CHAPTER II

REVIEW OF RELATED LITERATURE

Review of relevant literature will help the development of research procedure. "The literature in any field forms the foundation upon which all future works will be built." The literatures relevant to the present study which have been collected from different sources of references are described in this chapter.

2.1 STUDIES ON PHYSICAL FITNESS TRAINING

Rhea et al (2009) assessed the effect of heavy/slow movements and variable resistance training on peak power and strength development. Forty-eight National Collegiate Athletic Association (NCAA) Division I athletes (age: 21.4 +/- 2.1 years, all men) were recruited for this 12-week training intervention study. Maximum strength and jumping power were assessed before and after the training program. Athletes were randomly assigned to 1 of 3 training groups: heavy resistance/slow movement (Slow), lighter resistance and fast movement (Fast), or fast movements with accommodated resistance (FACC). All training groups performed similar training programs comprising free weight resistance training with lower-body compound exercises. The only difference among the training interventions was the speed at which subjects performed the squat exercise and the use of bands (Slow group: 0.2-0.4 meters/second; Fast group: 0.6-0.8 meters/second; FACC group trained 0.6-

0.8 meters/second with the addition of accommodated resistance in the form of large elastic bands). Post-test data revealed a significant difference between power improvements between the Slow and FACC groups (p = 0.02). Percent increases and effect sizes (ES) demonstrated a much greater treatment effect in the FACC group (17.8%, ES = 1.06) with the Fast group (11.0%, ES = 0.80) adapting more than the Slow group (4.8%, ES = 0.28). The FACC and Slow groups improved strength comparatively (FACC: 9.44%, ES = 1.10; Slow: 9.59%, ES = 1.08). The Fast group improved strength considerably less, 3.20% with an effect size of only 0.38. Variable resistance training with elastic bands appears to provide greater performance benefits with regard to peak force and peak power than heavy, slow resistance exercise. Sports conditioning professionals can utilize bands, and high-speed contractions, to increase power development.

Ghigiarelli et al. (2009) explored the effects of a 7-week heavy elastic band and weighted-chain program on maximum muscular strength and maximum power in the bench press exercise. Thirty-six (n = 36) healthy men aged 18-30 years old, from the Robert Morris University football team, volunteered to participate in this study. During the first week, predicted 1 repetition maximum (1RM) bench press and a 5RM speed bench press tests were conducted. Subjects were randomly divided into 3 groups (n = 12): elastic band (EB), weighted chain (WC), and traditional bench (C). During weeks 2-8 of the study, subjects were required to follow the prescribed resistance training program. Mean and SD of the predicted 1RM bench press and 5RM speed bench press were computed. A two-factor (method X time) analysis was applied to identify significant differences between the training groups. Significance was set at alpha = 0.05. Results indicated a significant time ($p < 0.05$) but no group effect for both predicted 1RM (kg) and 5RM peak power tests (watts). Although not significant, results did show greater non significant improvements in the EB (848-883 W) and WC groups (856-878 W) vs. control (918-928 W) when the 2 highest and greatest values were selected regarding peak power. The use of EB and WC in conjunction with a general off-season strength and conditioning program can increase overall maximum upper-body strength in a sample of Division 1-AA football players. These types of training modalities add a unique training style and more flexibility with respect to exercise prescription for athletes and strength practitioners.

Watt (2004) examined the effect of three strength training exercises to improve stride length and frequency. The strength training activates the nervous system and there by it controlled muscles and improved the overall requirement of muscle fibers during a workout. The three exercises of the high bench step up, one leg squat and one leg hops in place were conducted for eight weeks. The findings showed that high amount of force can be exerted in a short period of time with an explosive foot strike during running and strength training improved both the stride length and frequency.

Bacharach and Davillard (2004) examined a study of intermediate and a long term anaerobic performance of elite Alpine skiers. Many researchers identified that Alpine skiers need muscular strength and complex motor skill abilities. After verifying a variety of tests short test of anaerobic capacity came into existence. Seventeen Nationally ranked male and female Alpine ski racers from USA were used. The power was measured in them by keeping 30.5 and 90.5 Wingate Cycle Ergometer tests. Through this study they found that the capacity of anaerobic power can be altered.

Hoffman et al. (2004) have conducted a study on the comparison between the Wingate Anaerobic power test both vertical jump motive drill tests in basketball players. Israel National Youth basketball team players participated as subjects. The field tests of 15 second anaerobic jump test and a sprint test was taken and laboratory test of Wingale Anaerobic power test was taken three times for the same group. Laboratory test of Wingate Anaerobic power test was taken to determine peak power, mean power and fatigue index. No significant correlations were observed between peak power and sprint test, but significant positive correlations were noted between vertical jump and the peak power and mean power. The results suggested that the line skill and jump tests might be acceptable field measures of anaerobic power specific to basketball players.

Faigenbaun et al. (2003) investigated the practicality and safety of performing maximal strength testing in healthy children. Ninety six subjects were experimented (32 girls and 64 boys) in the mean age group of 6.3 and 12.3 years. The subjects did not have previous strength training experiences and the subjects performed one upper body exercise and the lower body exercise using weight machines. After training a post exercise survey was conducted to check for any injury. The results showed that 1 RM tests could be performed safely and effectively with proper technique and under the supervision of a trained strength and conditioner.

Kraemer et al. (2003) compared the physiological and performance adaptations between periodized and nonperiodized resistance training in women collegiate tennis athletes. Thirty women (19 +/- 1 yr) were assigned to either a periodized resistance training group (P), nonperiodized training group (NV), or a control group (C). Assessments for body composition, anaerobic power, VO2 (max), speed, agility, maximal strength, jump height, tennis-service velocity, and resting serum hormonal concentrations were performed before and after 4, 6, and 9 months of resistance training performed 2-3 d.wk (-1). Nine months of resistance training resulted in significant increases in fat-free mass; anaerobic power; grip strength; jump height; one-repetition maximum (1-RM) leg press, bench press, and shoulder press; serve, forehand, and backhand ball velocities; and resting serum insulin-like growth factor-1, testosterone, and cortisol concentrations. Percent body fat and VO2 (max) decreased significantly in the P and NV groups after training. During the first 6 months, periodized resistance training elicited significantly greater increases in 1-RM leg press (9 +/- 2 vs 4.5 +/- 2%), bench press (22 +/- 5 vs 11 +/- 8%), and shoulder press (24 +/- 7 vs 18 +/- 6%) than the NV group. The absolute 1-RM leg press and shoulder press values in the P group were greater than the NV group after 9 months. Periodized resistance training also resulted in significantly greater improvements in jump height (50 +/- 9 vs 37 +/- 7%) and serve (29 +/- 5 vs 16 +/- 4%), forehand (22 +/- 3 vs 17 +/- 3%), and backhand ball velocities (36 +/- 4 vs 14 +/- 4%) as compared with nonperiodized training after 9 months. These data demonstrated that periodization of resistance training over 9 months was superior for enhancing strength and motor performance in collegiate women tennis players.

Carpinett (2003) studied the effect of varied weight training programmes on strength. The evidence of this study was revived earlier by Berger that a single set for maximal strength gains the validity and practical significance of Berger's strength training study questioned since this study came into existence with well controlled, methodologically sound studies that minimize confounding variables that was required to support the hypothesis that multiple sets of exercise elicit superior gains in strength.

Fletcher and Hartwell (2002) examined the effect of an 8 week combined weight and plyometric training program on golf drive performance. Eleven golfers were randomly assigned to control and experimental group. The control group continued their current training programmes. The experimental group performed combined weight and plyometric training twice in a week. The treatment group showed significant changes in head speed and driving distance.

Konig et al. (2001) reported that during the past decade, the physical and mental stress in professional tennis has been constantly increasing. The overall intensity in tennis ranges between 60 and 70% of maximum oxygen uptake and the energy requirements are mainly provided by aerobic energy metabolism. Therefore, particularly with respect to the duration of the tournaments and the length of the matches, a good aerobic capacity promotes continuous success in professional tennis. During frequent periods of high intensity, however, muscular energy is derived from anaerobic glycolysis. Therefore, sports-specific conditioning programs in tennis should improve both glycolytic and oxidative muscular metabolism. Years of training and competition induce a number of cardiovascular and metabolic adaptations: an increase in heart size in terms of an athlete's heart, higher oxygen uptake capacity, improved muscular oxidative enzyme activities, reduced baseline catecholamine levels, and a lower resting heart rate. In addition, tennis induces side-specific increments in bone density, bone diameter, and bone length of the upper extremity. Furthermore, structural and functional adaptations of the conducting arteries in the preferred arm could be demonstrated in professional tennis players. In conclusion, tennis is a very complex sport involving strength, power, speed, agility and explosiveness, as well as endurance components. Scientific data on exercise-related cardiovascular and metabolic parameters in professional tennis are important to evaluate the players individual fitness level and will help to improve sports-specific conditioning programs. This in turn will not only enhance performance but also prevent overstrain and burnout syndromes.

Balabins (2001) conducted a research on the effects of concurrent endurance and strength training. The study was conducted for 26 male basketball players. They were divided into four groups of strength and endurance groups and a control group. All groups except control group was trained four times a week for seven weeks. The strength and endurance groups perfomed both the endurance and strength programme with a seven hours recovery. Improvement were seen for all the groups according to their training in vertical jump, anaerobic power (Wingate Test) and aerobic capacity (1 mile walk). This was higher for the strength and endurance training group than the other groups. On all measures the strength training group alone increased anaerobic power but with decreased aerobic capacity. The endurance training group increased aerobic capacity with decreased anaerobic power. The results of the study showed that the concurrent strength and endurance training improved anaerobic power better than strength training alone and it improved VO_2 max better than endurance training alone.

Clutch et al. (2001) examined the effect of depth jumps and weight training on leg strength and vertical jump in two studies. The effects of depth jumping (plyometrics) and traditional weight training on performance of vertical jump and other measures of length are review below.

Study1: Three jumping activities were compared (a) maximum vertical jump (b) 0.3 m depth jumps and (c) 0.75 m and 1.10 m depth jumps. These activities were preceded by three weeks of weight training. Weight training with jumping activities were conducted for twice in a week for four weeks. All groups demonstrated similar improvements on 1 RM squat strength, isometric knee-extension strength, and vertical jump. The lack of significant differences could have been due to the small group sizes. It restricted the statistical power of the analysis.

Study 2: A weights alone group (N=14) was compared to weights plus depth jumping group (N=14). Training was performed twice per week for 16 weeks. The weight training group did not improve vertical jump although strength parameters improved. The weights plus jumping group did improve in the vertical jumping.

It was found that weights plus jumping produced no added beneficial performance improvement than the jumping alone group. The weight training programme did not provide added benefit.

Hue (1998) conducted a study to find that triathletes were right to combine cycling and running in the same training session. To find the differences existed in the 10 K run immediately following a 40^{th} cycle (Olympic distance triathlon) compared with 10 K running alone triathletes were tested for two testing sessions on two different days.

Forty kilo meters of cycling followed by a 10 K treadmill run a 10 K treadmill run at the same speed as cardiorespiratory data was collected during both runs and stride length and frequencies were analysed using videotape. The results showed that cycling section prior to the run in a triathlon competition placed an extra physiological demand on the run. It held because of the reduced physiological economy, such as increased lipid metabolism, increased body temperature and dehydration status.

Clader et al. (1996) examined whole and split weight training routines in young women to three weight training regimes, namely, (a) a whole routine (W) where four upper (five sets of 6-10 RM) and three lower body (five sets 10-12 RM) weight training exercises in two single sections per week (b) a split session routine (S) where the upper body exercise were performed on two days a week and the lower body exercise on two other days of the week and (c) a control group with no training. Both groups changed similarly over 20 weeks of training in terms of 1 RM arm curl, bench press, and leg press, arm and trunk and lean mass in upper body cases. Similarly for increase in leg mass, whole body lean tissue mass increased and whole body percent fat decreased with training in both groups. Thus the results showed that young untrained women respond to weight training in terms of strength increased and lean body mass changes irrespective of the exercise training schedule.

Gains et al. (1996) examined the effects of velocity specific isokinetic training on strength, hypertrophy and cross education on 15 male and 15 female subjects. The study showed slow velocity, fast velocity stomach training and no training control group. The results showed that in the untrained individuals strength training was likely to have a more general effect than could be expected with highly trained athletes. It was accounted for the partial generalization of both training speeds to an intermediate speed.

Housh et al. (1995) examined the effect of eccentric dynamic constant external resistance training on concentric isokinetic torque velocity curve. This study showed that the nature of strength training stimulus (dynamic constant external resistance) only improved strength performances in its training exercises and testing activities. It supported the notion of specificity of testing and training. Concentric isokinetic testing was not sensitive to changes brought about by eccentric training. It implied that strength training was more likely to benefit the activities than other training.

Wilson et al. (1994) conducted a study on the optimal training load for the development of dynamic athletic performance. Traditional weight training group, plyometric training group, dynamic weight training group and a control group of recreationally weight trained individuals were compared on 30 m sprint, vertical jump without counter movement, maximal cycle test, isotonic leg extension and maximal isometric tests. The results showed that the dynamic weight training was the only training group that produced significant changes in all measures than the traditional weight training group and plyometric training group.

Hortobagyi et al. (1991) examined the effects of simultaneous training for strength and endurance on upper and lower body strength and running performance. High Resistance (HR), Low Resistance (LR) and Control groups of college men were used as subjects without the difference in body compositions in fitness. It was concluded that gains in strength were compromised by simultaneous endurance training. High resistance or low resistance training did not affect the gains in strength and endurance. It would appear to be unproductive to mix strength and endurance training because an athlete would gain maximum benefits in the mixed training.

Schantz and Kallman (1989) conducted a study on the relationship between strength training programme effects and aerobic endurance adaptations. Strength training programmes are considered to be anaerobic in nature. Muscle biopsies were taken from three groups (a) strength trained athletes (b) endurance trained swimmers and (c) a non trained control group. It was concluded that strength training did not effect the enzymes associated with aerobic metabolism.

Messier and Dill (1981) compared Naultilus to free weight training tasks of leg strength which were performed on a cyber II semi-isometric leg extension device. The machine (Nautilus) group used leg extensions in training (open kinetic chain exercises). However, the free weight group used squats (closed kinetic chain) and no leg extension in training. It was found that 1 RM measures of strength carry over from free weights to machines better than machines carry over to free weights.

Berger (1963) has stated in the following about "effect of valid weight training programme on strength." He conducted experiment with varied bench press weight training programme. All were different weight training programme had been under taken. Training took place three times weekly with variations in programme. The results showed that six repetition per set were best for improving strength.

2.2 STUDIES ON PSYCHOTONIC TRAINING

Dave (2005) measured the effects of a six-week course of meditation on the ability to concentrate with scores on the Stroop Color and Word test. Participants were 30 undergraduate psychology students who were randomly assigned either to meditate once every day over the course of the treatment or to a control group that was instructed to sit quietly for the allotted time. Participants were tested at the beginning of the course and at the end. It was hypothesized that participants who meditated would improve in scores of the Stroop test at second testing and would score higher on the Stroop test than the control group at the second test. Scores for the meditation group were found to increase at the second test, but they were not significantly higher than the control group. Future research should involve larger samples for longer periods.

Harinath (2004) demonstrated the effects of Hatha yoga and Omkar Meditation on Cardiorespiratory Performance, Psychologic Profile, and Melatonin Secretion".: Thirty healthy men in the age group of 25-35 years volunteered for the study. They were randomly divided in two groups of 15 each. Group 1 subjects served as controls and 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 2 subjects practiced selected yogic asanas (postures) for 45 minutes and pranayama for 15 minutes during the morning, whereas during the 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 1 second, forced expiratory volume percentage, peak expiratory flow rate, and maximum voluntary ventilation), and psychologic profile were measured before and after 3 months of yogic practices. Serial blood samples were drawn at various time intervals to study effects of these yogic practices and Omkar meditation on melatonin levels.: Yogic practices for 3 months resulted in an improvement in cardiorespiratory performance and psychologic profile. The plasma melatonin also showed an increase after three months of yogic practices. The systolic blood pressure, diastolic blood pressure, mean arterial 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. These observations suggest that yogic practices can be used as psycho physiologic stimuli to increase endogenous secretion of melatonin, which, in turn, might be responsible for improved sense of well-being.

Peng et al. (2004) conducted a study on heart rate and respiratory rate dynamics during three forms of meditation. This study was designed to quantify and compare the instantaneous heart rate dynamics and cardiopulmonary interactions during sequential performance of three meditation protocols with different breathing patterns. : We analyzed beat-to-beat heart rate and continuous breathing signals from 10 experienced meditators (4 females; 6 males; mean age 42 years; range 29-55 years) during three traditional interventions: relaxation response, breath of fire, and segmented breathing. Heart rate and respiratory dynamics were generally similar during the relaxation response and segmented breathing. We observed high amplitude, low frequency (approximately 0.05-0.1 Hz) oscillations due to respiratory sinus arrhythmia during both the relaxation response and segmented breathing, along with a significantly ($p<0.05$) increased coherence between heart rate and breathing during these two maneuvers when compared to baseline. The third technique, breath of fire, was associated with a different pattern of response, marked by a significant increase in mean heart rate with respect to baseline ($p< 0.01$), and a significant decrease in coherence between heart rate and breathing ($p<0.05$). These findings suggest that different meditative/breathing protocols may evoke common heart rate effects, as well as specific responses. The results support the concept of a "meditation paradox," since a variety of relaxation and meditative techniques may produce active rather than quiescent cardiac dynamics, associated with prominent low frequency heart rate oscillations or increases in mean resting heart rate. These findings also underscore the need to critically assess traditional frequency domain heart rate variability parameters in making inferences about autonomic alterations during meditation with slow breathing.

Williams (1998) conducted a study on Transcendental Meditation and Mirror-Tracing Skill. Learning, performance and patterns of inter- and intra-individual variability of 32 experienced Transcendental Meditators was compared to those of 32 non-meditators. The data indicated that certain effects attributed to the practice of Transcendental Meditation (such as increased alertness and maintenance of attention, greater consistency and less anxiety) are not manifested in terms of learning and performance of a novel perceptual-motor skill.

Solberg (1996) conducted a study to find the effects of meditation on the shooting performance. 25 elite shooters were investigated in an independent groups design. The results in standardised test shootings indoors and in ordinary competitions outdoors were assessed before and after regular meditation training for the experimental group. The experience of tension during the test shootings was self recorded on a visual analogue scale (VAS).

The competition results in the outdoor season (1993), just after the meditation training period, compared with the results the previous season (1992), were better in the meditation group ($P < 0.05$). No significant difference between the groups was observed in the test shootings before and after the relaxation intervention. A significant association was shown between low tension and the results in the test shootings (correlation $r = 0.42$, $P < 0.0001$; Wilcoxon rank sum test, $z = -3.36$, $P < 0.001$); 18% (= r2) of the variance in performance was explained by tension. Meditation may enhance competitive shooting performance.

Whitehead (1996) suggested the suitability of Gray's (1975) three-factor arousal theory as a model of human performance under stress was investigated by Roger Whitehead in a study of basketball free-throw shooting. Free-throw attempts, made by members of an NCAA Division I men's varsity team, were videotaped during one full season. On the basis of Gray's theory, we predicted that increased stress (assumed to be present in games as opposed to practices) would be associated with longer pre-shot preparations and a greater incidence of overthrow shots. The prediction was confirmed by the results. Moreover, we found that free-throws were more frequently overthrown when attempted during crucial rather than non-crucial game situations. Further tests of the utility of Gray's theory are suggested.

Wolkove et al. (1984) investigated a research on effect of Transcendental Meditation on Breathing and Respiratory Control They studied the effect of transcendental meditation (TM) on breathing using 16 experienced meditators and 16 control subjects. In control, there was no significant difference in minute ventilation (VE), respiratory pattern, or hypercapnic response, whether breathing with eyes open-awake (CA), or with eyes closed-relaxing (CR). In meditators, VE decreased significantly during quiet breathing from 14.0 +/- 0.7 1/min with eyes open-awake (MA) to 12.4 +/- 0.6 1/min during meditation (MM) (P less than 0.02). The change in VE during meditation was due to a decrease in tidal volume (VT) resulting from a shortened inspiratory time (TI). Meditation was associated with a decreased response to progressive hypercapnia from 3.7 +/- 0.4 to 2.5 +/- 0.21 X min-1 X Torr-1 during MA and MM trials, respectively (P less than 0.01). During meditation VT was smaller at a given alveolar PCO2 than during MA studies because of a decrease in mean inspiratory flow rate (VT/TI). These observations suggest that an alteration in wakefulness, more subtle than sleep or the unconscious state, can significantly affect the chemical and neural regulation of breathing.

Delmonte (1984) conducted a study on physiological responses during meditation and rest. Forty nonmeditators and 12 experienced transcendental meditators were randomly assigned to four experimental cells devised to control for order and expectation effects. All 52 (female) subjects were continuously monitored on seven physiological measures during both meditation and rest. Each subject was her own control in an able experimental paradigm comparing meditation to rest. Analysis of variance on change scores calculated from both initial and running (intertrial) baselines revealed small but significant conditions effects for all variables except diastolic BP. The same subjects (both experienced meditators and those meditating for the first time) showed lower psycho physiological arousal during the meditation than during the rest condition for systolic BP, HR, SCL, digital BV, digital ST, and frontalis EMG. The experienced meditators showed only marginally more conditions effects than the novices practicing "noncultic" meditation. For the nonmeditators, deliberately fostering positive expectations of meditations was associated with lower physiological arousal in terms of diastolic BP, HR, and SCL. These findings suggest that both cultic and noncultic meditation are associated with lower physiological activation than eyes-closed rest.

Throll (1982) investigated a research on Transcendental Meditation and Progressive Relaxation: and their Physiological Effects. Oxygen consumption, tidal volume, respiration rate, heart rate, systolic and diastolic blood pressure were measured before the subjects (N = 39) learned Transcendental Meditation (TM: N = 21) or Jacobson's Progressive Relaxation (PR: N = 18). Subjects were tested immediately after learning either technique and again 5, 10, and 15 weeks later. While there were no significant differences between groups for any of the physiological variables at pretest, the TM group displayed more significant decreases during meditation and during activity than did the PR group. Both groups displayed significantly lowered metabolic rates during TM or PR. The generally more significant and comprehensive results for mediators were explained primarily in terms of the greater amount of time the TM group spent on their technique, plus the differences in the two techniques themselves. Several avenues for future research are discussed.

Puente (1981) did a research on Psycho physiological Investigations on Transcendental Meditation. Two experiments were conducted to evaluate the psycho physiological changes reported to occur during the practice of transcendental meditation. In Experiment I, 47 volunteers solicited from the community were randomly assigned to transcendental meditation (TM), Benson's relaxation response (BRR), or no treatment (NT) instruction. Respiration rate, heart rate, electromyogram, electroencephalogram, and skin conductance level were recorded during the practice of each technique, approximately 1 week after terminating instruction. The results indicate that while BRR, TM, and NT exhibited different physiological patterns, none of the techniques showed a clear superiority in reducing tonic physiological arousal. In Experiment II, 30 volunteers with previous experience were assigned to one of the three groups based on their meditating experience (range 16-96 months). The same physiological signals as in Experiment I were also recorded in this experiment during TM practice. The results suggest that individuals with 1.5 years of meditation experience exhibited physiological arousal levels similar to those seen in persons with over 5 years' experience.

Frumkin and Pagano (1979) conducted a study on the effect of Transcendental Meditation on Iconic Memory the task involved reporting of digits shown tachistoscopically, using Sperling's partial-report technique. Experiment 1 was a pilot study involving a meditation group and a nonmeditation group. All subjects were run in a pretest/treatment/posttest design. During the treatment phase the meditation group practiced TM for a 20-minute period and the nonmeditation group relaxed with eyes closed. The results showed that the treatment increased performance in meditators, but not in nonmeditators. In this experiment important controls such as individual administration of the task, extrinsic rewards, subject pacing, and adequate practice were lacking. Experiment 2 was a replication of the first, with these controls added. The results no longer showed a superiority for the meditation treatment. In fact, the meditation group performed worse on each day of running. Experiment 3 was a replication of Experiment 1, to assess whether the meditation effect of Experiment 1 was due to (a) differential increased attention of the meditators (minimized in subject-paced Experiment 2), (b) a gain early in learning for the meditators that was eliminated due to practice in Experiment 2, or (c) a lack of proper control procedures in Experiment 1. The performance of the meditators was, again, significantly lower. This research illustrates the importance of careful control when investigating the effects of meditation on behavior. It also suggests that the effects of meditation may depend on which hemisphere is dominant in performing the task.

Pagano and Frumkin (1977) conducted a research on the effect of Transcendental Mediation on Right Hemispheric Functioning and Skill Performance. The task used in both experiments was the Seashore Tonal Memory Test. In the first experiment a nonmediator group and an experienced mediator group were run. The denonmeditator group and an experienced mediator group were run. The design involved three periods: a pretest, a meditation or a rest period, and then a posttest. The results showed the experienced meditators were significantly better in both pretest and posttest performance. There was no pretest--posttest differences. The second experiment was done to replicate the first experiment and to control for possible selection bias. The design was the same as the first experiment, except that an additional group of inexperienced meditators was included. The results again showed significantly superior performance for the experienced meditators compared to the nonmeditators. In addition, the experienced meditators were superior to the inexperienced meditators. There were no significant differences between the nonmeditators and the inexperienced meditators. These results support the hypothesis that meditation facilitates right hemispheric functioning. Alternative explanations, such as selection bias, are also discussed.

Morse and et al. (1977) conducted a study on a Physiological and Subjective Evaluation of Om Meditation, Hypnosis, and Relaxation. Subjects were monitored for respiratory rate, pulse rate, blood pressure, skin resistance, EEG activity, and muscle activity. They were monitored during the alert state, meditation (TM or simple word type), hypnosis (relaxation and task types), and relaxation. Ss gave a verbal comparative evaluation of each state. The results showed significantly better relaxation responses for the relaxation states (relaxation, relaxation-hypnosis, meditation) than for the alert state. There were no significant differences between the relaxation states except for the measure "muscle activity" in which meditation was significantly better than the other relaxation states. Overall, there were significant differences between task-hypnosis and relaxation-hypnosis. No significant differences were found between TM and simple word meditation. For the subjective measures, relaxation-hypnosis and meditation were significantly better than relaxation, but no significant differences were found between meditation and relaxation-hypnosis.

Williams and Herbert (1976) conducted a research on Transcendental Meditation and Fine Perceptual-Motor skill. 30 college male meditators had a 20-min. meditation followed by a 6-min. waking phase prior to 5-min. continuous practice on the pursuit rotor task. This was followed by a 4-min. rest then a further 2-min. of pursuit rotor practice. A similar group of college males who were non-meditators (N = 30) followed the same procedures except that instead of meditating they sat quietly for the initial 20-min. period. The expectations that Transcendental Meditation would (a) facilitate learning and performance; (b) cause less within-subject variability; and (C) cause less reactive inhibition, (c) cause less reactive inhinition, were not upheld by the results. With the exception of performance, which was significantly lower for the meditators, the two groups were no different. Thus, it appears that certain reported physiological and psychological benefits that are attributed to the practice of Transcendental Meditation (such as less anxiety, greater consistency, more awareness, altertness, and attention) are not manifested in the present behavioral test of perceptural-motor function. In fact, in terms of performance, the meditators seemed to be at a disadvantage

Williams and Vickerman (1976) elucidated the effects of transcendental meditation on fine motor skill.. 46 college female volunteers were given 66 10-sec. trials on the pursuit rotor task in 3 practice sessions (18, 30, and 18 trials/sessions). After the first 18 trials, the 23 subjects who were practiced Transcendental Meditators meditated for a 20-min. period followed by a 5-min. "waking" phase prior to the performance of a further 30 trials on the rotor. A 4-min. rest was taken before resuming practice for the final 18 trials. The other 23 subjects, who were not meditators, followed the same procedures except instead of mediating they sat quietly with closed eyes. In terms of performance, learning, reminiscence and intra-individual variability, the two groups were similar. These results were not in accordance with the expectations that these parameters would reflect the facilitative effects of Transcendental Meditation on alertness, awareness, consistency, and resistance to stress. After the meditation session, inter-individual variability was increased for the mediation group. While the conclusion that the practice of Transcendental Meditation does not benefit acquisition of fine perceptual-motor skill appears strong, further investigation would assist in obtaining a more complete understanding of such effects on perceptual-motor behavior.

Glaser et al. (2010) compared inflammatory and endocrine responses of novice and expert yoga practitioners before, during, and after a restorative hatha yoga session, as well as in two control conditions. Stressors before each of the three conditions provided data on the extent to which yoga speeded an individual's physiological recovery. A total of 50 healthy women (mean age, 41.32 years; range, 30-65 years), 25 novices and 25 experts, were exposed to each of the conditions (yoga, movement control, and passive-video control) during three separate visits. The yoga session boosted participants' positive affect compared with the control conditions, but no overall differences in inflammatory or endocrine responses were unique to the yoga session. Importantly, even though novices and experts did not differ on key dimensions, including age, abdominal adiposity, and cardiorespiratory fitness, novices' serum interleukin (IL)-6 levels were 41% higher than those of experts across sessions, and the odds of a novice having detectable C-reactive protein (CRP) were 4.75 times as high as that of an expert. Differences in stress responses between experts and novices provided one plausible mechanism for their divergent serum IL-6 data; experts produced less lipopolysaccharide-stimulated IL-6 in response to the stressor than novices, and IL-6 promotes CRP production. The ability to minimize inflammatory responses to stressful encounters influences the burden that stressors place on an individual. If yoga dampens or limits stress-related changes, then regular practice could have substantial health benefits.

Weinberg (2008) provided a review of the literature on the relationship between imagery and sport performance as well as between imagery and the development of mental skills. First, the many anecdotal reports of imagery effectiveness are noted and a definition is provided focusing on the multidimensional nature of imagery. The evidence of the enhancing influence of imagery on sport performance is then examined by looking at the early studies (mental practice), case studies, preparatory imagery, imagery used as part of a mental training package, and the use of imagery by successful athletes. After discussing the limitations in research imagery relating to performance, the focus turned to the relationship of imagery and the development of mental skills (e.g., confidence, dealing with pressure, motivation). Factors affecting imagery effectiveness were highlighted including imagery perspective, type of task, positive versus negative imagery, and timing of imagery. The paper concluded with future directions for research including such areas as amount of time to image, imagery and children, imagery ability, and imagery and performance expertise.

Ditto (2006) concluded in his research that the Mindfulness-Based Stress Reduction program has positive effects on health, but little is known about the immediate physiological effects of different components of the program.. This study examined the short-term autonomic and cardiovascular effects of one of the techniques employed in mindfulness meditation training, a basic body scan meditation. In Study 1, 32 healthy young adults (23 women, 9 men) were assigned randomly to a meditation, progressive muscular relaxation or wait-list control group. Each participated in two laboratory sessions 4 weeks apart in which they practiced their assigned technique. In Study 2, using a within-subjects design, 30 healthy young adults (15 women, 15 men) participated in two laboratory sessions in which they practiced meditation or listened to an audiotape of a popular novel in counterbalanced order. Heart rate, cardiac respiratory sinus arrhythmia (RSA), and blood pressure were measured in both studies. Additional measures derived from impedance cardiography were obtained in Study 2. In both studies, participants displayed significantly greater increases in RSA while meditating than while engaging in other relaxing activities. A significant decrease in cardiac pre-ejection period was observed while participants meditated in Study 2. This suggests that simultaneous increases in cardiac parasympathetic and sympathetic activity may explain the lack of an effect on heart rate. Female participants in Study 2 exhibited a significantly larger decrease in diastolic blood pressure during meditation than the novel, whereas men had greater increases in cardiac output during meditation compared to the novel. The results indicate both similarities and differences in the physiological responses to body scan meditation and other relaxing activities.

Knapen et al. (2005) compared the changes in physical self-concept, global self-esteem, depression and anxiety after participation in one of two 16-week psychomotor therapy programs for non psychotic psychiatric inpatients. The second objective was to study the relationship between changes in these variables. One hundred and ninety-nine inpatients were randomly assigned to either a personalized psychomotor fitness program, consisting of aerobic exercise and weight training, or a general program of psychomotor therapy, consisting of different forms of physical exercises and relaxation training. Physical self-concept was evaluated using the Dutch version of the Physical Self-Perception Profile at baseline, after 8 weeks, and after completion of the 16-week interventions. At the same time points, additional variables of global self-esteem, depression and anxiety were assessed by means of the Rosenberg Self-Esteem Inventory, the Beck Depression Inventory and the Trait Anxiety Inventory, respectively. After 16 weeks, both groups showed significant improvements in all outcome measures (p values ranged from 0.01 to < 0.0001), with no between-group differences. In both groups, the improvement in physical self-concept was correlated with increased global self-esteem and decreased depression and anxiety levels ($p < 0.01$). The results suggest that both psychomotor therapy programs are equally effective in enhancing physical self-concept. The relationship between improvements in physical self-concept and enhancements in global self-esteem, depression and anxiety supports the potential role of the physical self-concept in the recovery process of depressed and anxious psychiatric inpatients.

Geir (2005) has conducted a study on the perceptual training in soccer: an imagery intervention study with elite players. The purpose of this study was to determine whether an ecological imagery intervention program would affect perception (i.e., exploratory activity and prospective control of future actions) in three elite soccer players. The imagery was adjusted to the unique action opportunities typically experienced by each player in games. A single case, multiple baseline across participants design was implemented and close-up video analyses were conducted from a series of league games. Post-intervention questionnaires and interviews were also carried out to support the video analyses. Two of the participants appeared to increase their visual exploratory activity, but only one of the participants marginally improved his performance with the ball. It was concluded that elite players can improve components of perception through ecological imagery training, but it is questionable to what extent this leads to improved prospective control of actions. It is recommended that future imagery and/or perceptual training research addresses specific types of actions more directly.

Solberg et al. (2000) studied the effects of relaxation techniques on response to exercise and exercise recovery in runners. The researchers first measured pre-intervention anxiety levels, resting heart rate, and response to exercise (blood lactate concentrations, heart rate (HR), and oxygen consumption (VO_2) as measured immediately after and 10 minutes after exercise) among a group of adult male runners. For the next six months, these runners practiced one of two relaxation techniques, meditation or autogenic training. Resting HR was assessed each week during the relaxation training. After the six months, anxiety levels and response to exercise were measured again. Blood lactate levels dropped significantly after exercise in the meditation group as compared to their previous measures, but no other differences were noted among this group. The autogenic training group did not have any significant differences in any area after six months.

Anderson (1997) argued a different point of view on psyching up for distance runners. He cited several studies in which runners who had learned relaxation techniques could decrease their heart rate and lower their oxygen consumption at a particular pace. These results might indicate an improvement in VO_2 max and in performance. Anderson suggested two techniques for relaxation, progressive muscle relaxation (PMR) and centering. In PMR, one contracts and then relaxes his/her muscles in succession down the entire body while focusing on releasing tension. Centering involves abdominal breathing and the repetition of words to induce relaxation. Anderson believed that usage of these techniques over time can reduce heart rate and muscle tension in distance races, thereby improving performance.

Neiss (1995) wrote an article on reconceptualizing relaxation treatments: psychological state in sports. This article reviews studies relating relaxation treatments to motor performance and attempts to explain these treatments from a psychological perspective. The inverted-U hypothesis is evaluated for this purpose and found deficient for several reasons. It is based on arousal which has serious construct validation problems and is essentially a physiological, rather than a psychological, construct. As such, arousal cannot distinguish among fear, anger, sexuality, and other psychobiological states. Predictive validity is consequently low in the area of motor performance, where it appears that debilitating anxiety can occur at the same arousal level as the state optimal/or performance, being “psyched up.” The inverted-U hypothesis is effectively refutable in current usage, and empirically supported in only a weak and psychologically trivial fashion. Relaxation treatments are re-conceptualized as relatively nonspecific psychological therapies, potentially useful in alleviating dysphonic, debilitating psychobiological states. These treatments are particularly apt for athletics, where performance anxiety is a pervasive problem. Additionally, sports psychology seems an ideal proving ground for wider clinical application of these techniques

Blair et al. (1993) conducted a research on imagery effects on the performance of skilled and novice soccer players. The purpose of this study was to investigate the effect of an imagery training programme on the performance of a soccer task by skilled and novice players. An initial assessment of performance on the soccer task was undertaken, and then 22 skilled and 22 novice players were equally and randomly assigned to either a control or an experimental group. The experimental group was given an imagery training programme consisting of both visual and kinaesthetic imagery, and in which both internal and external imagery perspectives were included. The programme lasted 6 weeks, with the subjects attending bi-weekly sessions of approximately 15 min each. The control group developed a competitive strategy that was totally unrelated to the performance task. Similar to the experimental group, the controls did this over a 6-week period, attending bi-weekly sessions of 15 min duration. Two performance measures were recorded--response time (i.e. the time to complete the soccer task) and performance accuracy (i.e. errors in performing the soccer task recorded in the form of time penalties). Performance on the post-test as measured by response time revealed a significant improvement for both the skilled and novice players in the imagery group. The control group failed to show any such improvement. No effects were found for performance accuracy.

Wood (1986) conducted a research on evaluation of Meditation and Relaxation on Physiological Response during the Performance of Fine Motor and Gross motor Tasks. A pretest-posttest control group, randomized-blocks design was used to study a group of 16 meditators and a group of 16 nonmeditators, subgroups of each who relaxed prior to performing on a pursuit-rotor tracking device as a fine motor task and to performing the Luft cycle ergometer protocol to a heart rate of 70% of age-adjusted maximum heart rate as a gross motor task. During each of these tasks heart rate, systolic blood pressure, rate-pressure-product, and EMG activity of the frontalis muscle were monitored. No significant difference in the performance of either the fine motor or the gross motor task was noted for persons practicing meditation and persons who were nonmeditators but were given the opportunity to relax prior to a motor task. Likewise, no significant difference was noted in the pattern of response to the imposed fine motor or gross motor task by meditators or relaxed nonmeditators.

Caudill et al. (1983) performed two experiments dealing with the method of “psyching up” prior to a sprint race. Although research at the time held that psych up techniques did not improve speed, both experiments indicated that speed did improve with psych up techniques. Athletes did not receive instruction as to how to psych themselves up, and they used a variety of techniques including imagery, preparatory arousal, self-efficacy statements, attentional focus, religious beliefs, and relaxation/distraction techniques. The athletes using these techniques ran faster than both the control group (in experiments 1 and 2) and the placebo group (used only in experiment 2). The experimenters concluded that psych up techniques could improve sprint performance but that further research is necessary to determine which techniques have the most positive effect.

2.3 SUMMARY OF REVIEW OF RELATED LITERATURE

The investigator in this chapter reviewed a number of related literature pertaining to this study under three broad headings, namely, studies on the effect of different physical fitness training and studies on psychotonic training and its effects on physical fitness, physiological and psychological variables. It was observed that there was further scope for research in finding out the isolated and combined effect of physical and psychotonic training on selected physical fitness, physiological and psychological variables among college men. Based on the experience gained the investigator formed suitable methodology to be followed in this research, which is presented in Chapter III.