted in pre test and post test on both groups. The results related to the hypothesis had been recorded. The difference between pre and post tests in experimental group and control group was highly significant. It was observed from the analysis of data that fitness variables like speed, agility and endurance were improved in the experimental group.

**Samsudeen (2011)** investigated the effect of asana, pranayama, meditation and game-specific training on selected physical fitness components and performance parameters among district level cricketers. Forty eight male college level cricketers were randomly selected from various affiliated clubs of Madurai District and their age ranged between 18 and 25 years. Group-I was involved in game-specific field training, Group-II was given game-specific field training combined with yogic practices and Group-III (Control) was not exposed to any specific training / conditioning. The game-specific field training schedule was specifically designed to improve the cricket playing ability and fitness levels of the cricketers for a period of twelve weeks, five days a week and two sessions each day, each session lasted two hours. The yoga practice included selected asana, pranayama and meditation technique. The motor components namely speed; explosive strength, endurance and flexibility were selected as variables for this investigation. Fifty meters run, standing broad jump, twelve minutes run, walk and sit & reach tests were administered to collect the physical fitness components of the subjects. Three qualified coaches subjectively rated the cricket playing ability of each player. The pre and post test were conducted one day before and after the experimental treatment. Analysis of covariance was used to analyse the collected data. Scheffe's test was used as a post hoc test to determine which of the paired mean differ significantly. The results of the study revealed that both game-specific training and game-specific combined with yogic practice produced positive impacts on the selected motor components and performance parameters.

**Samsudeen and Kalidasan (2007)** investigated the influence of game specific field training and yogic practices on physical, physiological, psychological and performance variables among college level cricketers. Four matched group each having sixteen boys of 18 to 25 years of age served as subjects. Group I involved in game-specific field training, Group II was given game specific field training combined with yogic practices, Group III

underwent yogic practices alone and Group IV (control) was not exposed to any specific training or conditioning. The training was administered for a period of twelve weeks, six days a week, two sessions each day and each game specific field training session lasted two hours. Yogic practices were melted out for 45 minutes to Groups I and III. Flexibility, endurance, resting pulse rate, breath holding time, sports competitive anxiety, self confidence, and technical skill level were selected as parameters for the study. The standardized test was administered before and after the experimental treatment for all parameters barring technical skill. Three qualified coaches subjectively rated the technical skill level of each player before and after the treatment. Analysis of covariance was used to analyse the collected data. The results indicated that the training groups I and II produced positive impact on all the selected parameters. The analysis also revealed that game- specific field training combined with yogic practices (Group II) showed significant improvement on all selected parameters among cricket players.

**Ramesh and Subramaniam (2010)** carried out a study on the effect of yogic pranayama and meditation on selected physical and physiological variables in adolescents with age group of 12 to 15 years. The subjects were divided into two groups namely control group and experimental group. The experimental group was given yogic pranayama and meditation for a period of twelve weeks, both morning and evening on alternative days in a week. The control group did not participate in yogic pranayama and meditation training programme. The collected data were statistically analyzed by using ANCOVA. The results revealed that there was a significant change in increasing the flexibility among adolescents of experimental group.

**Avalle and Valliumurgan (2010)** investigated the effects of selected yogic exercises and psychological skill training on selected psycho, physiological and psychomotor variables of high- level participants. The forty five intercollegiate level players were selected as subjects at random and their age ranged from 18 to 24 years. The subjects were divided into three equal groups. The study was formulated as a true random group design, consisting of a pre test and post test. The subject (n=45) were randomly assigned to three equal groups of fifteen men each as psychological skill training (PST), yogic exercises (YE) and control group (CG). The psychological skill training group and yogic exercises group participated for a period of twelve weeks and the post tests were conducted. The training programme was scheduled for one hour in the morning for three alternate days in a week for eight weeks. The results indicated that selected yogic exercises and psychological skill training on selected psycho, physiological and psychomotor variables gave positive results.

**Chen et al. (2009)** studied the effect of yoga program on fitness scores among school children. 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 30 subjects (exercise group 16; control group 14) completed follow-up. 1. Compared with children in the general population, the study subjects (n = 30) all fell below the 50th percentile in all five physical fitness items of interest. There was no significant difference in scores between the two groups at baseline (i.e., pre-exercise) for all five 78 fitness items. 2. Research found a positive association between exercise habit to muscular strength and endurance among asthmatic children. 3. Compared to the control group, the exercise group showed favorable outcomes in terms of flexibility and muscular endurance. Such

favorable outcomes remained evident even after adjusting for age, duration of disease and steroid use, values for which were unequally distributed between the two groups at baseline. 4. There was a tendency for all item-specific fitness scores to increase over time in the exercise group. The GEE analysis showed that yoga exercise indeed improved BMI, flexibility, and muscular endurance. After 2 weeks of self-practice at home, yoga exercise continued to improve BMI, flexibility, muscular strength, and cardiopulmonary fitness.

**Padmadevi (2007)** investigated the effects of yogic practices, physical exercises and combination of both the trainings on selected physiological and psychological variables of college women. The resting pulse rate, cardio respiratory endurance and breath holding time as physiological variables and anxiety, aggression, achievement motivation and self confidence as psychological variables were selected. Hundred and twenty college women were selected as subjects at random between the age group of 17 to 21 years. Further, they were divided into four equal groups and the treatment was given as follows. Group I- Physical training, Group II –yogic practices, Group III- Combination of both the training, and Group IV- control group. Pre test was conducted for the entire four groups prior to the training and the post test was conducted after six weeks of experimental treatment. Analysis of covariance was used to find out the significant effects of the treatment & Scheffee's post hoc test was used to find out the paired mean significant in selected difference. It was concluded that combination of both trainings ie Group III improved significantly in selected variables.

**Ghosh (2003)** conducted a study on the effect of physical exercises, yogic practices and the combined training on selected physiological variables among high school boys. Sixty subjects, age ranged from 13-15 years, were randomly divided into four groups of equal number such as physical exercise group, yogic practice group, combined group and a control group. The experimental groups underwent twelve weeks treatment programme. Both

pre- test and post- test were conducted for the collection of data. The data collection was made on the selected physiological variables, namely, pulse rate, respiratory rate, breath- holding time and mean arterial pressure. The study was aimed to find out which of the experimental factors was comparatively more effective. The result, after practice of yoga and a fitness plan on selected physiological parameters indicated an increase in vital capacity, chest expansion, breath holding time and body flexibility.

**Kamakhya (2007)** aimed at finding out the effect of Yoga Nidra on stress and anxiety of college men and women. The study was with a conducted at the Yoga clinic of Dev Sanskriti Vishwavidyalaya. Practice time was 30 min and the duration of six months. 80 students were selected from PG Yoga classes for observing the effect as well as 30 was in control group. The result showed a significant change in the practice group as yoga nidra positively decreased the stress level of the male and female subjects. The study was also substantiated with the result of several other studies proved that Yoganidra equally influences anxiety level significantly in both male and female subjects.

**Ranjita Mehrotra (2012)** studied the effect of Yoga on anxiety score and resting heart rate in young healthy individuals. The objectives for the study were to assess effect of yoga practices on anxiety score (using Taylor's manifest anxiety scale) and resting heart rate. Methods: Study group included subjects who participated in yoga practices for a period of 3 months. Control group included subjects who did not perform yoga or any exercise. Anxiety score and resting heart rate were recorded in both the groups before and after the treatment. Anxiety score was estimated with the help of Taylor's manifest anxiety scale questionnaire and resting heart rate was estimated by using electrocardiogram (ECG). Collected data was analysed using Mann Whitney test and paired't' test. At the end of three months statistically significant decrease in anxiety score and resting heart rate was observed in the

experimental group. Whereas, there was no statistically significant difference in anxiety score and resting heart rate of control group. Conclusion& Interpretation: It was evident from the study that yoga practices of even short duration (3 months) could reduce anxiety status and decrease resting heart rate. This probably indicated that parasympathetic activity was increased while sympathetic activity was decreased with yoga practices.

**Bhaskar (2012)** assessed the effect of yoga training on depression, self concept and mental health. 40 normal healthy students whose age was between 20 to 30 years were selected in which 20 were allotted for experimental group and 20 were in control group. Both groups were given pre test in three dimensions, i.e., Depression, Self concept and Mental Health. A yoga module consisting of yoga asanas, pranayama, meditation, of 30 minutes of training was given daily for a month. The pre and post tests were conducted for all the subjects. Positive effect of yoga was shown on depression, self concept and mental health of normal healthy students. Yogic exercises could reduce the depression and improve the self concept and mental health.

**Kumaraiyanathan and Surendar (2013)** found out the effects of circuit training and Yogic practices on power production. The study was conducted on sixty college men selected from various arts and science Colleges in Thanjavur district .They were randomly assigned into three groups, Group –I underwent circuit training (n = 20), Group II underwent yogic practices (n=20) and Group-III acted as control Group (n=20). Among the power parameters leg explosive strength was selected as criterion variables measured through surgeant vertical jump. The data collected from the experimental and control groups were statically examined with Analysis of Covariance (ANCOVA). The results showed there was a significant difference found among the groups on explosive power.

**Manikam (2011)** investigated the influence of strength training packages with and without yogic practices on selected psychological and technical skills among collegiate level Football players. Three matched groups each having 15 males of 18 to 25 years of age served as subjects. The Group-I acted as control group, Group-II was given strength training without yogic practices and Group-III was given strength training with yogic practices. The strength training was given for twelve weeks, four days per week of two hours duration every day in the morning session. Yogic package with strength training was given for 45 minutes of twelve weeks and four days per week of two hours duration every day in the evening session to Group-III. Psychological variables namely anxiety and achievement motivation were selected as variables as they may have direct relation to the performance of football players in competitive situation. These variables were assessed by administering standardized questionnaires. The skill level of the players was subjectively rated by three qualified coaches. Analysis of Covariance (ANCOVA) was used to analyze the collected data. Scheffe's test was followed as a post hoc test to determine the level of significant difference between the paired means. The results indicated that there was a significant difference in players' performance due to training. The results also showed that strength training with yogic practice group showed significant improvement in all the selected psychological and technical skill level of the players compared to other groups.

**Udupa et al. (2005)** carried out a study to find out the "Slow and Fast Pranayams on Reaction Time and Cardio respiratory Variables". The study consisted of short term (three weeks) training in savitri (slow breathing) and bhastrika (fast breathing) pranayams on respiratory pressures, endurance, reaction time, blood pressure and heart rate, respiratory pressures product and double product. Thirty student volunteers were divided into two groups of fifteen each. Group I was given training in savitri pranayam that involves slow, rhythmic, and deep breathing. Group II was given training in bhastrika



pranayam, which is bellows-type rapid and deep breathing. Parameters were measured before and after three week training period. Savitri pranayam produced a significant increase in respiratory pressures and respiratory endurance. In both the groups, there was an appreciable but statistically insignificant shortening of reaction time. Heart rate and respiratory pressure product and double product decreased in savitri pranayam group but increased significantly in bhstrika group. It was concluded that different types of pranayams produced different physiological responses in normal young volunteers.

**Pratima et al. (2008)** done a research on “effect of suryanamaskar practice on cardio-respiratory fitness parameters”. The study tested efficacy of regular practice of ‘suryanamaskar’ in improving the cardio-respiratory fitness. The study was conducted on 78 subjects, (48 males and 30 females) and observed for 6 months of suryanamaskar practice which eventually decreased resting pulse rate and blood pressure. At the same time it increased cardio-respiratory efficiency and respiratory capacity as evaluated by bicycle ergometer and various lung functions tests, in both male and female subjects. From this study it was concluded that suryanamaskar practice could be advocated to improve cardio-respiratory efficiency for patients as well as healthy individuals.

**Dhungel et al. (2008)** made a research on “effect of alternate nostril breathing exercise on cardiorespiratory functions”. The responses of Alternate nostril breathing (anb) the nadisudhi pranayama on some cardio-respiratory functions were investigated in healthy young adults. The subjects performed ANB exercise (15 minutes every day in the morning) for four weeks. Cardio-respiratory parameters were recorded before and after 4-weeks training period. A significant increment in peak respiratory flow rate (PEFR L/min) and Pulse Pressure (PP) was noted. Although Systolic blood pressure (SBP) was decreased insignificantly, the decreases in pulse rate (PR), respiratory

rate (RR), diastolic blood pressure (DBP) were significant. Results indicated that regular practice of ANB (Nadisudhi) increases parasympathetic activity.

**Sisodia and Tomar (2009)** carried out a research on “effect of anuloma viloma pranayama on selected respiratory variables”. The study was conducted on selected respiratory variables on 30 male college students, 15 students in each group (experimental & control) with the purpose to investigate the effect of anuloma viloma pranayama on selected respiratory variables. The selected respiratory variables were vital capacity, peak flow rate, positive breath holding time & negative breath holding time. To determine the effect of anuloma viloma pranayama on selected respiratory variables, analysis of covariance (ANCOVA) was employed at 0.05 level of significant. On the basis of results, the following conclusions were drawn: Significance improvements were found in relation to vital capacity (189.37), peak flow rate (13.44) & negative breath holding time (47.17). No significance effect was found on male students in relation to positive breath holding time (1.042).

**Sodhi, Singh and Dandona (2009)** made a research on “A Study of the Effect of Yoga Training on Pulmonary Functions in Patients with Bronchial Asthma”. The role of yoga breathing exercises, as an adjunct treatment for bronchial asthma is well recognized. One hundred twenty patients of asthma were randomized into two groups i.e., Group A (yoga training group) and Group B (control group). Each group included sixty patients and Pulmonary function tests were performed on all the patients at baseline, after 4 weeks and then after 8 weeks. Majority of the subjects in the two groups had mild disease (34 patients in Group A and 32 in Group B). Group A showed a statistically significant increasing trend ( $P < 0.01$ ) in % predicted peak expiratory flow rate (PEFR), forced expiratory volume in the first second (FEV1), forced vital capacity (FVC), forced mid expiratory flow in 0.25-0.75 seconds (FEF25-75) and FEV1/FVC% ratio at 4 weeks and 8

weeks as compared to Group B. Thus, yoga breathing exercises used adjunctively with standard pharmacological treatment significantly improves pulmonary functions in patients with bronchial asthma.

**Ray et al. (2001)** conducted a research on “aerobic capacity & perceived exertion after practice of hatha yogic exercises”. In this study the effect of Hatha yogic exercises on aerobic capacity and PE after maximal exercise was observed. Methods: Forty men from the Indian army (aged 19-23 years) were administered maximal exercise on a bicycle ergometer in a graded work load protocol. The oxygen consumption, carbon dioxide output, pulmonary ventilation, respiratory rate, heart rate (HR) etc., at maximal exercise and PE score immediately thereafter were recorded. The subjects were divided into two equal groups. Twelve subjects dropped out during the course of study. One group (yoga, n = 17) practiced Hatha yogic exercises for 1 h every morning (6 days in a week) for six months. The other group (PT, n = 11) underwent conventional physical exercise training during the same period. Both groups participated daily in different games for 1 h in the afternoon. In the 7th month, tests for maximal oxygen consumption (VO<sub>2</sub>Max) and PE were repeated on both groups of subjects. Results: Absolute value of VO<sub>2</sub>Max increased significantly ( $P < 0.05$ ) in the yoga group after 6 months of training. The PE scores after maximal exercise decreased significantly ( $P < 0.001$ ) in the yoga group after 6 months but the PT group showed no change. Interpretation & conclusion: The practice of Hatha yogic exercises along with games helped to improve aerobic capacity like the practice of conventional exercises (PT) along with games. The yoga group performed better than the PT group in terms of lower PE after exhaustive exercise.

**JohnsonPremkumar and Mariayyah (2006)** analysed the effect of selected yogic practices and physical exercises in amplifying the cardio respiratory endurance among the residential male college students. Sixty residential male college students were selected at random and divided into three groups of twenty each namely, Group A, Group B and group C. The first two groups were experimental groups and the third group was a control group. The experimental group A underwent a designed yogic practices training for three months and similarly the group B was treated with designed physical exercises. The control group (group C) did not undergo any special training. The status of cardio respiratory endurance of all the groups was measured through Cooper's 12 Minutes run/walk test and was recorded as initial scores. The same test was administered after three months of specific training and was recorded as the post test. The obtained pre test and post test were analysed by using Analysis of Covariance for significant improvements. Post- hoc test was applied to find out the better group among the three. The designed training package was suitable and made positive training impacts on cardio respiratory endurance among the subjects at various levels.

**Nandi et al. (2004)** studied the effects of aerobic exercise, yogic practice and the combination of both on cardio respiratory endurance. Eighty school boys (9th and 10th grade) were randomly selected and sub divided into four equal groups (n=20 in each group). Three training programmes viz., aerobic exercise, Yogic practice and combination of aerobic exercise and yogic practice were randomly allotted to three groups, where the remaining one group was control group. The performance on cooper's test (12 minutes run or walk) of all the three groups were recorded before and after 12 weeks training programmes. Result of ANCOVA reveals that the aerobic group showed greater cardio respiratory endurance ability. However the yogic practices group as well as the combination of aerobic exercises and yogic practice also have a significant improvement on the development of greater cardio respiratory endurance (post test f value=3.785.2.73 at .05 level).

**Harinath (2004)** studied thirty healthy men in the age group of 25-35 years who volunteered for the study. They were randomly divided in two groups of 15 each. Group I subjects served as controls who performed body flexibility exercises for 40 minutes and slow running for 20 minutes during morning hours and played games for 60 minutes during evening hours daily for 3 months. Group II subjects practiced selected yogic asanas (postures) for 45 minutes and pranayama for 15 minutes during morning, whereas during evening hours these subjects performed preparatory yogic postures for 15 minutes pranayama for 15 minutes and meditation for 30 minutes daily, for 3 months. Orthostatic tolerance, heart rate, blood pressure, respiratory rate, dynamic lung function (such as forced vital capacity, forced expiratory volume in onesecond, forced expiratory volume percentage, peak expiratory flow rate and maximum voluntary ventilation), and psychological profile were measured before and after 3 months yogic practices. Serial blood samples were drawn at various time intervals to study the effects of these yogic practices and omkar meditation on melatonin levels. Yogic practices for 3 months resulted in an improvement in cardio respiratory performance and psychological profile. The plasma melatonin also showed an increase after three months of yogic practices. The systolic blood pressure, diastolic blood pressure, mean arterial blood pressure, and orthostatic tolerance did not show any significant correlation with plasma melatonin. However, the maximum night time melatonin levels in yoga group showed a significant correlation ( $R=0.71$ ,  $P < 0.05$ ) with well-being score.

**Kamahi (2004)** examined the effect of yoga nidra on stress, anxiety and general well being on the students at the yoga clinic of Dev Sanskriti viswavidyalaya. The practice time was 30 minutes daily for a total duration of 6 months. 40 Students were taken from P.G.Yoga classes for observing the effects as well as 12 were in control group. The result showed a significant change as yoga nidra positively decreased the stress level of the subjects

where as no significant change had been seen in anxiety level. Moreover, Yoga nidra positively increased the general well being of the subjects.

## **2.2 AEROBIC EXERCISES**

**Ramesh (2012)** carried out a study to find out the effect of aerobic exercises and yogic practices on selected physiological parameters of diabetic patients. Forty five middle aged diabetic patients from Pudukkottai, Tamilnadu, India were selected as subjects at random and they were divided randomly into three groups of fifteen each, namely Group I underwent Aerobic Exercise (n=15), group II underwent Yogic Practices (n=15) and group III acted as Control group (n=15). The training period was limited to eight weeks, three days per week. Brisk walking with light conventional exercises were given to aerobic exercises group. Pre-test data of control and experimental group and also post test data of control and experimental groups were analyzed by Analysis of Covariance (ANCOVA). Better improvement was seen on the selected physiological variables due to the effect of aerobic exercises and yogic practices.

**Kumar and Kareemulla (2012)** conducted a study on forty male students of age group between 19 to 24 years. The subjects selected were divided randomly into four equal groups i.e. control group, Aerobic exercises group, Pranayama group and combined activity group (Pranayama with Aerobic exercise group) The criterion variable chosen for this study were as follows: Physiological variables – VO<sub>2</sub> max and Mean arterial pressure, Haematological variables – Red blood cells count and Hemoglobin content. The analysis of covariance was used to find out the difference among the groups after treatment. Scheffe's Post hoc test was used to find out the significant differences between the groups. The results indicated that aerobic exercises group and combined activity group (Pranayama and Aerobic exercises) were significantly improved two physiological and two

hematological parameters. The study also indicated that the aerobic exercises and the combined activity of Pranayama and aerobic exercises were found to be better in improving the physiological and haematological variables.

**Ramesh and Subramaniam (2011)** conducted a study on the effect of aerobic and calisthenics exercises on health related physical fitness variables such as muscular strength, muscular endurance, flexibility, cardio respiratory endurance and body mass index (BMI) of obese adolescents. Their age ranged from 12 to 18 years. The selected subjects were divided into two groups and assigned as experimental group and control group. The experimental group was given aerobic and calisthenics exercises for a period of three months, in the morning and evening for five days in a week. However, the control group was not allowed to participate in aerobic and calisthenic exercises training programme. The result of this study indicated that the experimental group showed better increment on muscular strength, muscular endurance, cardio respiratory endurance. It was also observed that Body mass Index significantly reduced in experimental group.

**Chaudhary et al. (2010)** evaluated the effects of aerobic and strength training on cardiac variables such as blood pressure, heart rate (HR), and metabolic parameters like cholesterol, high density lipoprotein (HDL), triglycerides and anthropometric parameters of obese women of Punjab. This study was performed as an experimental study, in which subjects were randomly selected. There were thirty obese women, aged between 35-45yrs with body mass index (BMI) of above 30. Subjects were grouped into control (n=10), aerobic training (n=10) and resistance training (n=10). Aerobic training was given for three days a week at 60-70% of maximum HR for 6 weeks. Resistance training (Delorme and Watkins Technique) was given for alternate days for 6 weeks. HR and blood pressure were measured before and after the exercise. Recovery HR was also measured. Aerobic training was considered more beneficial and could be used as a preventive measure in

patients who were at risk of developing cardiovascular diseases due to obesity.

**Sukhee Lee and Kim (2006)** identified the effects of aerobic exercise and yoga on body composition and lipid metabolism in abdominal obese women. Using one-group pretest-post test design, a convenience sample of 23 women who had abdominal obesity (greater 88 than 32 inches of waist circumference) was recruited in a local area of city and participated in 1 hour of aerobic exercise and yoga program twice a week for 12 weeks. Body composition was measured by body mass index, body fat ratio, waist and hip circumference, and waist-hip ratio; and lipid metabolism was measured with blood pressure, total cholesterol and triglycerides. At pretest, mean age of the subjects was 48.7(SD=9.5) and body fat ratio was 33%, and waist-hip ratio was .85. By paired t-tests. The results revealed that waist-hip ratio were significantly decreased after the aerobic exercise and yoga program.

**Nagarajan et al. (2013)** found out the effect of aerobic circuit training and parcours training on physical and physiological variables on college men. For this purpose, thirty men students, free from deformities and ailments, were selected at random by lot from VGR, Groups of arts and science college Thiruvallur. The age of the subjects were ranged from 20 to 25 years. The subjects were randomly assigned into one of the three groups in which group I acted as control (n=10), group II underwent circuit training (n=10) and group III underwent parcours training (n=10). In circuit training, a subject moved from one station to another and performed the prescribed exercise with the fixed duration at each station. The time was increased from fifteen seconds to forty seconds per station during the period of six weeks it was emphasized that the intensity of the exercise was kept at the maximum possible level throughout the prescribed total time and the circuit was repeated thrice daily. Parcours training consisted of a series of stations set up over a one to two and half km path, to provide exercise circuit for individuals. Parcours was a



technique for improving cardio respiratory endurance that basically combines continuous training and circuit training. This technique involved jogging a short distance from station to station and performing a designated exercise at each station according to guidelines and directions provided on an instruction board located at that station. The exercises performed at different parcours stations were jumping jack, step up, rope skipping, jumping on and off the bench, push up, sit up, shuttle run, half squat with weights. The results proved that aerobic circuit training and parcours training improved physical fitness and physiological variables of college men. Hence, it was recommended to include these training methods for improving specified physical fitness and physiological variables of college men.

**Marinković (2013)** made an attempt to discover whether there was a statistically significant difference between university basketball players in different playing positions (guard, wing and center) in terms of aerobic capacity. The study sample consisted of 30 basketball players, who had been categorized as guards ( $n = 11$ ), wings ( $n = 11$ ) and centers ( $n = 8$ ). The overall sample consisted of players of the basketball team of the faculty of Sport and Physical Education in Novi Sad, aged 20-26. With a laboratory on-line, breath-by breath (CPET) system their relatively maximal oxygen consumption –  $Vo_2max$  ( $ml \cdot kg^{-1} \cdot min^{-1}$ ) was diagnosed. The analysis of variance (ANOVA) was applied to the analysis of differences between participants in different playing positions. It was determined from the result that there was a difference ( $p < 0.05$ ) in the aerobic capacity of players in relation to their playing position. Players in the guard positions had the largest value of  $Vo_2 max$ , while the centers had the lowest values.

**Sekhon (2013)** found out the effects of yoga training, aerobic training and detraining on muscular endurance among college boys. To achieve this purpose, forty five college boys were selected as subjects from various departments of Nagaland University, Lomami. Their age was ranged between 18 to 21 years and were randomly divided into three groups of 15 each Group I acted as experimental group (yoga training) and group II acted as experimental group II (aerobic training) and group III acted as control group. The subjects were tested on selected criterion variable such as muscular endurance prior to and immediately after the training period. The selected criterion variable such as muscular endurance was measured by Bent knee sit ups. The collected data from the three groups before, during and after the experimentation was statistically analyzed by using two-way (3×3) factorial analysis of variance with last factor repeated measures. The data collected from the three groups at post test and detraining (three cessation) was statistically analyzed by using two way (3×4) factorial ANOVA with last factor repeated measures. Two way factorial ANOVA was used to find out the significant differences, if any, and the Scheffe's test was applied as post hoc test to determine which of the paired mean had significant differences. The 0.05 level of confidence was fixed to test the significance. The result of the study revealed that there was a significant difference among the experimental and control groups on muscular endurance.

**Merom (2009)** documented that walking is the most prevalent form of leisure time physical activity (LTPA) and examined the effect of prompting "walking for exercise, recreation, and sport" (WERS) upon surveillance estimates of LTPA and assessed what types of walking were recalled when reporting LTPA generally and when WERS was prompted specifically. METHODS: Data were collected by telephone survey from a random sample of 3,415 Australian adults (> or = 15 yrs). Respondents were asked first to recall any type of LTPA they participated in (unprompted) and if walking was not mentioned, WERS was prompted. All walkers were asked to describe the

type of walking they did. Open-ended responses were categorized according to physical activity measurement dimensions. RESULTS: Forty three percent did not report WERS unless prompted to do so. The prevalence of meeting recommendations by all LTPA was reduced by 10% for both genders and across all age groups if not prompted to recall WERS. The interpretation of WERS was broad and included travel related walking and dog walking whether unprompted or prompted. CONCLUSIONS: Current challenges in walking surveillance included ensuring that both researchers and respondents understand WERS in a standardized manner.

**John (2009)** assessed differences between seated and walking conditions on motor skills and cognitive function tests. METHODS: Eleven males (24.6 +/- 3.5 y) and 9 females (27.0 +/- 3.9 y) completed a test battery to assess selective attention and processing speed, typing speed, mouse clicking/drag-and-drop speed, and GRE math and reading comprehension. Testing was performed under seated and walking conditions on 2 separate days using a counterbalanced, within subjects design. Participants did not have an acclimation period before the walking condition. RESULTS: Paired t tests ( $P < .05$ ) revealed that in the seated condition, completion times were shorter for mouse clicking (26.6 +/- 3.0 vs. 28.2 +/- 2.5s) and drag-and-drop (40.3 +/- 4.2 vs. 43.9 +/- 2.5s) tests, typing speed was greater (40.2 +/- 9.1 vs. 36.9 +/- 10.2 adjusted words x min(-1)), and math scores were better (71.4 +/- 15.2 vs. 64.3 +/- 13.4%). There were no significant differences between conditions in selective attention and processing speed or in reading comprehension. CONCLUSION: Compared with the seated condition, treadmill walking caused a 6% to 11% decrease in measures of fine motor skills and math problem solving, but did not affect selective attention and processing speed or reading comprehension.

**Gappmaier et al. (2006)** examined the aerobic exercise in water versus walking on land, effects on indices of fat reduction and weight loss of obese women. To test this hypothesis 38 middle-aged obese woman (25-47% body fat) participated in a 13 week exercise-diet program to compare the effects of aerobic exercise in water versus walking on land on indices of fat reduction and weight loss changes. Subjects were randomly assigned to 1 of 3 exercise groups: 1) walking on land (WL), 2) swimming (SW) at 27 degrees C water temperature and 3) walking in 29 degrees C water (WW) at the shallow end of a declining pool with the water at navel height. Subjects in the SW group alternated breast-, side-, and backstroke swimming without face immersion. Exercise parameters were kept constant for all three groups. Subjects participated in supervised exercise sessions for 40 min, 4 times a week at 70% of age-predicted maximum heart rate. Subjects were tested before and after the 13-week experimental period. Significant reductions in body weight, (5.9 kg), percent body fat, (3.7%), and skin fold and girth measurements, occurred in all groups. There were no significant differences between groups. The results of this study indicated that there were no differences in the effect of aerobic activities in the water versus weight-bearing aerobic exercise on land on body composition components as long as similar intensity, duration and frequency were used.

**Selvam and Sudha (2008)** conducted a study on selected effect of aerobic exercise on selected physiological variables among college girls. For this study aerobic exercise uses, large muscle groups rhythmically and continuously and elevates the heart rate and breathing for a sustained period. Common examples include walking, jogging/running, swimming, rowing, stair climbing, bicycling, cross country skiing, step and dance exercises roller skating, etc. To achieve this purpose, 60 girls were selected from Theivannai Ammal College for women, Villupuram. The age group of the subjects ranged between 18 to 20 years. The selected subjects were divided into two groups. The groups first trained for aerobic exercise. The training group underwent

the training for 5 days in a week for eight weeks and group second acted as control group to make adjustments for differences in the initial means and test the adjusted post test means for significant differences. The researcher used analysis of covariance (ANCOVA) for interpreting the results. The results for the study revealed that aerobic exercises had a significant effect in the improvement of the physiological variables such as resting pulse rate, breath holding time, vital capacity and respiratory rate.

**Gregory Haff (2003)** investigated the effects of no training, aerobic training program, and combined resistance and aerobic training on middle aged women. The aerobic training group trained 6 days a week for 60 minutes at an intensity of 60 – 70% maximum heart rate, while the combination group performed resistance training 3 days per week (Monday, Wednesday, and Friday) and aerobic training 3 days per week (Tuesday, Thursday, and Saturday). Abdominal fat volume was evaluated with computed tomography before and after 24 weeks of training. Both the aerobic and combined groups experienced increased in maximal aerobic capacity ( $VO_{2max}$ ) and high-density lipoprotein-cholesterol. Also, the combined group experienced the greatest declines in subcutaneous fat (-61.8  $cm^3$ ) and abdominal visceral fat (-93.0  $cm^3$ ) when compared to the aerobic training group (subcutaneous: -23.1  $cm^3$ ; abdominal visceral fat: -82.6  $cm^3$ ). The findings of this study suggested that utilizing a combination of aerobic and resistance training produced the greatest alterations in body composition.

### 2.3 PHYSICAL FITNESS VARIABLES

**Reddy Kumar and Srinivas Reddy (2012)** investigated the effect of yogic exercises on speed and muscular power. The selected subjects were divided into two groups namely yogic exercises group and control group consisting of 15 each (n=15). During the training period the experimental group underwent their respective training programme i.e., yogic exercises for 45 minutes and 5 days a week for 8 weeks. The control group did not participate in any specialized training programme. Speed and muscular power was measured by AAHPERD youth fitness tests i.e., 50 mts. sprint and standing, long jump respectively. All the scores were recorded before and after the training. The statistical derivations included Mean, Standard Deviation and 'T' test. The results revealed that the yogic (Experimental) group showed significant difference between the pre test and the post test at 0.01 level of significance on both speed and muscular power.

**Fillmore et al. (2010)** documented the effects of yoga interventions on balance, flexibility, and strength in adolescent girls between the age of 14 to 18 years. Quasi- experimental, non-randomized and a convenience sample of 33 female adolescents participated in yoga training 2 times per week and a walking program 3 times per week, for 7 weeks. Pre- and post-measurements of weight, hamstring flexibility, body fat, strength, and balance were collected. Means were computed for all variables. Levene's tests for equality of variances were done to determine baseline homogeneity. Histograms with a normal curve superimposed were drawn to check for normal distribution. Repeated-measures general linear model tests were done to test for both within- and between-subjects factors, as well as 83 interactions between the two. It was concluded that yoga might be a useful adjunct to therapy programs.

**Raja (2011)** studied the 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, Chidambaram 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 yoga and physical exercises and group III acted as a control group. The experimental groups underwent their training programme five days per week for eight weeks. Control group did not undergo any training programme besides their routine work. The study indicated that muscular strength and self concept had significantly improved due to experimental treatments.

**Patricia et al. (1994)** determined the effects of a combined aerobic and circuit weight training program on maximal oxygen consumption, body composition, and muscular strength of college-age women. Of the 33 who volunteered to participate, 17 were randomly assigned to the exercise program while the remaining 16 served as controls. The training involved a 45-min circuit of 30 activities including five 3-min aerobic exercises and 25 to 30sec weight training or calisthenic exercises. The subjects exercised at 40 to 50% of their 1-RM for each weight station. Data were analyzed using repeated measures ANOVA with significance established at  $p < 0.05$ . The exercise group had significant increases in VO<sub>2</sub> max, upper body strength, and lower body strength, and significant decreases in skinfold sum and percent body fat. This indicated that an aerobic circuit weight training program was an effective way to improve cardiovascular fitness, body composition, and muscular strength in college women.

**Chen et al. (2009)** done a research on “the effect of yoga exercise intervention on health related physical fitness in school-age asthmatic children”. The study employed a quasi-experimental research design in which 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 30 subjects (exercise group 16; control group 14) completed follow-up. Results included: 1. Compared with children in the general population, the study subjects (n = 30) all fell below the 50th percentile in all five physical fitness items of interest. There was no significant difference in scores between the two groups at baseline (i.e., pre-exercise) for all five fitness items. 2. Research found a positive association between exercise habit after school and muscular strength and endurance among asthmatic children. 3. Compared to the control group, the exercise group showed favorable outcomes in terms of flexibility and muscular endurance. Such favorable outcomes remained evident even after adjusting for age, duration of disease and steroid use, values for which were unequally distributed between the two groups at baseline. 4. There was a tendency for all item-specific fitness scores to increase over time in the exercise group. The GEE analysis showed that yoga exercise indeed improved BMI, flexibility, and muscular endurance. After 2 weeks of self-practice at home, yoga exercise continued to improve BMI, flexibility, muscular strength, and cardiopulmonary fitness.



**Reddy and Ravikumar (2001)** conducted a study on yogasanas and aerobic dance and their effects on selected motor fitness components in girl subjects. The speed, shuttle run, agility, sit and reach to test flexibility and 9 min run/walk to test cardio respiratory endurance were conducted for control, yogasana and aerobic dance groups. The training was given for a period of 12 weeks with 10 subjects in each group. The data was analysed by 't' test, analysis of co-variance and post hoc test was done with Scheffes test. It was concluded that the practice of Yogasana improved significantly the speed, agility, flexibility and cardio-respiratory endurance, while practice of aerobic dance also improved significantly the above factors and there was no difference in between yogasanas and aerobic dance groups after training with regard to the speed, agility, flexibility and cardio-respiratory endurance.

**Tiken et al. (2002)** conducted a study on the influence of specific yoga and aerobic exercise on physical fitness of SAI (NERC IMPHAL) STC Athletes. 30 boys and 30 girls from SAI NERC Imphal were divided into two groups according to their mean age and height of 17.5 years and 15 years and 172.8cms and 156.4cms respectively. Training was given twice in a week for four months. Vertical jump to test explosive power, pushups and sit ups to test strength endurance, sit and reach to test flexibility, 50 yards dash to test speed and 12 min run walk to test endurance were conducted for aerobic exercise and yoga group before the training and after the two months and four months of training. It was concluded that (i) Improvement of physical fitness assessed on three selected physical fitness tests after four months of yoga and aerobic had justified the fact that both yoga and aerobic exercise were effective in developing physical fitness and (ii) in yoga and aerobic exercise groups, boys were found superior to girls group in sit and reach (flexibility) and 12 min run – walk (endurance), 50 yards (speed).

## 2.4 PHYSIOLOGICAL VARIABLES

**Toy (2008)** 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 did not undergo any training. The selected variables for this study were VO2 max, body weight, and BMI and percentage body fat measure. 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 also highlighted that systematic aerobic dance training helped to increase the physical and cardio respiratory fitness among middle aged women.

**Babu (2012)** determined the effects of selected yogasanas, pranayama and meditation on Physiological variables of male students, such as breath holding time and forced vital capacity. To achieve the purpose of the study forty male students were selected from Tagore Arts College, Laws pet, Pondicherry, India, to be random and their age ranged from 18 to 23 years and all of them were found to be healthy and normal. They were divided into two groups and designed as experimental and control group of twenty male (n=20) each. The experimental groups underwent a twelve weeks of yogasanas, pranayama and meditation training. The control group was not allowed to participate in any training programme except their regular physical education classes. The collected data were analyzed by using analysis of covariance (ANCOVA). The results of the study showed that yoga training could be an effective training programme to increase the breath holding time and forced vital capacity of male students.

**Singh and Deol (2012)** analyzed the differences of physiological variables of basketball players at different levels of competitions. The Study was conducted on 50 basketball male players (25 inter-collegiate and 25 under-19 School male basketball players). In this study the following physiological variables were taken (i) vital capacity (FVC, PIF & PEF) (ii) Vo2max. Results showed that there existed a significant difference between Inter Collegiate and Under-19 School Male Basketball players. The study also showed that Vital Capacity and Vo2max were higher in Inter collegiate Basketball Male Players when compared to with Under-19 school basketball male players.

**AnandaKumar and Elangovan (2011)** attempted to find out the effects of selected asanas and suryanamaskar on selected physiological variables among diabetic patients. Their age ranged between 30 to 40 years and divided into three equal groups of 10 each and assigned in to experimental group-I, experimental group-II and control group. In a week the experimental group I underwent asana practice, experimental group II underwent suryanamaskar practice and control group was not given any specific training. All the subjects underwent the following tests namely Resting Pulse rate, and Respiratory Rate. The selected variables were assessed before and after the training period of six weeks. The analysis of covariance was used to analyze the data. The study revealed that the selected criterion variables were significantly improved due to the influence of asana and suryanamaskar among diabetic patients.

**JohnParthiban (2011)** investigated to find out the quantification of physiological responses to yogic practices and weight training among professional college men players. For this purpose, forty five men studying in undergraduate engineering courses in government college of engineering, Salem, Tamilnadu, India, during the year 2010-2011 were selected as subjects at random and they were divided into three groups of fifteen each. In which

group I underwent yogic practices, group II underwent weight training and group III acted as control. The training period was limited to twelve weeks. The dependent variables selected for this study were resting pulse rate, respiratory rate and cardio respiratory endurance. All the subjects were tested prior to and immediately after the experimental period on resting pulse rate, respiratory rate, cardio respiratory endurance. The data obtained from the experimental groups before and after the experimental period were statistically analyzed with Analysis of covariance (ANCOVA). Whenever the 'F' ratio for adjusted post test means was found to be significant, the Scheffe's test was applied as post hoc test to determine the paired mean differences. The level of confidence was fixed at 0.05 levels for all the cases. Resting Pulse Rate, Respiratory Rate and Cardio Respiratory Endurance showed significant difference among the groups.

**Rajakumar (2010)** in his study analyzed the impact of yogic practices and physical exercises on selected physiological variables among the intercollegiate soccer players. To achieve this purpose, sixty (60) male intercollegiate soccer players from various colleges of Chennai, Tamil Nadu were selected at random. Their age ranged between 17 and 22. The selected subjects were divided into three equal groups of 20 each, namely yogic practice group (Group A), physical exercises group (Group B) and control group (Group C). The experimental groups underwent 12 weeks of training namely; yogic practices and physical exercises respectively, whereas the control group (Group C) maintained their daily routine activities. The subjects of the three groups were tested using standardized tests and procedures on selected physiological variables before and after the training period to find out the training effects in the following test items: resting pulse rate through stethoscope, breath holding time through digital stop watch, peak flow rate through Wright's peak flow meter. The collected data were analyzed statistically through Analysis of Co-variance (ANACOVA) and Scheffe's post hoc test to find out the pre and post training performances. The results

revealed that the yogic practices group showed significant improvement due to 12 weeks of training on resting pulse rate, breath holding time and peak flow rate compared to the physical exercise and control group. In the overall training effects in terms of improved number of physiological variables and their magnitude of improvement through training, yogic practices group was found to be the better group.

**Selvalakshmi (2007)** conducted a study on the effect of varied aerobic training program on obese women working in companies. In this study, two randomized groups of obese women working in IT companies and their effects on cardio respiratory functions was tested. The obese women were grouped into three namely, control, floor aerobic and step aerobics group. The collected data on the cardio respiratory parameters prior to and after 12 weeks of varied aerobics training were statistically analyzed using analysis of covariance (ANCOVA) as recommended by Clarke and Clarke. The result showed significant improvement on vital capacity due to varied aerobic exercises, whereas no significant improvement in resting heart rate was recorded.

**Wilber et al. (1996)** exercised aerobically trained subjects 5 days a week, alternating high intensity shorter workouts (90-100%  $VO_2$ max for 30 minutes) with moderately intense longer sessions (70-75%  $VO_2$ max for 60 minutes). Similarly, Bushman et al. (1997) employed a training regimen consisting of DWR 5-6 days a week integrating two long and short interval days, one long run and an easy recovery run. These training schedules not only reflect actual training routines of these competitive athletes but more importantly insure adequate exercise intensity for the maintenance  $VO_2$ max. Only one published training study investigated the effects of DWR with older adults (mean age of controls  $57.5 \pm 2.3$  yr, mean age of experimental group =  $63.1 \pm 1.6$  yr). In this investigation Long et al. (1996) reported significant

VO<sub>2</sub>max improvements in a group of 35 sedentary older women after a 10-week DWR program.

**Madanmohan and Mahadevan (2008)** found out the effect of six weeks yoga training on weight loss following step test, respiratory pressures, handgrip strength and handgrip endurance in young healthy subjects”. On 46 healthy subjects (30 males and 16 females, aged 17-20 year), 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 inspiratory pressure, maximum expiratory pressure, 40 mm endurance, handgrip strength and 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, P < 0.0001). 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 40 mm Hg test in both male and female subjects (P < 0.05 for all comparisons). In conclusion, attenuation of the sweating response to step test by yoga training was observed. Further, yoga training for a short period of six weeks could produce significant improvements in respiratory muscle strength and endurance.

**Clay et al. (2005)** made a research on “the metabolic cost of hatha yoga”. To determine the metabolic cost and heart rate (HR) responses of hatha yoga, 26 women (19-40 years old) performed a 30-minute hatha yoga routine of supine lying, sitting, and standing asanas (i.e., postures). Subjects followed identical videotaped sequences of hatha yoga asanas. Mean physiological responses were compared to the physiological responses of resting in a chair and walking on a treadmill at 93.86 m.min<sup>-1</sup> [3.5 miles per hour (mph)]. During the 30-minute hatha yoga routine, mean absolute

oxygen consumption ( $\text{VO}_2$ ), relative  $\text{VO}_2$ , percentage maximal oxygen consumption ( $\% \text{VO}_2 \text{R}$ ), metabolic equivalents (METs), energy expenditure, HR, and percentage maximal heart rate ( $\% \text{MHR}$ ) were  $0.45 \text{ L}\cdot\text{min}^{-1}$ ,  $7.59 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ,  $14.50\%$ ,  $2.17 \text{ METs}$ ,  $2.23 \text{ kcal}\cdot\text{min}^{-1}$ ,  $105.29 \text{ b}\cdot\text{min}^{-1}$ , and  $56.89\%$ , respectively. When compared to resting in a chair, hatha yoga required  $114\%$  greater  $\text{O}_2$  ( $\text{L}\cdot\text{min}^{-1}$ ),  $111\%$  greater  $\text{O}_2$  ( $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ),  $4,294\%$  greater  $\% \text{VO}_2 \text{R}$ ,  $111\%$  greater METs,  $108\%$  greater  $\text{kcal}\cdot\text{min}^{-1}$ ,  $24\%$  greater HR, and  $24\%$  greater  $\% \text{MHR}$ . When compared to walking at  $93.86 \text{ m}\cdot\text{min}^{-1}$ , hatha yoga required  $54\%$  lower  $\text{O}_2$  ( $\text{L}\cdot\text{min}^{-1}$ ),  $53\%$  lower  $\text{O}_2$  ( $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ),  $68\%$  lower  $\% \text{VO}_2 \text{R}$ ,  $53\%$  lower METs,  $53\%$  lower  $\text{kcal}\cdot\text{min}^{-1}$ ,  $21\%$  lower HR, and  $21\%$  lower  $\% \text{MHR}$ . The hatha yoga routine in this study required  $14.50\% \text{ VO}_2 \text{ R}$ , which can be considered a very light intensity and significantly lighter than  $44.8\% \text{ VO}_2 \text{ R}$ , for walking at  $93.86 \text{ m}\cdot\text{min}^{-1}$  ( $3.5 \text{ mph}$ ). The study revealed that the intensity of hatha yoga may be too low to provide a training stimulus for improving cardiovascular fitness.

**Moore and Rundle (2007)** did a research on “Does practicing hatha yoga satisfy recommendations for intensity of physical activity which improves and maintains health and cardiovascular fitness”. The purposes of this study were 1) to determine whether a typical yoga practice using various postures meets the current recommendations for levels of physical activity required to improve and maintain health and cardiovascular fitness; 2) to determine the reliability of metabolic costs of yoga across sessions; 3) to compare the metabolic costs of yoga practice to those of treadmill walking. Methods: In this observational study, 20 intermediate-to-advanced level yoga practitioners, age  $31.4 \pm 8.3$  years, performed an exercise routine inside a human respiratory chamber (indirect calorimeter) while wearing heart rate monitors. The exercise routine consisted of 30 minutes of sitting, 56 minutes of beginner-level hatha yoga administered by video, and 10 minutes of treadmill walking at  $3.2$  and  $4.8 \text{ kph}$  each. Measures were mean oxygen consumption ( $\text{VO}_2$ ), heart rate (HR), percentage predicted maximal heart rate

(%MHR), metabolic equivalents (METs), and energy expenditure (kcal). Seven subjects repeated the protocol so that measurement reliability could be established. Results: Mean values across the entire yoga session for  $VO_2$ , HR, %MHR, METs, and energy/min were 0.6 L/kg/min; 93.2 beats/min; 49.4%; 2.5; and 3.2 kcal/min; respectively. Results of the ICCs (2,1) for mean values across the entire yoga session for kcal, METs, and %MHR were 0.979 and 0.973, and 0.865, respectively. Conclusion: Metabolic costs of yoga averaged across the entire session represent low levels of physical activity, are similar to walking on a treadmill at 3.2 kph, and do not meet recommendations for levels of physical activity for improving or maintaining health or cardiovascular fitness. Yoga practice incorporating sun salutation postures exceeding the minimum bout of 10 minutes might contribute some portion of sufficiently intense physical activity to improve cardio respiratory fitness in unfit or sedentary individuals. The measurement of energy expenditure across yoga sessions was highly reliable.

**Sinha et al. (2004)** conducted a research on “energy cost and cardio respiratory changes during the yoga practice and surya namaskar”. The present study was undertaken to observe critically the energy cost and different cardiorespiratory changes during the yoga practice and SN. Twenty-one male volunteers from the Indian Army practiced selected Yogic exercises for six days in a week for three months duration. The Yogic practice schedule consisted of Hatha Yogic Asanas (28 min), Pranayama (10.5 min) and Meditation (5 min). In the Yogic practice schedule 1st they practiced Kapala Bhati (breathing maneuvers) for 2 min then Yoga mudra (yogic postural exercise) for 2 min, after that they talk rest until oxygen consumption and heart rate (HR) comes to resting value. Subsequently subjects performed SN for 3 min 40 seconds on an average. After three months of training at the beginning of the fourth month subjects performed entire Yogic practice schedule in the laboratory as they practiced during their training session and experiments were carried out. Their pulmonary ventilation, carbon dioxide



output, Oxygen consumption, HR and other cardiorespiratory parameters were measured during the actual practice of SN. Oxygen consumption was highest in the eighth posture (1.22 $\pm$ 0.073 l min<sup>-1</sup>) and lowest in the first posture (0.35 $\pm$ 0.02 l min<sup>-1</sup>). Total energy cost throughout the practice of SN was 13.91 kcal and at an average of 3.79 kcal/min. During its practice highest HR was 101 $\pm$ 13.5 bpm. In an aerobic exercise SN seemed to be ideal as it involves both static stretching and slow dynamic component of exercise with optimal stress on the cardio respiratory system.

## 2.5 PSYCHOLOGICAL VARIABLES

**Reddy (2013)** studied hundred volunteers who were randomly divided into two groups of which one practiced yogic asanas and breathing exercises and other practiced swimming for 12 weeks. Beck's anxiety inventory was used to assess anxiety level of subjects. Anxiety levels were assessed prior to the training and then after 12 weeks of training. The total score was calculated from 21 items and high scores indicated higher anxiety levels. The average anxiety scores decreased significantly ( $p < 0.0001$ ) in both the groups after training. In yoga group, average pre training score of 24.25 decreased to post training score of 20.27, whereas in swimming group it decreased from 23.57 to 20.8. However, the decrease in anxiety was similar with both modalities of exercise ( $p > 0.05$ ).

**Mehrotra et al. (2011)** made an attempt to find out the effects of yoga practices on anxiety score and autonomic functions in young healthy students. Method: Study was conducted in 141 student volunteers between the age group of 18-20 years. They were divided into study group and control group. Study group consisted of 74 students (36 male & 38 females) and control group consisted of 67 students (35 males & 32 females). Study group performed yoga for one hour per day for 7 days for 12 weeks. Control group did not perform any yoga practices. Taylor's manifest anxiety scale was used for assessment

of anxiety status and autonomic functions were assessed by heart rate response to Valsalva manoeuvre, change in diastolic blood pressure to sustained handgrip and change in systolic blood pressure from supine to standing position. The data was analysed statistically by using paired test. After yoga practices in study group anxiety scores were found to be reduced while autonomic function tests showed improvement in parasympathetic dominance. Sympathetic activity was found to be reduced after yoga practices.

**Muller (2012)** assessed the influence of yoga practice on anxiety level of apparently healthy female subjects of Bijapur (Karnataka). The study was conducted on 50 apparently healthy female individuals aged 20- 50 years who attended one month Yoga camp. Hamilton Anxiety (HAMA) Scale was used to evaluate anxiety levels before and at the end of the yoga camp. Before yoga, subjects having mild moderate and severe anxiety were 12.12%, 24.24% and 63.63% respectively. After yoga training subjects having mild, moderate and severe anxiety were 24.24%, 33.33% and 42.42% respectively. There was highly significant ( $p=0.001$ ) difference in the mean values of total score before ( $32.0+6.10$ ) and after ( $28.54+6.0$ ) yoga. These results indicated that there was a reduction in the severity of anxiety from severe to moderate and mild indicating improvement in general well being following yoga. Based on the results of the study, one might include the regular yogic practice in day to day life which reduces the anxiety level and improve the subjective feeling of well being.

**Javanbakth Hejazi and Ghasemi (2009)** sought to evaluate the influence of yoga in relieving symptoms of depression and anxiety in women, who were referred to yoga clinic. Method: The study involved a convenience sample of women who were referred to yoga clinic from July 2006 to July 2007. All new cases were evaluated on admission using a personnel information questionnaire as Beck and Spiel Berger tests. Participants were

randomly assigned into experimental and a control group. The experimental group (N=34) participated in twice weekly yoga classes of 90 minute duration for two months. The control group (N=31) was assigned to a waiting list and did not receive yoga. Both groups were evaluated after two months study period. Participation in two month yoga class could lead to significant reduction in perceived level of anxiety in women who suffered from anxiety disorders. This study further suggested that yoga could be considered as a complementary therapy or an alternative method for medical therapy in the treatment of anxiety disorders

**Rahimi and Bavaqar (2013)** evaluated the effects of yoga on anxiety and depression in women. Thirty-four Shirazian women age  $34 \pm$  volunteer participated in this study and divided randomly in two i.e. control and experimental groups. Exercise protocol included 16 sessions of hatha Yoga which was carried out for the experimental group. The two training sessions were given a week and for each session 90 minutes were allotted. DASS questionnaire was used to assess anxiety and depression. Results showed that anxiety and depression showed significant difference between pretest and post-test experimental group. Also, test anxiety and depression between the experimental and control groups at  $p < 0.05$  was a significant difference

**Shirley (2009)** determined the effect of yoga practices and a yoga theory session on state anxiety yoga techniques practiced for varying durations which have been shown to reduce state anxiety. In this study, there were 300 naïve yoga persons of both sexes who were attending a yoga therapy center in north India for stress relief as day visitors and were not residing at the center. They were assigned into two groups, yoga practice and yoga theory, and their state anxiety was assessed before and after a 2-hr. yoga session. A significant reduction in scores on state anxiety was found in the yoga practice group (14.7% decreases), as well as in the yoga theory group (3.4% decrease). The difference in scores following the sessions was

statistically significant. Hence, yoga practices as well as learning about theoretical aspects of yoga appeared to reduce state anxiety, with greater effect yoga.

**Elangovan (2012)** evaluated the effect of different packages of yogic practices on selected motor fitness components, physiological and psychological variables among juvenile delinquents. To facilitate the study, ninety juvenile delinquents confined in different Rehabilitation Homes in Chennai were randomly selected in the age group of 14 to 17 years. The selected subjects were randomly divided into three groups, namely, Iyengar Yoga group and Christina yoga group and control group consisting of 30 juveniles in each. Motor fitness variables - flexibility, muscular endurance, agility, physiological variables – vital capacity, vo2 max, cardio respiratory endurance, psychological variables – anxiety, aggression and self confidence were selected for this study. The study was formulated as a true random group design, consisting of a pre and post test. Pre tests were conducted for all the subjects on selected motor fitness, physiological and psychological variables. The experimental groups participated in their respective yogic package I and package II for a period of twelve weeks. The post tests were conducted on the above said dependent variables after the experimental periods. The obtained data were subjected to statistical treatment to find out the significance using ANCOVA. In all cases 0.05 level was fixed to test the hypothesis and scheffe's post hoc test was used to find out the paired mean differences. The results of this study proved that different packages of yogasanas significantly improved selected motor fitness variables, flexibility, muscular endurance, and agility; physiological variables, vital capacity, VO<sub>2</sub> max and cardiorespiratory endurance; reduced psychological variables anxiety and aggression and improved self confidence of the juvenile delinquents.

**Deshpande (2012)** studied the effect of yoga on verbal aggressiveness in normal healthy adults. The 1228 persons who attended introductory lectures, 226 subjects of both sexes who satisfied the inclusion and exclusion criteria and who consented to participate in the study were randomly allocated into two groups. These 226 subjects were between the ages of 17 and 62 years and 173/226 completed the eight weeks of intervention. The Yoga (Y) group practised an integrated yoga module that included asanas, pranayama, meditation, notional correction, and devotional sessions. The control group practised mild moderate physical exercises (PE). Both groups had supervised practices (by trained experts) for one hour daily, six days a week for eight weeks. Verbal Aggressiveness was assessed before and after eight weeks using the self-administered Verbal Aggressive Scale. This study had demonstrated that an eight week intervention of an integrated yoga module decreased verbal aggressiveness in the yoga group (in males and those below 25 years of age), with a non significant increase in the PE group.

**Perry et al. (2003)** conducted a study on Measures of aggression and mood changes in male weightlifters with and without androgenic anabolic steroid use. The study attempted to characterize this relationship among weightlifters who were users (n=10) and nonusers (n=18) of anabolic steroids. Participants were interviewed using the Modified Mania Rating Scale and Hamilton Rating Scale for Depression to assess mood, the Buss-Durkee Hostility Inventory (BDHI) and Point Subtraction Aggression Paradigm (PSAP) to assess aggression, and the Personality Disorder Questionnaire (PDQ-R) to assess personality. Blood samples were obtained for the determination of total, free, and weekly bound testosterone. Comparisons of continuous variables between testosterone users and non-users were performed with a parametric (unpaired t-test) or non-parametric (Mann-Whitney) test where appropriate. Correlations with testosterone were examined separately for testosterone users and non-users, using Spearman rank correlation. The subjective (BDHI) and objective (PSAP) assessments of

aggression found that supra normal testosterone concentrations were associated with increased aggression. However, the PDQ-R results suggested that this finding was confounded by the personality disorder profile by the steroid users, because steroid users demonstrated Cluster B personality disorder traits for antisocial, borderline, and histrionic personality disorder.

## 2.6 SKILL PERFORMANCE VARIABLES

**Parimalam and pushparajan (2011)** investigated the effect of specific basketball training program on selected physical variables and skill performance variables of Inter Collegiate women basketball players. To achieve this purpose 30 inter collegiate female basketball players were selected from Bharathiar University, Coimbatore. Tamilnadu, India. They were divided into two equal groups namely specific basketball training program group (Group – 1) and control group (Group -2). The total period of training was 12 weeks. After 12 weeks of training, two data was collected on dependant variables for both groups. The collected data was statistically analyzed by using “t” test. The results concluded that the specific basketball training program group was significantly improved the selected physical variable (agility) of female basketball players.

**Ahmed and El- Aal, (2012)** determined the effect of educational module on basic basketball skills performance in junior basketball. The study was designed to assess the effects of an educational module program on the basic skills levels development of young male basketball players, aged 11–12 years old. Two groups; experimental (n = 10; EG) and control (n = 10; CG) groups were selected for this purpose and (7) seven players for expeditionary study. Twenty seven young male basketball players volunteered to take part in this study. Results revealed that existence of statistically significant ( $p < 0.05$ ) differences between the two measures pre and post for experimental and control group in skills variables (Pass Velocity- Pass Accuracy- Dribble

Velocity- Free Shot- Layup Shot) was in favour to post measurements. In conclusion statistically significant differences existed between the two post measures for experimental group and control group in skills variables (Pass Velocity- Pass Accuracy- Dribble Velocity Free Shot- Layup Shot) was in favour to experimental group.

**Oudejans Karamat and Stolk (2012)** investigated the effects of different actions preceding the jump shot on basketball shooting in expert female basketball players. Participants took two-point jump shots after a dribble or after receiving a pass. The dribble was executed with the dominant or non-dominant hand. Similarly, the pass was received from the side of the dominant or non dominant hand. Shooting percentages were higher after a pass than after a dribble and a dominant-side than after a non-dominant-side pre action. Higher percentages were accompanied by longer execution times of actions preceding the shot. Furthermore, it appeared that in all conditions players looked at the rim sufficiently long for accurate shooting. It was concluded that actions preceding the jump-shot affect shooting percentages. Effects were related to execution time of actions prior to the shot, possibly in combination with the biomechanical consequences of performing these actions on the dominant or non-dominant side.

**Karkare and Awasare (2012)** studied the effect of selected yogic exercises on physical fitness of basketball players. Hundred basketball players who represented state level tournament was divided into two groups of fifty players (n=50) each, namely control group and experimental group. Pre test was taken to entire hundred players to find out the physical fitness of basketball players. For the experimental group selected yogic exercise programme had been conducted for the duration of 45 minutes, five days in a week for a period of twelve weeks. After the completion of training, post test had been administered to record the improvement in physical fitness of basketball players. Results found that the mean differences of pre and post

test on physical fitness of basketball players had improved significantly in experimental group.

**Singh and Bilaspur (2012)** conducted a study on 30 women basketball players who were randomly selected from the players undergoing training of skill performance as independent variables which were passing, defensive and dribbling and motor fitness variables involved were speed, explosive power, agility, cardio-respiratory endurance and flexibility. Defensive ability, passing ability, speed shot shooting ability and control dribbling ability was assessed by AAHPERD basketball test battery (1984). The test selected for assessing motor fitness variables were speed by 50 meter run, explosive jump by sergeant jump, agility by (6x10meter) shuttle run cardio-respiratory endurance by 12 minute run/walk test and flexibility by sit and reach test Product Moment Correlation method was used to find out the correlation between selected motor fitness variables to skill performance of tribal basketball players. The result showed that defensive ability had positive correlation with speed and agility whereas explosive power, cardio-respiratory endurance, and flexibility showed negative correlation.

**Delextrat and Martinez (2013)** compared the effects of 2 training interventions based on small-sided games (SGG) and high-intensity interval training (HIT) on physical and technical performance of male junior basketball players. A secondary objective was to investigate if these effects were similar in starting and bench players. 18 players participated in a pre-testing session, 6-weeks intervention period and a post-testing session. Pre- and post-sessions involved assessments of aerobic fitness, repeated sprint ability (RSA), defensive and offensive agility, upper and lower body power, shooting and passing skills. Mixed-design analysis of variance (ANOVA) with Bonferroni corrected pairwise comparisons examined the effects of time and type of intervention on physical and technical performances. The results showed that both interventions resulted in similar improvements in aerobic



capacity (+3.4% vs. +4.1%), with greater improvements in bench players compared to starting players (+7.1% vs. +1.1%,  $P < 0.05$ ). However, RSA was unchanged after both interventions. In addition, compared to HIT, SSG resulted in greater improvements in defensive agility (+4.5% vs. -2.7%,  $P < 0.05$ ), shooting skills (+7.4% vs. -2.4%,  $P < 0.05$ ) and upper body power (+7.9% vs. -2.0%,  $P < 0.05$ ). These results suggested that SSG should be prioritized in physical conditioning of junior basketball players during the season. However, when RSA targeted, more specific training seems necessary.

**Dominic and Talabi (2008)** identified the strength demands of the layup, free throw and jump shots. The 18 registered players of the Niger potters' team of Nigeria were used as the participants. It was found that only the general leg explosive power training was needed for the three styles of shooting ( $r = 0.07, 0.03$  &  $-0.06$ ) and general strength fitness of the abdominal muscles were required for the layup and jump shot ( $r = 0.33$  &  $-0.23$ ), but specific abdominal strength had significant relationship with the free throw shooting ( $r = 0.517$ ). These results revealed that specific athletic strength was demanded by the arms for jumps shot, and the abdominal muscles for free throw shot, harmonized with the technique was paramount to optimal performance in these shooting styles.

**Balasundari and Pushparajan (2013)** analyzed the effect of varied modalities of high intensity interval training on physical fitness variables and skill performance of male basketball players. To achieve these purpose 60 male basketball players from Park group of Institutions, Coimbatore, Tamilnadu, India were randomly selected as subjects and their age group was 18 to 23 years. They were divided into four equal groups namely strength based high intensity interval training group (Group -1), cardio vascular based high intensity interval training group (Group - 2), combination of strength and cardio vascular based high intensity interval training Group (Group - 3) and

control group (Group - 4). After assigning the subjects into various groups, sargent vertical jump test and over all playing ability test was conducted and score was recorded in centimeters and numbers respectively and this was considered as pre-test. After the pre-test, all the groups were treated with their respective training program for 12 weeks three days per week except control group. After 12 weeks of training program, post-test was conducted for all the four groups and score was recorded in its respective units. The collected data were analyzed by using of analysis of covariance. The results revealed that there was a significant improvement in the physical fitness and skill performance due to the influence of the training.

**Sisodiya and Abhinav (2012)** investigated plyometric exercise, circuit training and their combined effect on the basketball playing ability. The criterion measure selected for basketball playing abilities were throw for accuracy, speed dribble and field goal speed performances. The subjects were 75 male basketball players of J.N.V. University and Govt. College of physical education, Jodhpur. The age of players ranged from 18 to 25 years. The selection of subjects and training treatments were assigned to the groups using random group design. The three experimental groups participated in the training for a period of eight weeks(training was carried out thrice a week on Mondays, Wednesdays, and Fridays) The first group (A) performed plyometric exercises, the second group (B) performed circuit training and the third group (C) performed combined training. All the three groups, however, kept participating in the college and University physical education programme. Each subject of experimental & control groups was tested at the beginning and at the end of an experimental period of eight weeks to obtain pre-test and post-test scores. The significant differences between the pre-test and post-test means of the three experimental groups were analysed by applying ANOVA. The level of significance chosen was 0.05. The analysis of variance exhibited that the resistance by plyometric exercises, circuit training and combined training in terms of experimental and control groups brought

significant improvement in playing ability skills in basketball. The analysis of variance for throws for accuracy, speed dribble and field goal speed skills indicated significance. The critical difference for adjusted means revealed that the mean gain made by all experimental groups showed statistically significant difference between experimental groups.

**Stolk (2012)** investigated the effects of different actions preceding the jump shot on basketball shooting in expert female basketball players. Participants took two-point jump shots after a dribble or after receiving a pass. The dribble was executed with the dominant or non-dominant hand. Similarly, the pass was received from the side of the dominant or non dominant hand. Shooting percentages were higher after a pass than after a dribble and after a dominant-side than after a non-dominant-side preaction. Higher percentages were accompanied by longer execution times of actions preceding the shot. Furthermore, it appeared that in all conditions players looked at the rim sufficiently long for accurate shooting. It was concluded that actions preceding the jump-shot increase shooting percentages.

**Raja Singh Rogland (2006)** investigated the contribution of selected psychological profiles on skill performance of university basketball players. Forty men basketball players from different universities were selected as subjects. For the purpose of the study, Basketball skills performance, namely dribbling, passing and shooting were measured using standardised tests. Their psychological characters such as anxiety, aggression, achievement motivation and self concept were measured through multiple correlation techniques. It was found that there was a significant relationship between the skills performance of dribbling, passing and shooting and the combined effects of anxiety, aggression, achievement motivation and self concept.

## **2.7 SUMMARY OF THE LITERATURE**

The review of literature helped the investigator to spot out relevant topics and variables. Further the literature supported the investigator to frame the suitable hypothesis leading to the problem. The latest literature also provided the investigator to support their findings with regard to the problem.