CHAPTER - II

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

"The review of related literature is an instrument in the selection of the topic, formulation of hypothesis and detective reasoning leading to the problem. It helps to get a clear idea and supports the findings with regard to the problem under study". (Tirumalai Swamy, 1995).

Michael, (1960) conducted a study to find out the pulse and blood pressure changes occurring during a physical training programme. It was concluded that the resting and post exercise systolic blood pressure measurement decreased significantly during training. The changes were significant after 16 weeks. During training these measurements were reversed and made significant change in ten weeks.
Giri, (1966) using a set of yogic exercise studied the effects of the programme for 6 weeks on the five tests of National Physical Efficiency. He found a significant improvement among the experimental group in all the five sets as a result of yogic training. However when the group discontinued the practice of yogic exercises for the same period of 6 weeks, the effect gained was significantly lost.

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

Miller and Morehouse, (1967) states that repeated continuous physical exercise may produce extensive change in the respiratory system.

Kobayashi, (1969) studied the effects of 8 week rope skipping programme on the cardiovascular fitness of 13 male high school non-athletes. Each boy skipped rope for five minutes daily for 35 training sessions. Oxygen consumption and heart rate were determined from a standard treadmill run. The result of the test showed that cardio-respiratory fitness was improved significantly.
Gharote, (1973) conducted a study on the effect of yogic training on physical fitness. He employed fliesman basic fitness test. 17 males and 12 females were his subjects and they were given three weeks training in selected yogic exercises. He found significant increases of 7.74 in fitness index in males and 11.75 in females.

Gharote and Ganguly, (1973) observed that nine weeks practice in yogic culture was helpful to improve general physical fitness level of 49 cadet police who were already conditioned to physical activities. The control group was engaged only in school schedule. The physical fitness of the subjects were judged through (a) Fleishman – basic fitness test (b) Cureton’s flexibility test (c) Skin – fold and (d) Harvard – step test. The improvement was most significant in flexibility.

Dhanaraj, (1974) studied the effect of yoga and the 5BX fitness plan as selected physiological parameters. The results indicated increase in flexibility after yoga training. Decreases in heart and respiratory rates in basal state were also covered. When yogic training was discontinued for six weeks following the six-week treatment, a significant decline in the valve of PWC 130, flexibility and breath holding time was noticed.
Santo, (1976) selected 76 college men to study the effects of physical conditioning programmes on cardio respiratory endurance. The subjects were divided into four groups, three of which participated in different physical conditioning programmes and one remained as control group. Three conditioning programmes were (i) Cooper’s aerobic programme (ii) Interval training and (iii) Regular physical education programme. Cardio respiratory endurance was measured by Harvard step test, 12 – minute run / walk test, a three – minute shuttle run and one – minute lateral jump. It was concluded that interval training, aerobic conditioning and regular physical education programme groups improved significantly in cardio respiratory endurance in comparison to control group.

James, (1978) investigated the effects of isotonic and isometric exercise on heart rate and blood pressure and determined the relationship of these effects to physiological work capacity. He reached the conclusion that both isotonic and isometric exercises resulted in significant changes in the heart rate, systolic and diastolic blood pressure and pulse rate.

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

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

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

**Uppal, (1982)** found that the efficiency of an individual in performing physical activities depends basically on cardio respiratory changes and training results in development of the circular – respiratory efficiency. As a result of
his study, he came to the conclusion that by endurance training, the efficiency of the circulatory and respiratory system is improved. Maximal $O_2$ uptake is increased. Stroke volume and cardiac output are increased. Ventilator efficiency is improved, lung volumes become longer and diffusion capacities increased.

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

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

Mall, (1989) found Savasana, a yoga relaxation method to be of great utility in reducing the heart rate, systolic and diastolic pressure. Nine weeks’ training in yogic physical culture was helpful to improve general physical fitness level of forty – nine cadet police who were already conditioned to physical activities as against the control group of forty – nine engaged only in school schedule as judged through Fleischmann basic fitness test.

Krishnan, (1991) conducted a study on the effect of exercises and yogic exercises on physiological variables among school boys. In this study 90 students were selected from Thirumayam. Three groups were randomly selected of which one served as control group and other two served as experimental groups with Bharathiym and Yogasana respectively. They were measured for selected physiological variables like pulse rate, breath holding time, cardiovascular efficiency and vital capacity before training as well as immediately after six weeks of training. The significance of the difference
among the means of control group, Bharathiyam group and Yogasana group, pre test and post test were determined by ‘t’ – ratio. Through analysis of co-variance, Bharathiyam and yogic group significantly improved the pulse rate, breath holding time, cardiovascular efficiency and vital capacity.

Balasubramanian B.Pansare MS, (1991) in their study “Effect of Yoga on aerobic and anaerobic power of muscles” inferred that aerobic power (VO2 max) and anaerobic power were estimated in medical students before and after 6 weeks of yoga training. A significant increase in aerobic power and a significant decrease in anaerobic power were observed. This was considered to be due to conversion of some of the Fast Twitch (FT) muscle fibers into Slow Twitch fibers (ST) during yoga training.

Chinnasamy, (1992) conducted a study on effects of Asana and physical exercise on selected physiological and Bio-chemical variables among school boys. In this study ninety male students were randomly selected from Government Higher Secondary School. The initial scores were measured for the selected variables namely pulse rate, systolic blood pressure, diastolic blood sugar level. The treatment was given for a period of 6 weeks for the experimental group. The results analyzed by F-ratio through analysis of variance showed that asanas had significantly improved the hemoglobin content, blood sugar, pulse rate and blood pressure.
Bera and Rajapurkar MV, (1993) in the study “body composition, cardiovascular endurance and anaerobic power of yogic practitioner” revealed that a significant improvement in ideal body weight, body density, cardiovascular endurance and anaerobic power was observed as a result of yoga training. But it did not show significant change in body fat, skeletal diameter and body circumferences.

Madanmohan, Thombre DP, Balakumar B, Nambinarayanan TK, Thakur S, Krishnamurthy N, Chandrabose A. (1993). studied the effect of yoga training on reaction time, respiratory endurance and muscle strength. There is evidence that the practice of yoga improves physical and mental performance. The present investigation was undertaken to study the effect of yoga training on visual and auditory reaction times (RTs), maximum expiratory pressure (MĖP), maximum inspiratory pressure (MIP), 40 mmHg test, breath holding time after expiration (BHT exp), breath holding time after inspiration (BHT insp), and hand grip strength (HGS). Twenty seven student volunteers were given yoga training for 12 weeks. There was a significant (P < 0.001) decrease in visual RT (from 270.0 ± 6.20 (SE) to 224.81 ± 5.76 ms) as well as auditory RT (from 194.18 ± 6.00 to 157.33 ± 4.85 ms). MEP increased from 92.61 ± 9.04 to 126.46 ± 10.75 mmHg, while MIP increased from 72.23 ± 6.45 to 90.92 ± 6.03 mmHg, both these changes being statistically significant (P < 0.05). 40 mmHg test and HGS increased significantly (P < 0.001) from
36.57 ± 2.04 to 53.36 ± 3.95 s and 13.78 ± 0.58 to 16.67 ± 0.49 kg respectively. BHTexp increased from 32.15 ± 1.41 to 44.53 ± 3.78 s (P < 0.01) and BHTinsp increased from 63.69 ± 5.38 to 89.07 ± 9.61 s (P < 0.05). The scores show that yoga practice for 12 weeks results in significant reduction in visual and auditory RTs and significant increase in respiratory pressures, breath holding times and HGS.

Rai L, Ram K, (1994) in their study “energy expenditure and ventilator responses during siddhasana – a yogic seated posture” observed various cardio ventilator responses and found out that the posture was characterized by greater minute ventilation, larger tidal volume, higher oxygen consumption, greater carbon dioxide elimination and higher heart frequency. The observation suggests that siddhasana is a mild type of exercise and may have its applications in conditions of low cardio respiratory reserves especially in individuals in whom heavy exercises are contra indicated.

Naveen KV, Nagarathna R, Nagendra HR, Telles S, (1997) studied that Yoga breathing through a particular nostril increases spatial memory scores without lateralized effects. Uninostril breathing facilitates the performance on spatial and verbal cognitive tasks, said to be right and left brain functions, respectively. Since hemispheric memory functions are also known to be lateralized, the present study assessed the effects of uninostril breathing on the performance in verbal and spatial memory tests. School children
(N = 108 whose ages ranged from 10 to 17 years) were randomly assigned to four groups. Each group practiced a specific yoga breathing technique: (i) right nostril breathing, (ii) left nostril breathing, (iii) alternate nostril breathing, or (iv) breathe awareness without manipulation of nostrils. These techniques were practiced for 10 days. Verbal and spatial memory was assessed initially and after 10 days. An age – matched control group of 27 were similarly assessed. All 4 trained groups showed a significant increase in spatial test scores at retest, but the control group showed no change. Average increase in spatial memory scores for the trained groups was 84%. It appears yoga breathing increases spatial rather than verbal scores, without a lateralized effect.

Tommijean Thomas, Ph.D., Christopher D. Tori, Ph.D., Benjamin A. Thomas, B.A. (1998) assessed the Benefits of Practicing Iyengar Yoga. Personality traits, emotional stability, coping and cognitive states among 21 men and 36 women attending an intensive training workshop in celebration of Yogacharya Dr. B.K.S. Iyengar’s 75th birthday were quantified. It was hypothesized that experienced yoga practitioners would obtain higher scores on the battery of psychological tests than normative samples. Statistical analyses revealed that the coping, stamina, and self – control levels of the yoga practitioners were significantly elevated and, relative to norms, the mood of the yoga experts was characterized by emotional stability, high energy,
exhilaration, and vigorousness with reduced feelings of hostility, tension / anxiety, and apathy. Personal reports indicated that yoga had notable influence on the participants in four areas: (a) physical gains, (b) mental and emotional functioning, (c) personal growth and (d) general life satisfaction. These findings provide support for the proposition that yoga practice is associated with enhanced mental and physical health.

N.K. Manjunath and Shirley Telles, (Indian J Physiol Pharmcol 1999; 43 (2): 225-229) stated that yoga has already been shown to improve perceptual-motor skills, but the factors which influence its effects are not well defined. This study correlates age, gender and motivation to learn yoga with the performance in a dexterity task following yoga. Tweezers dexterity was recorded in eighty subjects belonging to four groups. Two groups were given a month of yoga training. One group consisted of subjects who had volunteered to join for the training and the other group was deputed for the training as part of their job. The two remaining groups did not receive yoga training and were selected to match the respective groups receiving yoga, for age and sex, but not for their motivation to learn yoga. The test involved using a tweezers to place metal pins in evenly spaced holes in a metal plate within four minutes. Following yoga the scores of the volunteers who learnt yoga increased significantly, whereas there was no change in scores of deputed subjects and non-yoga groups. For reasons described in detail factors such as age and gender
did not appear to contribute to the difference in performance. Hence motivation
to learn yoga appeared to influence the magnitude of increase.

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

Manjunath, Shirley Telles, (2001) took twenty girls between 10 and 13
years of age, studying at a residential school and they were randomly assigned
to 2 groups. One group practised yoga for one hour fifteen minutes per day, 7
days a week, while the other group was given physical training for the same
time. Time for planning and for execution and the number of moves required
to complete the Tower of London task were assessed for both groups at the
beginning and end of a month. These three assessments were separately tested
in increasingly complex tasks requiring 2 moves, 4 moves and 5 moves. The
Pre Post data were compared using the Wilsoxon Paired Signed Ranks Test.
The Yoga group showed a significant reduction in planning time for both 2
moves and 4 moves tasks (3.9 and 59.1 percent respectively) execution time in
both 4 moves and 5 moves tasks (63.7 and 60.3 percent respectively) and in the number of moves in the 4 moves tasks (20.9 percent). The physical training group showed no change. Hence yoga training for a month reduced the planning and execution time in simple (2 moves) as well as complex tasks (4,5 moves) and facilitated reaching the target with a smaller number of moves in complex tasks (4 moves).

Govindarajulu, (2003) “Effect of Yoga Practices on Flexibility and Cardio Respiratory Endurance on High School Girls” Sixty (n = 60) high school girls (average age 12 years) volunteered for a pre-experimental group design, where the practice of selected yoga practice was given as an intervention to the experimental group ‘A’ (n₁ = 30) for a period of eight weeks. The control group ‘B’ (n₁ = 30) was not allowed to participate in the experimental treatment. The pre – and post tests were conducted on flexibility and cardio respiratory endurance. The results of ANOVA revealed that there was improvement in flexibility and no significant change was evident in the cardio respiratory endurance.

Mishra et al., (2003) “Cardiac Efficiency of Long Distance Runners and Yoga Practitioners” Cardiac efficiency of 120 male students, in the age range from 16 to 17 years, from the Aggarsain Public School, Kurukshetra, Haryana, was tested through Harvard Step Test. The students were divided into three equally matched groups viz. Long Distance Running Group (Group
A), Yoga Group (Group – B) and Control Group (Group – C). Duration of the experimental period was 6 months which was divided into two sessions of 3 months each. Results of $2 \times 3$ factorial ANOVA revealed that Yoga practitioners had higher cardiac efficiency than long distance runners.

Bhavanani AB, Madanmohan, Udupa K, (2003) studied the acute effect of Mukh bhastrika (a yogic bellow type breathing) on reaction time. Reaction time (RT) is an index of the processing ability of the central nervous system and a simple means of determining sensory-motor performance. It has been reported that yoga training improves human performance including central neural processing. Earlier studies from our laboratories have shown that yoga training produces a significant decrease in visual reaction time (VRT) and auditory reaction time (ART). The study was planned to determine if mukh bhastrika (a yogic technique in which breath is actively blasted out in whooshes following a deep inspiration) has any effect on central neural processing by studying its effect on RT. 22 healthy schoolboys who were practising yoga for the past three months were recruited for the present study. VRT and ART were recorded before and after nine rounds of mukh bhastrika. Mukh bhastrika produced a significant ($P < 0.01$) decrease in VRT as well as ART. A decrease in RT indicates an improved sensory-motor performance and enhanced processing ability of central nervous system. This may be due to greater arousal, faster rate of information processing, improved concentration
and/or an ability to ignore extraneous stimuli. This is of applied value in situations requiring faster reactivity such as sports, machine operation, race driving and specialized surgery. It may also be valuable in training mentally retarded children and older sports persons who have prolonged RT.

Madanmohan, Udupa K, Bhavanani AB, Shatapathy CC, Sahai A, (2004) studied the modulation of cardiovascular response to exercise by yoga training. This study reports the effects of yoga training on cardiovascular response to exercise and the time course of recovery after the exercise. Cardiovascular response to exercise was determined by Harvard step test using a platform of 45 cm height. The subjects were asked to step up and down the platform at a rate of 30/min for a total duration of 5 min or until fatigue, whichever was earlier. Heart rate (HR) and blood pressure response to exercise were measured in supine position before exercise. Rate-pressure product \[RPP = (HR \times SP)/100\] and double product \(DoP = HR \times MP\), which are indices of work done by the heart were also calculated. Exercise produced a significant increase in HR, Systolic pressure, RPP & DoP and a significant decrease in diastolic pressure. After two months of yoga training, exercise-induced changes in these parameters were significantly reduced. It is concluded that after yoga training a given level of exercise leads to a milder cardiovascular response, suggesting better exercise tolerance.
Madanmohan, Udupa K, Bhavanani AB, Vijayalakshmi P, Surendiran A, (2005) studied the effect of slow pranayams and fast pranayams on reaction time and Cardio respiratory variables. They planned to undertake a comparative study of the effect of short term (three weeks) training in savitri (slow breathing) and bhashrika (fast breathing) pranayams on respiratory pressure and endurance, reaction time, blood pressure, heart rate, rate-pressure 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 bhashrika pranayam, which is bellows-type rapid and deep breathing. Parameters were measured before and after three week training period. Savitri paranayam 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, rate-pressure product and double product decreased in savitri pranayam group but increased significantly in bhashrika group. It was concluded that different types of pranayams produce different physiological responses.

Researchers from Hampton University in Virginia presented findings on the benefits of yoga and pranayama for teenagers at the March 2006 American Heart Association's annual conference on Cardiovascular Disease Epidemiology and Prevention. Their study compared weight loss/gain in two groups of overweight high school students: 30 students who were taught 40 minutes of yoga and pranayama four times a week for 12 weeks, and 30 students who received no instruction. Neither group was instructed to diet or change food intake. Students in the yoga group showed a 5.7 percent decrease in average body mass index (BMI) and weight loss of six pounds, whereas students in the control showed a non-significant increase in average BMI.

Brenda Ann Burke, (Apr 16, 2008) in The Suite 101 article “Yoga for the Boys” describes the advantages of yoga for athletes in sports such as football, rugby, and martial arts. These include superior recovery; improved flexibility, strength, and spatial awareness; and better mental focus. The article provides more specific information on how the practice of yoga can achieve “winning” physical and mental changes.

Yoga teaches one to regard one’s body as an object. Yoga postures are performed slowly and mindfully and attention is focused on the bone and muscle structure, the alignment of the hips, or where the feet are in relation to the edge of the mat. While in a pose, one is constantly making adjustments to become more comfortable or to challenge one more.
This is a type of body awareness is not achieved in most types of aerobic or conventional strength training. Understanding how to make adjustments to the body position is important to a whole range of sports. In rowing, for example, the position of the chest in relation to the knees at the start of the drive and the degree of backward lean at the finish make a real difference to efficiency. All endurance sports require relaxing and adjusting the body to achieve the maximum comfort possible in challenging conditions.

With dedicated practice in yoga, one could develop an intuitive understanding of where the body ends, that is, where you are, and how you are making contact with the floor, the wall or the yoga mat. This can also have a carry-through to grace of movement in sport and life. Awareness of the environment will help you to make practical decisions in sport, such as how to use the state of the playing field to your advantage.

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