REVIEW OF RELATED LITERATURE
CHAPTER II

REVIEW OF RELATED LITERATURE

Study of the related literature implies locating, reading and evaluating reports of research as well as reports of casual observation and opinion that are related to the individual's planned research report. A study of relevant literature is an essential step to get a full picture of what has been done with regard to the problem under study.

The objectives of the present study is to design a specific pre-season training package which will develop the performance factors of football players. To find out the effect of the training package on selected physical fitness variables, cardio-pulmonary variables and skill performance of college football players and to observe the periodical improvement. The investigator had made an attempt to bring a brief review of research related to the present study to form the background for the present study.

2:1 STUDIES ON SPECIFIC TRAINING AND PHYSICAL FITNESS VARIABLES

A.K. Uppal (1982) conducted a study on effect of four weeks intensive training in Badminton on selected
physical fitness components of women players.

Fifteen women junior badminton players had been selected and trained six days a week in the morning and afternoon sessions for a total period of 4 weeks. The morning session was devoted to the development of components of physical fitness in addition to the technique of the game and the afternoon session was devoted to the technical development of the players. The training programme for the development of physical fitness consisted of continuous running, exercise on the wall bars, rope skipping and free hand exercises.

The mean differences between the initial and final scores of the players were tested by 't' test for finding the significance of difference which had resulted during intensive training period of four weeks. Analysis of data showed significant improvement in 8 minute run/walk, standing broad jump, bent knee sit up and flexed arm hang and significant change in 50 m run and shuttle run.

Thomson (1985) conducted a study to find out the changes in body fat estimated from skin fold measurements of varsity football players during a season. The body composition especially body fat by the use of skin folds had been demonstrated. The skin fold measurements of chest and arms were measured on 16 varsity football players at the beginning and end of the season. Using this information,
changes in body composition that is required during conditioning and training were studied. Body weight did not change significantly but significant loss occurred from the three skin fold sites. Body density as estimated from skin fold data increased with training and conditioning presumably this increase was due to loss of body fat and increase in muscle mass and other bodily components.

Charles Frank Stiggins (1985) in his study developed an individualized, computerised off-season conditioning programme for football for the areas of strength, flexibility and endurance.

The strength programme is built upon a cycling concept to prevent over training and involves three different phases, the endurance, strength endurance and maximum strength phase moving from high repetitions, numerous sets, and light resistance to fewer repetitions, fewer sets and heavier resistance. As the athlete completes one cycle he obtains a new one repetition maximum upon which percentages of the next cycle are based. The flexibility programme is based upon a series of static stretching exercises and the endurance programme involves aerobic, anaerobic and speed work.

The computer programme is accompanied by a User's Manual. The computer prints out within seconds (1) the individual athlete's strength programme including sets,
Repetitions percentages poundage and recovery period (2) his flexibility program and (3) his endurance routine with appropriate repetitions, distances, work rates and recovery periods.

Rebecca D. Brown (1986) conducted a study to determine the effects of a strength training programme on strength, body composition and self concept in young and matured women. Forty three subjects completed 12 weeks of weight training while 42 acted as controls.

The mature experimental (ME) and young experimental (YE) groups showed significant (p<.05) increase in strength as compared to the control group. The ME group gained strength at the same rate as the YE group. No changes in body composition were observed. The experimental groups showed significant (p<.05) improvements on the self concept scales compared to control group. Those results support the inclusion of strength training in fitness programme for healthy mature women.

James William Kenney (1986) investigated changes in cardiovascular endurance, muscular strength, flexibility and body fat in male and female after three months of circuit weight training and variable resistance training. All subjects trained on the same equipments, hip and back, leg extension, leg curl, pull over, lateral raise, over head press, arm cross and declined press. Testing was done for
max $VO_2$ for arm ergometer, crunking and treadmill running for exhaustion, maximum lift 1 RM on Nautilus machine, flexibility for shoulder extension and trunk flexion and percent body fat from sum of skin folds and muscular endurance on cybex II.

A significant difference existed in cardiovascular endurance between VRT and CWT group for $VO_2$ max. on treadmill run. No significant difference existed in muscular strength between CWT and VRT groups on the Cybex II. The changes in muscular endurance were not significant for either of the training groups. No significant difference existed in flexibility between VRT and CWT. No significant difference existed in body fat between CWT and VRT groups.

Within the scope, limitations and procedures of the study the following conclusions appear justified:

1. High intensity training is better than lower intensity training for improving $VO_2$ max. on treadmill.

2. Males were significantly different from females for body fat reduction.

3. No difference existed between the CWT and URT groups for muscular strength, muscular endurance flexibility and body fat.

Kent Clark Scriber (1986) conducted a study to evaluate a college football conditioning programme by investigating selected components of physical fitness. This
assessment was made by measuring changes in body composition, cardiovascular endurance and muscular strength in college football players during various periods of training and detraining. Subjects were 43 members of 1984 Ithaca College Varsity football team that were placed into 4 groups based upon playing position. Body composition (percent body fat) was determined with a skynelex electronic skin fold caliper, cardiovascular endurance VO\textsubscript{2} max. was determined from a sub maximal bicycle ergometry test based upon Fox protocol, upper and lower body strength were determined by a single maximum lift for the bench press and the squat press.

Measurements were taken at 5 intervals during an 8 month period between July 1984 and March 1985. Testing periods were taken at the beginning, middle and end of the regular playing season and before and after a 6 week winter conditioning programme.

Analysis of data consisted of a 4 group X 5 time repeated measures factorial ANOVA design for each variable was used. A posthoc Turkey test for HSD was used for all significant F scores \( P < .05 \) to determine specifically where significant difference occurred between groups and over time. Significant difference were found between groups for body composition and cardiovascular endurance. Significant changes occurred over time in the entire groups for body...
composition, Cardiovascular endurance and upper and lower body muscular strength. It was concluded that pre-season, in-season and off-season conditioning programmes met objectives for the variables studied.

D. Islegen and N. Akgun (1987) conducted a study in which they examined the effects of pre-season training in Turkish footballers by measuring the aerobic capacity, maximal alactacid anaerobic power, strength, flexibility and some skinfold thickness at the beginning and at the end of a six week pre-season training period and compared the results. 17 players were selected as subjects and physical working capacity, $V_{O_2} max.$, maximal alactacid anaerobic power, explosive power, grip strength, leg strength and lower back flexibility were determined. During the first three weeks the players performed low intensity runs 5 days a week and 30-40 min. every day. During the second 3 weeks, again for 5 days a week and 30-40 min. every day, the intensity of the run was increased from time to time to force the aerobic - anaerobic threshold.

This training programme was composed of 3-4 X 10m. runs, static and dynamic stretching exercises, technical exercises with the ball and 10-30 m sprints. Strength exercises were performed with extra weights two days a week. First the maximum lifting capacity of different muscle groups of each of the players was determined. Exercises were
started with 40% of these maximal values. These weights were increased 10% every week. During the last week load was performed with 70-85% of the maximal weights.

The pre training and post training results were compared with paired 'T' test. After the six weeks of training period, the aerobic capacity, maximal alactacid anaerobic power, explosive muscular power, muscular strength and flexibility had all improved significantly (P <0.01). There was a small increase in the weight (P < 0.05) and a small decrease in the abdominal skinfold at the end of the training period.

Doughlas LeRoy Ballor (1987) completed two experiments to determine the effects of exercise on lean body weight during periods of calorically induced weight loss.

In the first experiment 10 subjects were randomly divided into diet only (Do) and diet plus exercise (DPE) groups. Exercises consisted of 3 days/week of weight training. Body weight decreased significantly (P <.05) for the DO (- 4.80 Kg) and DPE (- 6.0 Kg) groups LBW decreased significantly for the DPE group (- 1.60 Kg) with a non significant decrease (-.20) for the D.O. group.

In the second experiment 40 obese women underwent an 8 week diet and exercise program. Subjects were divided into control (C) DO, DPE and exercise only (EO) groups.
Weight training exercises were used exclusively in this experiment and consisted of 3 sets of 8 exercises, 3 days/week.

Body weight decreased significantly for DO (-4.47 Kg) and DPE (-3.89 Kg) compared to C (-.38) and E.O (-.45). LBW increased significantly for EO (107 Kg) compared to DO (-.91) and C (-.27) and for DPE (.44).

Faig Husni Abuhalimen (1987) in his study investigated the effects of two 10 week training programmes on self concept and student attitude toward physical activity of Jordanian College of physical education majors aged 18 - 21 years old. 72 male and female subjects were randomly assigned to either a weight training programme group or an aerobic training group. Each group participated twice a week for 50 minutes in either a weight training group or an aerobic training group for a period of 10 weeks.

The two groups were pre and post tested on Tennessee self concept scale (TSCS) AAPHERD youth fitness test and the Kenyan Attitude toward physical activity inventory.

The students F test for two related samples and Spearman correlation coefficient were used to test the hypothesis. The results showed that both groups significantly increased from pre to post test in their total self concept and total attitude towards physical
activity. There were no correlations between physical fitness gain scores and total positive self concept gain score and total attitude toward physical activity gain score with in either group.

Sari Ahmad Ghanima (1987) conducted a study to investigate the effects of a six week exercise and rope jump programme on AAHPERD health related physical fitness scores of highschool females.

Sixty two students were divided into two groups. One group participated in a designed exercise and rope jump programme which consists of warm up, conditioning exercise, rope jump and cool down periods. The other group of students participated in one or more sports activites.

All subjects participated in 18 sessions three times each week for 30 minutes in a six week period. Pre and posttest scores were recorded for the one mile jog/walk, body composition, situps and flexibility tests.

Subjects who participated in the exercise and rope jump programme scored significantly better in all four components than subjects who participated in the regular physical education classes. Subjects who participated in the regular physical education class did not score significantly higher in any of the four components.

Nancy Lynn Meyer (1987) conducted a study to investigate the effects of ten weeks of strength and
flexibility training on the strength, flexibility, body circumference and self perception. Thirty one untrained women were selected and trained three times a week for ten weeks for strength and flexibility using Nautilus machines and static stretching.

Significant difference was found for the total group between pretest and posttest. The younger group had a better body cathexis score. No significant differences were found between groups in pretest means. No significant differences were found in posttest means except in flexibility.

Joseph Peter Gearon (1987) used a pretest/posttest control group design to investigate the effect of eight week weight training program on the body composition and strength of preadolescent boys. Eighteen weight training subjects and thirteen control subjects ranged in age from nine to fourteen years.

The training group participated in a warmup, seven exercise De Lorma method weight training programme and cool down on three non consecutive days per week.

The training group increased significantly in body weight (t= 2.29, p<.05) and lean body mass (t= 1.78, p<.05). A decrease in body fat occurred (t=1.62 p<.05) but it was not statistically significant. No statistically significant
differences occurred in these variables for the non training group.

Strength increased significantly in both groups from pretest to posttest in all strength tests except for right elbow extension which did increase but was not statistically significant for the control group indicates that maturation and normal activities do affect the strength of preadolescent boys.

James A. Gemar (1987) conducted a study to determine if a plyometric exercise programme was better than a weight training exercise programme in improving leg power as measured by vertical jump, standing long jump and 40 mts sprint ability. The training protocol consisted of plyometric drills two times a week for an eight week period. Pretest, mid test and posttest assessments were taken. Mean gains from the pretest to the posttest for the weight training, plyometric and control groups respectively were standing long jump = 11.2 cm, 9.5 cm and 5 cm, vertical jump = 2.3 cm, 1.78cm, and 2 cm and 40 mts sprint = .21 sec .20 sec and .03 sec. The gains achieved by both treatment groups were significantly (p<.05) greater than those experienced by the control group, but no difference existed between the gains attained by the two treatment groups. It was concluded that under the delimitations of this study there is no
difference between the two programmes in improving leg power.

Jones and Laussen (1988) studied the requirements of football players and constructed a conditioning programme for them as a model for the development of a scientifically based conditioning programme.

The players registered with Fitzroy Football Club completed a game-requirement questionnaire followed by an interview. As per the responses, varied pace running drills were developed and used to stimulate game running stress during training. A minimum of 6 weeks of pre-season conditioning was recommended. 100 mts, sprint and 1-repetition maximum bench press test were measured.

The training item consisted of a varied pace drill.

4 x 75m - 75m jog for every repetition
40 m sprint followed every 75 m effort.

75m - 17 sec.
40m - 7 sec.

recovery 75m - 45 sec.

The individuals were maintained in a training zone 70 -85% of a heart rate maximum of 200 beats/min. In this range the players showed improvement on cardio-vascular function.

10 x 40m 7 sec. with 20 sec. rest- 2 min. rest between sets showed significant improvement in sprinting
ability which enhanced the game specific conditioning of the athletes. The strength training programme with three sessions per week improved the scores sufficiently.

Kritpet, et al. (1989) conducted a study to determine the effect of 6 weeks strength training programme consisting of squat and plyometric exercises on vertical power jump performance, static and dynamic muscular strength and muscular power production in college adults. Fifteen male and two female college students in an advanced weight training class at the Oregon state University served as subjects for the study. Nine subjects trained only with squat exercise whereas eight subjects trained with combined squat and plyometric exercises. All subjects trained twice a week for six weeks. A pretest and posttest randomized group design was utilised in this study. The statistical analysis was conducted using a paired 't' test and a repeated measures ANOVA. A.05 level of significance was selected for rejection of null hypothesis (p<.05).

The results of the training programme indicated a significant mean gain (p<.05) from the pretest and posttest for the vertical power jump within the combined squat and plyometric training programme. Hamstring strength and Hamstring power were significantly different (p<.05) within both training programmes. However no difference existed between the gains achieved by the two training programmes.
The result of the study will assist physical educationist and coaches in designing more effective training programme both at college and high school level.

James H. Tanaka (1989) investigated the relative effects on spot reduction of two types of exercise one representing the anaerobic (abdominal exercises) or the spot reduction model and the other represents the aerobic (jogging/running) model.

Fifty four male volunteer subjects ranging in age from 17 to 56 from a Northern California community college were stratified into three fitness levels. All subjects were then pretested on the hydrostatic and anthropometric measures. The population was randomly assigned to either order (12 sessions of anaerobic followed by 12 sessions of aerobic or 12 sessions of aerobic followed by 12 sessions of anaerobic). After each of the 12 exercise sessions all subjects were tested on the hydrostatic and anthropometric measures.

Aerobic exercise resulted in a 4 % decrease in the percent body fat and approximately one inch less in waist girth for the jogger/runner. Anaerobic treatment showed no effects.

Anindra Kumar Barik and Dr. A.K. Banerjee (1990) investigated the effects of specific conditioning programme on selected performance variables among tribal students. By
random sampling 17 tribal school boys of 14-16 years of age were selected from a residential school of West Bengal. All the subjects undergone a 6 weeks conditioning programme specially designed for developing speed, endurance, strength and other fitness components. Standard tests were conducted before the 6 weeks training programme and after its completion.

From the findings the following conclusions were drawn. Speed, endurance, strength and agility increased significantly after training. Insignificant changes in blood sugar level took place after training. Hemoglobin concentration, systolic and diastolic pressure decreased significantly after training.

2:2 STUDIES ON SPECIFIC TRAINING AND CARDIOFUTLUMONARY VARIABLES:

Michael and Gallon (1960) observed members of the Barbara Basketball team who were tested periodically during and after the season of play on selected physiological conditioning. They studied to investigate the effect of basketball conditioning on these measurements. The resting and post exercise systolic blood pressure measurements decreased significantly during training.

Choleking (1963) studied the effect of two training programmes on selected cardio-respiratory variables on
college women. The physiological variables measured were pulse rate, minute volume of respiration and oxygen consumption. The cardiovascular reaction was measured by counting the pulse rate. All the variables improved during the four weeks of training period regardless of the training programme prescribed.

William (1968) investigated the effect of three months track and field training competition on the vital capacity of 63 members of a varsity track and field team. The results indicated no significant difference in respiratory parameters.

Wallin and Schendal (1969) investigated the difference between the tests taken before and after ten weeks of training. Twenty one middle aged males who participated in a jogging programme performed a six minute submaximal exercise bout on a bicycle ergometer. Heart rates were obtained from electro cardiograph and blood pressure were measured by a manual sphygmomanometer. They reached the conclusion that ten weeks of jogging programme produced reduction in heart rate for middle aged men at rest and did not produce any significant change in either systolic or diastolic blood pressure.

Fringer (1972) concluded that the changes in selected physiological parameters in young male adult is due to a conditioning programme and the change in the
subsequent period of deconditioning. The subjects were forty-four male college students between 17 and 28 years of age who performed on a bicycle ergometer twice a week during a ten week conditioning period.

Stewart and crutin (1976) studied the effect of eight weeks interval training on cardio-respiratory parameters. Changes in submaximal heart rate and VO$_2$ max. as a result of eight weeks of interval training were studied in boys aged ten to twenty years. Heart rate and VO$_2$ max. did not change significantly with training. On the other hand, submaximal heart rate during bicycle and treadmill exercises decreased significantly with training. The O$_2$ cost of their maximal task remains unchanged.

The findings suggested that the use of VO$_2$ max. as the only training criteria for cardiovascular fitness may be misleading. Since most work tasks process of a submaximal response was demonstrated without improvement at a maximal effort.

Uppal (1982) in his study investigated endurance training employing slow continuous running method which significantly reduces resting systolic and diastolic blood pressure after exercise of the secondary school level boys. 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.
Cummings (1984) investigated a study to evaluate the effectiveness of six weeks endurance training, progressive relaxation - meditation and their combinations for changing stress levels as reflected by change in heart rate, state anxiety levels, urinary catecholamines at rest and after twenty minutes of examination stress. The effect of the treatment on PWC 170, trait anxiety levels and resting systolic and diastolic blood pressure were also determined.

Thirty seven healthy female subjects were randomly assigned to one of four treatments groups 1) Control no specific training 2) exercise 20 min/day 3 days/week at 75% of age related max. heart rate. 3) meditation 20 min/day, 3 days/week 4) Combination exercise plus meditation.

The result showed that post treatment adjusted mean trait anxiety, resting systolic pressure and stress heart rate were significantly reduced in the exercise, meditation and combination groups. The exercise and combination treatment also showed a significant increase in post treatment adjusted mean PWC 170. The groups trained in progressive relaxtaion meditation showed a greater effect on heart rate and blood pressure than the exercise group. The exercise group on the other hand had its greater effect on trait anxiety scores and urinary catecholamine concentrations.
Kramer (1984) conducted a study to determine the effects of aerobic training on pulmonary function and submaximal work performance in subjects with preclinical chronic obstructive pulmonary diseases.

Thirty seven subjects were assigned to one of four test groups, a control, aerobic training, ventilatory training and a combination of aerobic/ventilatory training. The subjects were given pre-training tests of pulmonary function and submaximal work performance. A training period of six weeks duration followed in which the subjects' training programmes were strictly monitored. Aerobic trainers rode a bicycle ergometer three times a week for a prescribed period of time. Following the training period, identical post training tests of pulmonary function and submaximal work performance were administrated. The aerobic and aerobic/ventilatory training groups demonstrated an improvement in submaximal work performance with reduction in post training heart rate at a given work load. The ventilatory and aerobic/ventilatory groups exhibited an increase in maximum voluntary ventilation and aerobic/ventilatory groups exhibited an increase in maximum voluntary ventilation for 10 sec. (MVV<sub>2</sub>) in their post training tests.

Sulin Kavil (1984) in his study investigated the effects of a conditioning programme on selected
physiological variables of college women gymnasts. Ten women gymnasts at Oklahoma state university were tested prior to and following a three month conditioning programme. The conditioning programme consisted of running, warm up including stretching flexibility exercise, formal gymnastic training and strength training. A modified Balke treadmill protocol was used to determine the anaerobic threshold and maximal oxygen uptake. Also measured were resting blood pressure, resting heart rate, percent body fat by skinfold and underwater weighing and strength. The data from pre and posttest were statistically analysed using t tests to determine if any significant differences existed in regard to the physical and physiological variables.

The results of this study revealed significant improvements in anaerobic threshold heart rate, blood pressure in the standing position, percent body fat from both skinfold and underwater weighing and all strength measures except for right leg strength. No significant differences were found in the means of VO\textsubscript{2} max, supine resting blood pressure, resting heart rate and right leg strength.

Gentry (1985) carried out a study to determine the effects of a nine weeks aerobic jogging programme on selected cardiovascular functions of young male college students through a time course evaluation procedure.
Pretests and posttests administered at the end of the third, sixth and ninth weeks were employed in order to evaluate the effects of the training programme. Significant decreases were observed in resting diastolic blood pressure and resting heart rate while no change occurred in exercise cardiac output rating and exercise cardio index.

Jun Tae Wan (1987) undertook a study to determine the relative effectiveness of interval weight training on the development of dynamic muscular strength, power and cardio-respiratory function.

The pre and post test control group research design was employed for this study. 16 male subjects were randomly assigned to either the experimental group interval weight training group or the control group (circuit weight training group). Training was limited to 60 minutes twice a week and continued for six weeks. All subjects were pretested for dynamic muscular strength, power and cardio-respiratory function. Initial and final means within each group were analysed by the 't' test for related samples. The one way analysis of covariance was used to determine sufficient difference between group mean scores. Six weeks of interval weight training did not produce statistically significant improvement in cardio-respiratory function.

Williford, et al. (1988) evaluated for healthy
untrained females to determine the effects of ten weeks of aerobic dance training programme on cardio-respiratory function, lipoprotein level and body composition. A control group of eight untrained females underwent to same evaluation procedures as training group. Blood samples collected pre and post training were arranged for triglycerides (T.C.) total cholesterol (T.C) high density lipoprotein cholesterol (HDL.C) maximal treadmill test and body composition. Low density lipoprotein and high density lipoprotein did not show significant change either in the experimental group or the control group. Changes in the experimental group were significantly greater (p<.05) than in the control group for maximum oxygen consumption.

Edgar Farrington Pierce (1989) in his study examined the effects of specificity of training on lactate threshold (LT) and VO₂ max, on the Cycle Ergometer (CE) and Treadmill (TM) before and after 10 weeks of training programme. Subjects were assigned to run training (n=5) cycle training (n=6) and control group (n=5) . Results indicated that run training resulted in significant increase of VO₂ max. LT within both the CE and TM protocols (17.91 to 22.46 ml/kg.min. for CE 22.68 to 35.75 ml/kg.min for TM p<.05) with the 58.8% increase in VO₂ LT for TM being greater than the 20.3% increase for CE(p<.05) . Cycle training resulted in a 38.7% increase in CE VO₂ LT (19.78
to 27.37 ml/kg.min, $p < .05$) with no significant improvement in TM $\text{VO}_2 \text{ LT}$ (23.64 to 24.02 ml/kg.min). Similar increase in $\text{VO}_2 \text{ max}$ were observed for CE and TM regardless of training mode. No changes were observed in the control group for any variable.

Gomes (1990) conducted a study to determine the effects of continuous and intermittent training on $\text{VO}_2 \text{ max}$ and body composition. 33 male subjects were subdivided into three groups and were submitted to 12 weeks of physical training on cycle ergometer and in addition another group served as control.

The first group (VTG) trained continuously at the ventilatory threshold ($\text{VT}_2$) the second group (BVTG) trained continuously at 15% below the $\text{VT}_2$. The third group (ITG) exercised intermittently 1:1 at 100% of the $\text{VO}_2 \text{ max}$.

The results of the study showed that $\text{CMO}_2$ increased significantly in the VTG and ITG. All training groups significantly increased $\text{VO}_2 \text{ max}$ relative to body weight. Body density increased significantly in BVTG with no significant change in other training groups. Changes in body density seemed to be due to training since the subjects did not alter their nutritional intake during the twelve week training programme. A significant reduction in the sum of skinfold was observed in BVTG.

Faria (1990) conducted on forty college men who
were randomly divided into three training groups and one control group in a study of selected cardiovascular adaptation to four weeks of training bouts eliciting either 120-130, 140-150 or 160-170 heart rates. Training consisted of bench stepping until the assigned heart rate was elicited five days per week. Significant changes were found in the analysis of pre-post 180 work capacity (PWC-180). Analysis of group difference revealed that the 140-150 and 160-170 training groups' improvement was significantly greater from the other group. No other differences was statistically significant. The study supported the hypothesis that when training to improve one's physical capacity to do work, the severity of the training effect is related but not proportional to intensity of the training.

Naganthine, et al. (1991) conducted a study to investigate the effects of yoga training on the development of pulmonary parameters. 86 subjects having bronchial asthmatic were treated by a special eight stepped yoga chair breathing procedures. The subjects underwent yoga training 7x2 weeks duration spread over three years covering various seasons. During the training programme, the subjects were taught yoga procedures of vajrasana, sarvangasana, tadasana, badahastasana, savasana with neck movements and breathing. The PFR reading was taken using mini Wright's PFR meter before and after the programme.
There is a statistically significant improvement in PFR in the group as a whole and in improved groups. The results pointed to the fact that yoga chair breathing is effective as well as risk free.

Mohan Rao, et al. (1992) investigated the pulmonary function values in industrial workers of Gujarat. Measurements of pulmonary function values provide a fairly good idea of physical fitness in normal people to assess the type and extent of impairment of chest disease patients.

This study concerned 326 healthy male non smokers industrial workers of Gujarat state. Pulmonary ventilatory function tests were measured in sitting posture by vitalograph spirometer. The 20-24 age showed an increase in the height and a significant increase in weight and FVC.

Further there is maintenance of FVC and FEV value upto 30-39 years age followed by a significant decrease in FVC and FEV. In 40-49 years age group a significant decrease in FEV is also revealed.

Denis E O' Donnel, et al. (1995) conducted a study to investigate the effects of exercises on pulmonary functions. Thirty subjects under pulmonary rehabilitation programme acted as experimental group and 30 as a control group. Subjects were tested for pulmonary functions. The experimental exercise programmes comprised three sessions per week for a period of six weeks. Each training session
spanned 2.5 hours period and incorporated walking, stair
climbing, arm ergometry, cycle ergometry, treadmill exercise
and breathing exercises. Spirometry was performed prior to
exercise with a dry rolling seal spirometer (P.K.Morgan).
Lung volumes were determined (T L C) by plethysmogapy.

Significant improvements in exercise capacity were
found in response to EXT on the cycle ergometer. Peak WR
increased by 56 +_ 11% (p<.01) and total cumulative work
increased by 142 +_ 70% (p<.05) after EXT (Endurance Exercise
Training). In contrast control subjects did not improve
exercise capacity or performance. Resting spirometry did
not change significantly in response to EXT.

Michael J. Berry, et al. (1996) investigated the
effect of inspiratory muscle training and whole body
recondition on pulmonary diseases. 25 subjects were
randomly assigned to one of the three groups 8 received IMT
only with general exercise reconditioning, 9 received
general exercise reconditioning and 8 received breathing
exercise control. All the subjects exercised three times per
week for 12 weeks period.

There were no significant differences among the
three groups on spirometry maneuver MVV. Results of ANACOVA
revealed significant differences in 12 min. walk distance
among GER+IMT and GER groups. Results showed no significant
differences among three groups in oxygen consumption and
minute ventilation at maximal exercise on the treadmill.

2:3 STUDIES ON SPECIFIC TRAINING AND SKILL PERFORMANCES

M.S. Malhotra and S. Subramanian (1982) conducted a study on Effects of pre-competitive and off-season trainings on General Physical fitness and skill in Basketball players. They had observed the effect of specific training on the performance of the basketball players. The study was conducted on seven students who were members of the college Basketball team. For four weeks a modified training for the general fitness, the specific game fitness and techniques and tactics were imparted simultaneously. After this training the subjects participated in University Competitions lasting for about two weeks. This was followed by the six weeks of rest without any training to offset the effect of the earlier training. Thereafter for a period of 4 weeks off-season conditioning, training was imparted for the development of general physical fitness.

The subjects were administered tests for measuring general physical fitness, specific physical fitness and skills in the games at the start of the training period, at the end of the pre-competition training, at the start of the off-season training and at the conclusion of the off-season training.

The training programme was conducted for six days
in a week with one day rest in between for recovery. On each day the training session lasted for 2 hours in the morning and 2 hours in the evening. First in the morning session, the training in individual techniques, tactics and group and team tactics were imparted. In the afternoon session 1 1/2 hour was used for tactics training as in the morning and 1/2 an hour for imparting training in the general physical fitness and the evening session for the development of individual skill in the game.

The findings show that the combined training did not result in any improvement in strength, agility, flexibility or explosive power. There is a drop in the general physical fitness. In the skill tests there has been significant improvement in three tests and in other tests there is a trend of improvement.

As a result of the off-season training, there was significant improvement in the speed, endurance, strength, flexibility and explosive power and there was significant improvement in two skill tests.

It was concluded that to prevent drop in general physical fitness during the pre-competitive training period, strength and flexibility exercises should be also included. As the improvement in the skill in the game is also dependent on the general physical fitness, it is imperative that the exercises required to build up general
fitness should also form the part of the training programme.

Ramesh Pal (1986) had investigated the training effect of aerobic and anaerobic exercises on the improvement of performance of middle distance running. One hundred boys were selected by random method and randomly assigned to five groups in which four acted as experimental groups and one as control group. The experimental groups underwent aerobic and anaerobic training with different ratio. The subjects trained thrice a week for a duration of ten weeks. The mean difference between the initial and final scores were tested by 't' test for finding the significant difference. The performance of the subjects were further subjected to Analysis of covariance to determine intergroup variability.

All the experimental groups brought about significant improvement in the performance of 1500m.run. The combination of 50% anaerobic proved to be the most effective for improvement.

Gavin R. White (1986) conducted a study to determine the relative effectiveness of a Hard Easy and Hard Hard training programme on the work performance of Collegiate Oarsmen over a eight week training period and a subsequent 6 weeks non rowing period. Ten subjects were assigned to two groups for eight weeks of rowing training followed by 6 weeks of non rowing training. The H.H group worked hard only on alternate days. The non rowing phase
involved running and weight training only. Work performance was assessed through rowing ergometer bouts of varying lengths, grip strength and head to head boat rowing. Additionally $VO_2$ max. and blood lactate were assessed.

ANOVA-R.M and ANACOVA-RM determined between group differences at the .05 level of significance. None of the measures of work performance demonstrated significant difference between the experimental groups following either eight weeks rowing training or the six weeks non rowing periods.

Joshi (1986) conducted a study to investigate the effects of warm-up exercises on physical fitness and skilled performance of basket ball players. 15 boys and 15 girls in the age group of 15 to 19 years were given intense advanced coaching for a duration of two months.

There is no significant increase in cardio-pulmonary reserve, Harvard's Fatigue index and anaerobic capacity. Due to the exercises there is improvement in the skilled performance which is indicated as decrease in the number of mispasses, decrease in the number of mistakes, decrease in the number of fouls and increase in the percentage shooting.

Jouko Juhani Kokonen (1986) in his study examined the effect of strength training on strength levels, vertical jump performance and shot put performance. Toe and finger
flexion forces were examined at the level of the metacarpal and metatarsal phalangeal joints among 102 college students randomly divided into control and treatment groups. This was done in order to determine the effect of regular progressive resistance exercise training on strength levels and the subsequent effects of strength increase on performance levels in the vertical jumps and shot put.

A specially designed toe and finger flexion exercise device adapted to a cybex machine by the use of cables provided the means of collecting and recording strength data. The same device hooked by the cables to a series of weights enabled the subjects to perform their training regimen. After a 12 weeks treatment period with the treatment groups training regularly 3 times a week, the increase to finger and toe strength levels and in the performance levels of the vertical jump and variations of the shot put proved to be statistically significant over control.

Smith Daniel Elen (1987) conducted a study to develop an imagery training programme using the best procedure currently known and to evaluate this imagery training programmes in a real life or field setting. It was conducted over an entire competitive season using the University Illinios men basketball team as the treatment group and two other teams as control group. Changes in
physical and psychological skills were measured.

The Sport Competition Anxiety Test and Coach's questionnaire were administered pre and post season. An analysis of covariance was used. A variety of evidence suggests that imagery training may have improved self confidence in shooting and ball handling. The imagery training improved specific strategies like offensive and defensive executions. The imagery training tended to believe the programme improved their basketball performance.

E. De Proft, et al. (1988) conducted a study to investigate the effect of specific strength training on improvement of strength of leg muscles and performance in soccer kicking. A total of 22 male soccer players and young soccer players and 20 male non soccer players were included in the experimental design. Six adult soccer players and five young soccer players were asked to participate in a strength training programme consisting of multiple repetitions at 80% of the maximal voluntary effort of different leg muscles in addition to the normal soccer training. The programme lasted for full soccer season, twice a week, each session lasting for half an hour.

Kick performance and strength of flexors and extensors of knee and hip were measured. In addition explosive power was also measured. The tests were performed at different occasions - before, in the middle and at the
end of the training period.

The data were statistically handled by means of test in order to evaluate any progress in strength and kicking performance. Pearson product moment correlation coefficient between kick performance and different strength measurements were calculated.

Comparing strength before and after the training period, the strength training group showed a significant in strength and kick performance. The correlation between strength and kick performance improved only in the strength training group.